

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

“I could cope so much better if I could just get a good night’s sleep”:

Maternal sleep and mental health from early pregnancy

to three years post birth

A thesis presented in partial fulfilment of the requirements

for the degree of

Doctor of Philosophy

in

Public Health

at Massey University, Wellington,

New Zealand

Clare Iona Ladyman

2020

ABSTRACT

Healthy sleep is vital to health and wellbeing at all life stages. But for many women, achieving restorative and satisfying sleep consistently throughout pregnancy is challenging. Because vulnerability to experiencing depressive symptoms increases with poor sleep and poor sleep influences the development and trajectory of depressive symptoms, sleep is an important and modifiable factor in the prevention and treatment of depression. Pregnancy is also considered a key teachable life stage as mothers wish to be healthy in order to protect their unborn baby. Yet research investigating non-pharmacological sleep education interventions for preventing perinatal depression is scarce.

This thesis comprises three studies that investigate the relationship between maternal sleep health and depression. It presents findings from a scoped review examining sleep health throughout pregnancy; a longitudinal analysis of depression trajectories from late pregnancy to three years post-birth and the association of different sleep dimensions to trajectory group membership; and, the development, implementation and efficacy of a sleep education pilot intervention designed to promote sleep health and reduce the likelihood of depressive symptoms throughout pregnancy.

Findings from the scoped review showed that while sleep in pregnancy is highly variable from one woman to the next, significant changes to sleep throughout pregnancy were not indicated for women who were considered physically and mentally healthy. However, the results of the longitudinal analysis revealed that for a sub-group of women, poor sleep was significantly associated with clinically elevated and persistent depressive symptoms throughout the perinatal period and into their child's preschool years, with the probability of experiencing depressive symptoms especially pronounced for Māori women.

The *Sleep HAPi* pilot study found recruiting and retaining previously depressed women into a longitudinal perinatal sleep education study achievable and the study design highly acceptable to participants. Similar to the results of the scoped review, self-reported sleep duration, quality, timing, continuity and daytime sleepiness remained stable throughout pregnancy, and at intervention end none of the women in this study were experiencing clinically elevated depressive symptoms. *Sleep HAPi* women were compared to a control group from a previous study with no sleep education component; *Sleep HAPi* mothers had significantly better sleep initiation and experienced fewer depressive symptoms at intervention completion, though results require confirmation in a larger randomised control group study.

Collectively, the findings from these studies highlight the strong relationship between sleep and maternal mental health. Sleep education interventions, such as *Sleep HAPi*, show promise for minimising depressive symptoms, and optimising sleep for pregnant women. These findings have important health care practice and policy implications and the potential to improve outcomes for mothers, children, families and society.

“Without enough sleep we all become tall two-year-olds.”

—JoJo Jensen, *Dirt Farmer Wisdom*, 2002

ACKNOWLEDGEMENTS

Being a thankful guest to Aotearoa for the past five years, I wish to first acknowledge and pay respect to the Te Āti Awa, Taranaki Whānui, the mana whenua with traditional authority over the land Massey University, Wellington, is built upon. I acknowledge the kaitiakitanga (stewardship), the wider whanaungatanga (sense of community) and mana (spiritual power and influence) of the traditional people.

I approached this PhD with awe and trepidation, but mostly an overwhelming desire to help mothers who are doing it tough. Being a mother can be the greatest juxtaposition. From the indefinable love and delight mothers have for their children and families, to a swallowing blackness that makes finding joy in the world a daily struggle. But at risk of sounding clichéd, the sunshine is there if you can just find a way to open the curtains. Reoccurring conversations with fellow mothers always seemed to result in the same statements: “I could cope so much better if I could just get a good night sleep.” And so, in the very fortunate position of being able to re-enter study, these conversations steered me to the field of sleep science to see if I could help mothers get the best sleep they can.

Undertaking this PhD has been truly life-changing and would not have been possible without the energy, support and guidance from many people. Perhaps the biggest thankyou and greatest appreciation goes to the *Sleep HAPi* and *E Moe Māmā/Moe Kura* women, who gave so much time and energy to participate in this research, especially at a profound time of life. Without you, this thesis would not exist. To the *Sleep HAPi* women who participated in the intervention study, I am so grateful that I had the chance to meet you. I wish I could acknowledge every single one of you but doing this would compromise research ethics. But please know that I am tremendously grateful to be part of that brief but incredible snapshot of your life. Your words,

time and strength were a great gift and the worth of your experiences will forever be appreciated. I hope I can do them proud.

I owe the utmost gratitude to my primary supervisor, mentor and friend, Leigh Signal. Your genuineness, cheerfulness, energy, and intellect are without equal. Your rigorous approach to science and passion to do good, makes you an exceptional researcher and leader. Thank you for sitting with me patiently to help craft my story, through the scary days of recruiting and statistics and the last stressful months of writing while trying to move countries. Your constant feedback, guidance and support has been truly extraordinary. Thank you for setting the bar high and knowing when to push but thank you for also understanding the demands of life, providing an empathetic ear and box of tissues too. The growth I have had under your guidance is immeasurable and I am extremely grateful. Most of all, thank you for believing in me and sharing my enthusiasm for mother's happiness and health. You have fostered in me even more love for this special field of research and the women that benefit.

A huge thanks goes to Philippa Gander, a true scholar and friend. Your passion for our field is inspirational, your knowledge is intellectually engaging, your enthusiasm for your work is contagious and your reassurance is treasured. Your valuable suggestions on data interpretation and writing have been invaluable as is your commitment to providing assistance on every level. Your generosity and support to build the Sleep/Wake Research Centre into a true family friendly and caring place of academic growth is exceptional.

Bronwyn Sweeney, you were instrumental in getting me through the first year of my candidacy and your mantra of "just keep swimming" got me to the end (along with a few well-timed hugs of support). Thank you Mark Huthwaite, for helping to provide a wonderful blueprint from which to launch as well as the invaluable advice, support and guidance, especially with my writing. To all my supervisors, your guidance and belief in me has shaped my research into

something hugely meaningful and you have provided a great cornerstone upon which to build on. Thank you.

To Mona, Margo and Edgar, your statistical brains astound me. Thank you for imparting your knowledge and being so patient with your time and words. To the midwives and health professionals in the community and at Wellington Hospital, who helped facilitate recruitment for our studies, thank you for your time and commitment, especially Andrea Sarty and Helen Pulford.

I am indebted to the wonderful team that surrounded me at the Sleep / Wake Research Centre. The help and reassurance I received from Lora, Karyn, Jenn, Rosie, Mirjam, Kat and Travis have been unwavering. SWRC is a stimulating and supportive team and I have been blessed to have had your support for the last four years.

To Margo and Dee, my fellow PhD buddies, your friendship and love has been pivotal. We've shared moments of sadness, anxiety and frustration but also great laughter, excitement and achievement, not to mention the great wonders of our teenagers growing up. Your presence has been immense in such a solitary process and there are not enough words to express my gratitude to you both for your friendship.

A big thanks to Laura, Pip, Chris, Jane, Dannie, Lachlan, Wendy, Karen and Rob and all of my extended family for encouraging me and helping in whatever way they could from far afield. A special thanks to my dearest friends, Jules, Justine, Nicole, Sharyn, Karen and Marcia. Thank you for your kind messages of love and support from 5000km away, especially when it felt like I was ignoring you all, which is farthest from the truth. Thanks for being there for me.

I would also like to say a heartfelt thanks to my parents. I am really proud of this work, but I can quite confidently say that they are even prouder. Dad, thanks for a childhood underwritten in

“You can!” Although I can admit to quite a few “I can’t’s” over the past four years, the “I can’s” won in the end. Thanks Mum, for keeping me company on the late-night drives home (there has to be a benefit of a Wellington-Perth time difference). Thank you both for believing in me, for all your love and support; for everything you have done and continue to do for me.

To my adoring Nanna and Norm, Gran and Grandad... well, there are no words... I will just pretend that you could see and understand this moment, I know you would be so proud.

And finally, to the most important players in the game and the people that keep my curtains open to the sunshine. To our two beautiful boys, Mac and Kit, I am so very proud of the young men you are growing up to be and I feel so privileged to be your mum. You do indeed light up my life and give me great perspective on what is important and valuable in this world. I know these last few years haven’t been easy, but always know that I will be there, always and forever.

To my furry friend, Oki, thanks for the head clearing walks and being a consistent source of unconditional cuddles.

To my loving husband Rod, who has never faltered in his encouragement and excitement in my work over this last four years. You gave me the courage to embark on this journey in the first place and your faith has never once wavered, even when I’ve stumbled. “You got this Chickerooney”, has been uttered many a time, especially when I needed it most. The depth of my love and gratitude will never be able to be put into words.

This thesis is dedicated to three beloved people,

my loving husband, Rod,

and my amazing sons, Mac and Kit.

TABLE OF CONTENTS

Abstract	i
Acknowledgments	iv
Table of Contents	xi
List of Figures	xvii
List of Tables	xix
List of Abbreviations	xx
List of Appendices	xxiii
CHAPTER 1 Introduction.....	1
1.1 Overview.....	2
1.2 Sleep	4
1.2.1 Defining sleep	5
1.2.2 Sleep/wake regulation	8
1.2.3 Sleep health	11
1.2.4 Conceptual model of Sleep Health	14
1.3 Measuring Sleep	22
1.3.1 Polysomnography	22
1.3.2 Actigraphy	23
1.3.3 Subjective sleep measures.....	24
1.4 Pregnancy	26
1.4.1 Maternity care in New Zealand.....	28
1.4.2 Sleep during pregnancy	30
1.4.3 Lack of first trimester data.....	40

1.4.4	Sleep from pregnancy to the postnatal period	43
1.5	Depression.....	45
1.5.1	Sleep and depression.....	46
1.5.2	Pregnancy and depression	47
1.5.3	Consequences of depression in pregnancy.....	54
1.5.4	Screening and treatment for depression in pregnancy.....	58
1.5.5	Postnatal depression	59
1.6	Sleep, pregnancy and depression	61
1.7	Sleep and depression interventions in pregnancy.....	65
1.7.1	Pharmacological treatments	65
1.7.2	Behavioural interventions	67
1.7.3	Availability of pregnancy sleep information.....	68
1.7.4	Sleep education.....	70
1.8	Reasons for the current research.....	81
1.8.1	Research questions.....	82
1.8.2	Thesis components.....	83
CHAPTER 2	Methodology	85
2.1	Overview	85
2.2	<i>E Moe, Māmā</i> and <i>Moe Kura</i> Research Studies.....	85
2.2.1	M The <i>E Moe, Māmā</i> and <i>Moe Kura</i> Names	86
2.2.2	Study teams	87
2.2.3	Researcher role.....	87
2.2.4	Ethical procedure	88
2.2.5	Recruitment.....	89
2.2.6	Inclusion criteria	90

2.2.7	Late pregnancy questionnaire	90
2.2.8	12-week postnatal questionnaire	90
2.2.9	Three-years post birth questionnaire	91
2.2.10	Measures.....	91
2.2.11	Statistical analysis	95
2.3	<i>Sleep HAPi</i> pilot study	96
2.3.1	The <i>Sleep HAPi</i> name	96
2.3.2	Study team	97
2.3.3	Researcher role	97
2.3.4	Recruitment	98
2.3.5	Participant eligibility	99
2.3.6	Ethical procedure	102
2.3.7	Study design.....	105
2.3.8	Sleep education intervention.....	107
2.3.9	Sleep education sessions	107
2.3.10	Measures.....	111
2.3.11	Statistical analysis	116
CHAPTER 3	Sleep health in pregnancy: A scoping review	117
3.1	Abstract.....	118
3.2	Introduction	119
3.3	Methods.....	121
3.3.1	Identifying the research question.....	121
3.3.2	Identifying the relevant studies	122
3.3.3	Inclusion/exclusion criteria	122
3.3.4	Study selection.....	123

3.3.5	Charting the data.....	124
3.4	Results.....	133
3.4.1	Duration.....	135
3.4.2	Continuity/sleep efficiency (SE).....	139
3.4.3	Sleep disturbances.....	142
3.4.4	Timing.....	143
3.4.5	Alertness/sleepiness.....	144
3.4.6	Satisfaction/quality.....	146
3.5	Discussion.....	147
3.6	Conclusion.....	150
CHAPTER 4	Multiple dimensions of sleep are consistently associated with chronically elevated depressive symptoms from late pregnancy to three years postnatally	151
4.1	Abstract.....	152
4.2	Introduction.....	153
4.3	Methods.....	156
4.3.1	Participants.....	156
4.3.2	Measures.....	157
4.3.3	Statistical analysis.....	159
4.4	Results.....	161
4.4.1	Sample characteristics.....	161
4.4.2	Sleep and depression results.....	164
4.4.3	Identification of depressive symptom trajectories.....	166
4.4.1	Depressive symptom trajectories for Māori and non-Māori.....	167
4.4.2	Sleep variables associated with chronic high trajectory group.....	169
4.5	Discussion.....	171

CHAPTER 5	<i>Sleep HAPi: A feasibility and descriptive analysis of an early and longitudinal sleep education intervention for pregnant women with a history of depression</i>	
	177
5.1	Abstract.....	178
5.2	Introduction.....	179
5.3	Methodology.....	181
5.3.1	Study design.....	181
5.3.2	Sample.....	182
5.3.3	Procedure.....	183
5.3.4	Sleep education sessions.....	184
5.3.5	Measures.....	184
5.3.6	Statistical analysis.....	188
5.3.7	Ethical approval.....	189
5.4	Results.....	189
5.4.1	Participants.....	189
5.4.2	Recruitment and retention.....	191
5.4.3	Intervention acceptability.....	192
5.4.4	Sleep characteristics.....	194
5.4.5	Depressive symptoms.....	196
5.5	Discussion.....	198
5.6	Conclusion.....	203
5.7	Appendix A.....	204
5.7.1	Additional sleep measures.....	204
CHAPTER 6	A longitudinal sleep education intervention from early pregnancy and its effect on optimising sleep and minimising depressive symptoms	207
6.1	Abstract.....	207

6.2	Introduction	208
6.3	Participants and methods	211
6.3.1	<i>Sleep HAPi</i> study design.....	213
6.3.2	Measures	214
6.4	Results	218
6.4.1	Sample characteristics.....	218
6.4.2	Sleep characteristics.....	218
6.4.3	Depressive symptoms.....	223
6.5	Discussion.....	224
6.6	Conclusion	228
CHAPTER 7	Discussion.....	231
7.1	Contribution to the Literature.....	234
7.2	Key Findings.....	235
7.2.1	Study 1 – Scoped review.....	235
7.2.2	Study 2 – Longitudinal study	236
7.2.3	Study 3 – Intervention study	237
7.3	Limitations.....	240
7.4	Clinical implications.....	243
7.5	Recommendations for future research.....	245
7.6	Conclusion	250
References	253
Publications, Presentations and Awards	309
Appendices	311

LIST OF FIGURES

Figure 1.1	Thesis foundations: Sleep, pregnancy and depression	2
Figure 1.2	Sleep cycles throughout the sleep period in a young healthy adult	7
Figure 1.3	Two process model of sleep	10
Figure 1.4	Sleep dimensions and intermediary processes	14
Figure 1.3	Publications investigating sleep and pregnancy from 1960 to 2019	30
Figure 1.6	Thesis study design	83
Figure 2.1	<i>Moe Kura</i> logo	87
Figure 2.2	Flow diagram of <i>E Moe</i> , <i>Māmā</i> and <i>Moe Kura</i> participants	89
Figure 2.3	<i>Sleep HAPi</i> logo	96
Figure 2.4	Flow diagram of <i>Sleep HAPi</i> recruitment and retention	102
Figure 2.5	<i>Sleep HAPi</i> study design	105
Figure 2.6	Content of sleep education sessions	109
Figure 3.1	Flow diagram of the study selection process	124
Figure 3.2	Number of publications over the past 25 years	134
Figure 3.3	Hierarchical representation of reported sleep parameters from included studies	135
Figure 4.1	Trajectories of depressive symptoms for the Māori and non-Māori and the total sample	168
Figure 5.1	Study design for <i>Sleep HAPi</i>	182
Figure 5.2	Recruitment and retention flow diagram	190
Figure 5.3	Panel A: Participants sleep knowledge prior to starting the intervention; Panel B: Level of helpfulness of information received in the intervention; Panel C: Ease or difficulty of the study components	192
Figure 5.4	Linear mixed model sleep and depressive symptom results throughout pregnancy	197

Figure 6.1	<i>Sleep HAPi</i> study design	213
Figure 6.2	Univariate analyses of sleep and depressive symptoms	220
Figure 7.1	Thesis foundations: Sleep, pregnancy and depression	231
Figure 7.2	Theses study design	233
Figure 7.3	Key findings, implications and future research recommendations	234
Figure 7.4	Future research recommendations pre-conception and postnatally	247

LIST OF TABLES

Table 2.1	Reasons for ineligibility in the <i>Sleep HAPi</i> study	100
Table 2.2	How enrolled participants found out about the study	101
Table 3.1	Summary of characteristics of the included studies alphabetically by author	125
Table 3.2	Sleep duration in each trimester as reported for night-time and day-time periods, in studies using PSG, actigraphy and self-reported measures	136
Table 3.3	Sleep stages, REM latency and movement time in each trimester, measured by PSG	138
Table 3.4	Continuity/sleep efficiency in each trimester reported by SE, WASO and SOL, in studies using PSG, actigraphy and self-reported measures	140
Table 3.5	Sleep timing in each trimester as measured by actigraphy and self-report	144
Table 3.6	Alertness/sleepiness in each trimester, measured by the ESS, FCF, POMS and VAS-F	145
Table 3.7	Sleep quality in each trimester, using the PSQI, ISQ and the SHPS	146
Table 4.1	Sample characteristics	163
Table 4.2	Sleep and depressive symptom scores for Māori and non- Māori at each timepoint	165
Table 4.3	Median and inter-quartile range for the EPDS (T1 & T2) and K-10 (T3) for the total sample, and separately for Māori and non-Māori	166
Table 4.4	Sleep variables associated with the CH trajectory group, adjusted for socio-demographic variables	170
Table 5.1	Sample characteristics	191
Table 5.2	Descriptive results of sleep and depressive symptom measures	194
Table 5.3	Additional sleep measure results	206
Table 6.1	Sample characteristics	219
Table 6.2	Linear mixed model analysis of variance results	222

LIST OF ABBREVIATIONS

AASM	American Academy of Sleep Medicine
ACOG	American College of Obstetricians and Gynecologists
ADHD	Attention Deficit Hyperactivity Disorder
AHI	Apnea-Hypopnea Index
AMI	Ambulatory Monitoring Inc.
APA	American Psychiatric Association
APGAR	Appearance, pulse, grimace, activity, and respiration
ART	Assisted reproductive technology
BDI	Becks Depression Inventory
BIC	Bayesian information criteria
BMI	Body Mass Index (weight (kg) / height ² (m))
CBT	Cognitive Behavioral Therapy
CBTi	Cognitive Behavioural Therapy for Insomnia
CCDHB	Capital and Coast District Health Board
CI	Confidence interval
CME	Continuing medical education
CSD	Consensus Sleep Diary
DSM	Diagnostic and Statistical Manual (of Mental Disorders)
EEG	Electroencephalography
EMM	E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand study
EMG	Electromyography
EOG	Electrooculography
EPDS	Edinburgh Postnatal Depression Scale
ESS	Epworth Sleepiness Scale
FCF	Fatigue Continuum Form
FIGO	International Federation of Gynecology and Obstetrics
GP	General Practitioner

GSDS	General Sleep Disturbance Scale
hCG	Human chorionic gonadotropin
HDEC	Health and Disability Ethics Committee
HG	Hyperemesis gravidarum
HPA	Hypothalamic-pituitary-adrenal
HRC	Health Research Council
HVDB	Hutt Valley District Health Board
ISQ	Insomnia Symptom Questionnaire
K-10	Kessler Psychological Distress Scale (10-item)
LCA	Latent class analysis
LMC	Lead maternity carer
MCTQ	Munich Chronotype Questionnaire
MDD	Major depressive disorder
Mdn	Median
NICE	National Institute for Health and Care Excellence
NREM	Non-rapid eye movement
NREM1/N1	Non-rapid eye movement stage 1
NREM/N2	Non-rapid eye movement stage 2
NREM3/N3	Non-rapid eye movement stage 3
NZ	New Zealand
NZDep2006	New Zealand Index of Deprivation 2006
NZDep2013	New Zealand Index of Deprivation 2013
NZGG	New Zealand Guidelines Group
OECD	Organisation for Economic Co-operation and Development
OSA	Obstructive Sleep Apnea
OR	Odds ratios
PADA	Perinatal Anxiety and Depression Aotearoa
PLMI	Periodic Limb Movement Index
PMMRC	Perinatal and Maternal Mortality Review Committee

POMS	Profile of Mood States
PP	Pre-pregnancy
PRAMS	Pregnancy Risk Monitoring System
PSG	Polysomnography
PSQI	Pittsburgh Sleep Quality Index
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
RCT	Randomised controlled trial
REM	Rapid eye movement
RLS	Restless Leg Syndrome
SAS	Statistical Analysis System
SCN	Suprachiasmatic nucleus
SD	Standard deviation
SE	Sleep efficiency
SEM	Standard error of the mean
SH	Sleep HAPi
SHPS	Sleep Hygiene Practice Scale
Sleep HAPi	Sleep Health and Pregnancy Information
SOL	Sleep onset latency
SPSS	Statistical Package for Social Sciences
SSRI	Selective serotonin reuptake inhibitor
SSS	Stanford Sleepiness Scale
SWS	Slow-wave sleep
TIB	Time in bed
TST	Total sleep time
USA	United States of America
VAS-F	Visual Analogue Scale for Fatigue
WASO	Wake after sleep onset
WHO	World Health Organisation

LIST OF APPENDICES

Appendix 1	Ethical approval <i>E Moe, Māmā</i> study	311
Appendix 2	Ethical approval <i>Moe Kura</i> study	313
Appendix 3	Sleep and health during pregnancy questionnaire <i>E Moe, Māmā</i> study	316
Appendix 4	Postnatal sleep and health questionnaire <i>E Moe, Māmā</i> study	322
Appendix 5	Sleep and health questionnaire <i>Moe Kura</i> study	332
Appendix 6	High-scorers protocol	346
Appendix 7	Protocol for miscarriage and stillbirth	350
Appendix 8	Recruitment poster, <i>Sleep HAPi</i> study	351
Appendix 9	Initial screening questionnaire, <i>Sleep HAPi</i> study	352
Appendix 10	HDEC out of scope confirmation, <i>Sleep HAPi</i> study	353
Appendix 11	Ethical approval, <i>Sleep HAPi</i> study	355
Appendix 12	Consent form at study entry, <i>Sleep HAPi</i> study	356
Appendix 13	Consent form trimester 2 & 3, <i>Sleep HAPi</i> study	357
Appendix 14	Consent form 6- & 12-weeks postnatal, <i>Sleep HAPi</i> study	358
Appendix 15	Information sheet, <i>Sleep HAPi</i> study	359
Appendix 16	Actigraph and sleep diary user information, <i>Sleep HAPi</i> study	362

Appendix 17	Sleep diary, <i>Sleep HAPi</i> study	363
Appendix 18	Pre-pregnancy questionnaire, <i>Sleep HAPi</i> study	365
Appendix 19	Trimester 1 questionnaire, <i>Sleep HAPi</i> study	367
Appendix 20	Trimester 2 questionnaire, <i>Sleep HAPi</i> study	379
Appendix 21	Trimester 3 questionnaire, <i>Sleep HAPi</i> study	389
Appendix 22	6 weeks postnatal questionnaire, <i>Sleep HAPi</i> study	399
Appendix 23	12 weeks postnatal questionnaire, <i>Sleep HAPi</i> study	409
Appendix 24	Feedback questionnaire, <i>Sleep HAPi</i> study	419
Appendix 25	Actigraphy scoring protocol, <i>Sleep HAPi</i> study	422
Appendix 26	References used for <i>Sleep HAPi</i> education booklet	423
Appendix 27	Results brochure for <i>Sleep HAPi</i>	424
Appendix 28	Statement of contribution, Chapter 3	425
Appendix 29	Statement of contribution, Chapter 4	426
Appendix 30	Statement of contribution, Chapter 5	427
Appendix 31	Statement of contribution, Chapter 6	428

1 INTRODUCTION

What a blessing man acknowledges in sleep, whose soft oblivion makes an island of every day, and breaks the hold of continuous care; that cools the hot brain, and bathes the weary eye-lids, and lets the buffeted and foundering heart cast anchor every night in some harbour of happy dreams. He feels the beneficence of that law which makes even misery halt, and besieging fortune strike its tents, and in the great democracy of nature levels the children of men in common helplessness and common need.

Edwin Hubbell CHAPIN, Living Words, 1869

1.1 Overview

Chapter 1 introduces the contextual setting of the thesis, evaluating current knowledge about its three foundations; sleep, pregnancy and depression, and their interactions (figure 1.1). It also describes the conceptual frameworks that guided the research, including evolving definitions of health and Buysse's (2014) model of sleep health and lastly, an overview of sleep education interventions during pregnancy. Because the findings of this research are presented in publication format (Chapters 3 to 6), Chapter 2 provides a more thorough description of the study design and methodology than is possible within the scope of the journal manuscripts.

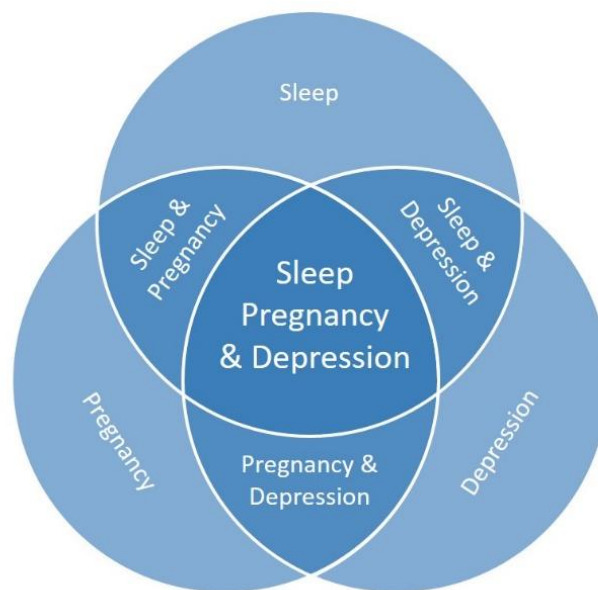


Figure 1.1 Thesis foundations: Sleep, pregnancy and depression

Chapters 3 to 6 present the findings of the three studies that comprise this program of research. Study 1 is a scoped review exploring what normal sleep looks like for a healthy pregnant woman (Chapter 3). Study 2 is a trajectory analysis of maternal depressive symptoms from late pregnancy to three years post birth, and examination of the dimensions of sleep that are related to those trajectories (Chapter 4); and Study 3 explores the development and implementation of a sleep education intervention beginning in the first trimester and aiming to minimise depression symptoms throughout pregnancy, with assessment of its feasibility and acceptability (Chapter 5) and efficacy (Chapter 6). Because the journal manuscripts presented in chapters 5 and 6 involve the same study, there are some overlap in the introduction and methodology sections.

Finally, Chapter 7 integrates the findings from these chapters and concludes with a discussion of their implications, both in relation to clinical practice and future research.

1.2 Sleep

“If sleep does not serve an absolutely vital function, then it is the biggest mistake the evolutionary process has ever made.”

Allan RECHTSCHAFFEN, University of Chicago, 1978 (cited in Walker (2011))

We spend around a third of our lives asleep. By the age of 50, approximately 17 years will be spent asleep. Sleep has persisted throughout evolution, even though it temporarily prevents us meeting other primary human needs, as we cannot consume, reproduce, nurture or work while asleep. It is against the logic of natural selection and evolution to have preserved sleep unless it serves vital functions (Rechtschaffen, 1998).

Sleep, nutrition and exercise are increasingly recognised as the three pillars of health and are fundamental to wellbeing (Heffron, 2014). Optimal sleep allows crucial somatic and neural functions to occur, such as muscle growth and tissue restoration, memory consolidation, downregulation of metabolism and homeostatic balance (Okun, Roberts, Hall, & Marsland, 2009). Many of these restorative and integrative processes occur predominantly, if not only, during sleep. Sympathetic nervous system activity and metabolic demands on the body are decreased during sleep, while tissue regeneration is increased. The active neural connections made during sleep allow memory consolidation, stability and retention, stimulating the idea that long-term memory formation is a function of sleep (Rasch & Born, 2013). Growth hormone, critical for muscle growth, is primarily released during slow wave sleep (Van Cauter & Plat, 1996), as is prolactin, an important immune system regulator (Spiegel et al., 1995; Van Cauter & Plat, 1996). Cardiorespiratory synchronisation occurs during sleep, assisting in the replenishment of neurons (Jerath, Harden, Crawford, Barnes, & Jensen, 2014). Overall, sleep allows the whole body to recalibrate, restore and develop (Smetacek, 2010).

1.2.1 Defining sleep

A simple behavioural definition explains sleep as:

“Sleep is a reversible behavioural state of perceptual disengagement from, and unresponsiveness to, the environment. Sleep plays a crucial role in allowing the brain to work properly, enhancing learning ability and remembering information. Without enough sleep, malfunctions occur in many vital areas of the body starting from impaired memory and thought processes to more serious conditions such as depression, decreased immune response, fatigue, increased pain perception, and ultimately in chronic health outcomes.” (Carskadon & Dement, 2017).

To an outside observer, sleep may seem like a unitary state. However, it is far from a single state of being, but rather a neurologically and physiologically dynamic and complex process. Sleep architecture describes the cyclic pattern of sleep stages defined by distinct electrical activity in the brain, eyes and muscles, recorded via electroencephalography (EEG), electrooculography (EOG) and electromyography (EMG) respectively, known collectively as polysomnography (PSG).

There are two distinct sleep states identified by PSG: REM (Rapid Eye Movement); and NREM (Non-Rapid Eye Movement). NREM sleep involves a progressive slowing of many physiological systems and is further sub-categorised into sleep stages: Stage 1 (NREM1), Stage 2 (NREM2) and Stage 3 (NREM3). Sleep is commonly entered through NREM1, the state of consciousness between sleep and wake. It is easy to be roused in this stage, and although muscles lose some tone, they are still active. In this sleep state, alpha waves are predominant in the EEG, slow rolling eye movements are seen in the EOG, and lower muscle tone in the EMG. NREM2 is a deeper stage of sleep, and conscious awareness of the external environment disappears. Theta

waves are observed, as are sleep spindles and K-complexes, both of which are unique to this stage of sleep. The EMG shows further loss of muscle tone and slow rolling eye movements are no longer seen on the EOG. Deep Sleep and Slow Wave Sleep (SWS) are interchangeable terminologies with Stage NREM3 sleep. In NREM3 sleep, body temperature, respiration, heart rate, cortical activity and energy consumption are at their lowest compared to the other stages of sleep. NREM3 sleep is considered deep sleep because it is hard to rouse an individual from this sleep stage, and therefore there are fewer arousals or awakenings.

REM sleep, however, is a highly active state of sleep with cortical activity similar to that of wake. REM is punctuated on the EOG by rapid movements of the eye, hence the term REM. During REM, the EEG shows brain activity similar to NREM1 but is differentiated by the inclusion of “saw tooth” waves. Other physiological behaviours unique to this phase of sleep include muscle paralysis and irregular heart rate, breathing and body temperature. REM mentation is characterised by emotional, vivid dream experiences. Healthy adults have around five REM cycles during a nocturnal eight-hour sleep period, but it is usually only the dream at the point of awakening that is remembered.

Each sleep stage is equally as important as another. Moorcroft (2013) suggests that instead of visualising sleep as a sliding scale, it can be helpful to view sleep as rooms in a house that are moved in and out of. The quality of life is not gained from spending all of one’s time in just one room but comes rather from moving into different rooms when the respective activity is required (e.g. cooking in the kitchen, showering in the bathroom).

Over the course of a normal nocturnal sleep period, humans progress through four to six sleep cycles of NREM and REM sleep, with longer periods of slow-wave, NREM3 sleep earlier in the night and longer periods of REM in the later part of the night (figure 1.2). In a healthy young adult NREM sleep (NREM1, NREM2 & NREM3) totals about 75-80% of a sleep period, while the REM component comprises the remaining 20-25%. Awakenings during the night are a normal aspect of sleep architecture.

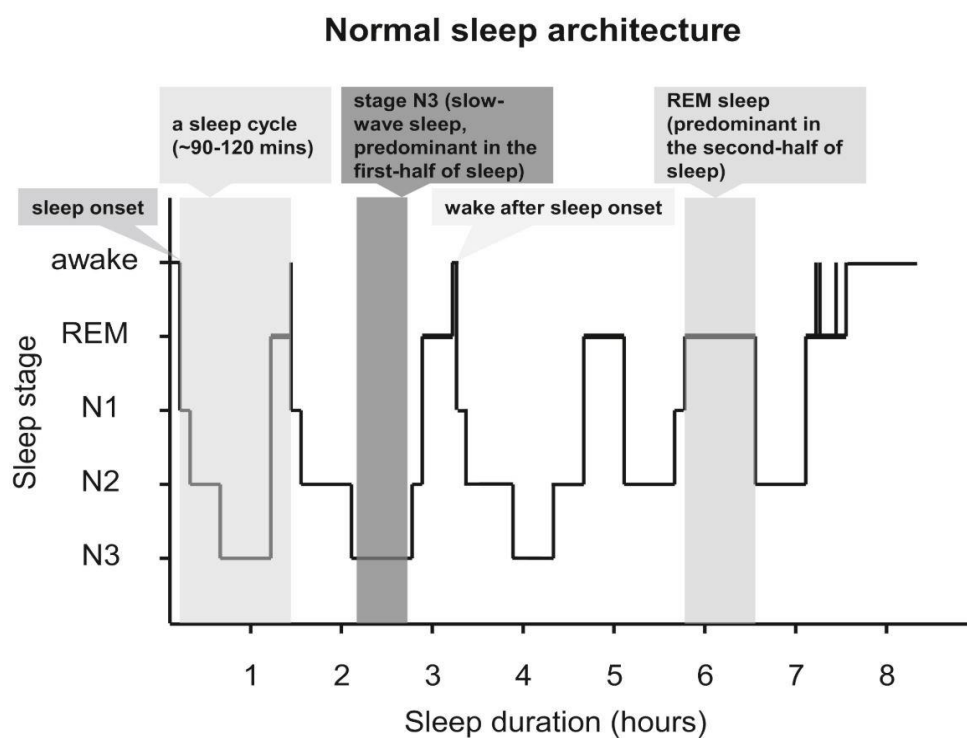


Figure 1.2 Sleep cycles throughout the sleep period in a young healthy adult. (Tan, van Egmond, Partinen, Lange, & Benedict, 2019)

1.2.2 Sleep/wake regulation

Two key processes are currently understood to regulate the timing and quality of sleep: The circadian time keeping system and a homeostatic drive for sleep.

A circadian master clock in the suprachiasmatic nuclei (SCN) of the hypothalamus governs the timing of sleep and underlies the human propensity to be alert during the day when it is light, and sleep during the night when it is dark (Assefa, Diaz-Abad, Wickwire, & Scharf, 2015). The clock genes that make up the molecular machinery for generating circadian rhythms are located in every cell in the body, however the master pacemaker orchestrates the synchrony of different rhythms (Borbély, Daan, Wirz-Justice, & Deboer, 2016) and is regulated (synchronised) by factors in the external environment (predominantly light). The SCN controls down-stream oscillators and rhythms via direct outputs to other brain regions and indirectly via its regulation of hormonal rhythms (primarily melatonin and cortisol) and behavioural rhythms, notably the sleep/wake cycle and feeding patterns (Czeisler & Buxton, 2017).

The SCN receives light information primarily from photosensitive cells in the retina. These cells contain a particular light-sensitive pigment called melanopsin, which is sensitive to short wavelength “blue light”. The light-sensitivity of the SCN enables it to keep physiological and behavioural rhythms in step with the day/night cycle and drive our innate preference for sleep at night. Melatonin plays a major role in inducing sleep onset, supporting healthy sleep architecture and coordinating physiological and behavioural functions while sleeping (Hickie, Naismith, Robillard, Scott, & Hermens, 2013). Towards the end of the sleep period, melatonin provides feedback to the SCN to inhibit the sleepiness signal, in turn promoting wakefulness (Hickie et al., 2013). If light, dark and other environmental cues are removed, most people adopt

an endogenous circadian cycle slightly longer than 24 hours (Sack, Brandes, Kendall, & Lewy, 2000).

Attempting to sleep during an inappropriate time of the circadian cycle, such as when melatonin is declining and body temperature is rising, will likely result in shorter sleep durations with more awakenings (Dijk, Duffy, Riel, Shanahan, & Czeisler, 1999). Circadian system disruptions, such as jet lag or shift work, are associated with negative outcomes such as shorter sleep, poorer sleep quality, poor mood, decreased cognitive functioning and adverse health outcomes (Zee & Goldstein, 2010).

Individual variability in preferred sleep times is well described in humans yielding a continuum of chronotypes, ranging from 'morning' chronotypes who prefer earlier bedtimes and rise times, to 'evening' chronotypes who prefer later bedtimes and rise times (anecdotally known as 'larks' or 'owls' respectively) (Wittmann, Dinich, Mellow, & Roenneberg, 2006). At extreme ends of this normal distribution are individuals whose preferred sleep times are well outside population 'norms'.

The second component regulating sleep is the homeostatic sleep drive that increases exponentially across time awake and decreases exponentially across time asleep. Typically, after a consolidated, good quality sleep period, the homeostatic drive for sleep will be fully dissipated. However, when a sleep opportunity is interrupted, the homeostatic drive for sleep may not be fully dissipated and the next wake period will start with residual sleep pressure.

The anatomical structures and physiological processes that underly homeostatic sleep pressure are unclear. Authors have suggested that NREM and REM may have separate homeostatic mechanisms (Franken, 2002; Ocampo-Garcés, Molina, Rodríguez, & Vivaldi, 2000) as suggested by NREM sleep being recovered first after a period of sleep restriction (Saper, Cano, & Scammell,

2005), and REM rebound following selective REM deprivation also a common phenomenon (Datta, Mavanji, Ulloor, & Patterson, 2004; Shea et al., 2008).

The interaction of the circadian effects on sleep and homeostatic sleep pressure is described by the two process model of sleep regulation (Borbély, 1982). For healthy individuals, the two processes interact during the day to produce stable levels of wakefulness, and during the night to provide a consolidated period of sleep. The homeostatic sleep pressure is considerable early in the night. During the second half of the night, the sleep drive begins to weaken but the circadian system sends signals to support sleep. At the end of the night the sleep drive is sated, wake signals from the circadian system emerge, and together they prompt the emergence from sleep to wake. Figure 1.3 illustrates the two-process model highlighting how the two systems interact.

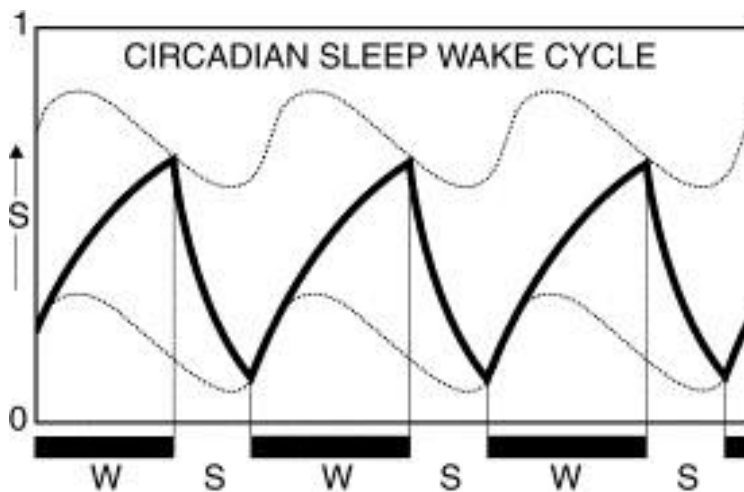


Figure 1.3 Two process model of sleep. The solid line illustrates the homeostatic pressure to sleep, which is low upon waking and gradually increases during the day. The dotted line, the rhythmical sleep alerting signals from the circadian system, demonstrates how the circadian signals maintain sleep even when homeostatic drive is low (Beersma & Gordijn, 2007).

Understanding the processes regulating sleep allows important insights into what happens when these processes become disrupted. When in synchronisation, the circadian and homeostatic processes ensure correctly timed and sufficient sleep (Dzaja et al., 2005). When out of synchrony with each other, (i.e. time zone changes, shiftwork) sleep and wake are forced to inappropriate times in the circadian clock cycle and both become impaired. Fortunately, jet lag is a temporary condition, but of greater concern are chronic disruptions to the body clock. Such evidence has come through epidemiological studies revealing significantly higher risks of cancer, cardiovascular disease, obesity and depressive disorders in people employed in shift work (Hastings, Brancaccio, & Maywood, 2014). Furthermore, consistency in wake–sleep cycles may also help improve a variety of psychiatric disorders, such as depression and anxiety disorders (Saper et al., 2005).

1.2.3 Sleep health

1.2.3.1 Health as an asset or deficit

In developed countries, the rapid increase in chronic disease prevalence, such as heart disease, diabetes, respiratory disease, obesity, cancer, asthma, mental health and dementia, are far surpassing the reductions in acute infectious diseases. In New Zealand, the Global Burden of Disease Study shows that between 1990 and 2013, chronic conditions make up 87% of all health loss (New Zealand Ministry of Health, 2016). In comparison, injuries (i.e. accidents and falls), only contribute 9% of health loss. Furthermore, life expectancy has increased at a faster rate than health expectancy, resulting in humans living longer with poor health (New Zealand Ministry of Health, 2016).

However, the organisational structure of medical care in the 21st century is still rooted in an acute care approach, focussing on the urgent instead of the important. Additionally, societal

behaviour favours instant gratification and quick fix solutions, even when considering health care. Political drivers are also evident with short term electoral cycles requiring short-term visible results. Preventative health care efforts for chronic disease and disorders are too often marginalised due to their long-term investments. For example, although chronic disease rates are rising and a third of chronic disease is preventable, only 5.9% of the 2005/2006 New Zealand health care budget was spent on preventing disease.

However human health is increasingly being defined by wellness and longevity. This precipitates actively seeking, promoting and facilitating the benefits of good health, a perspective outlined in the World Health Organisation's (WHO) Constitution (World Health Organization, 2019) so that humans are able to live full and satisfying lives (Liburd & Sniezek, 2007). By identifying health assets rather than health deficits the focus can shift to *"fostering people to be reconnected with their health and become co-producers"* (Hunter, 2008).

By employing these terms of assets and deficits, health can be further conceptualised as a 'resource'; capital that can be invested in to achieve positive health returns (Williamson & Carr, 2009). Most currently and relevantly, the New Zealand Mental Health Inquiry (Government Inquiry into Mental Health and Addiction, 2018) incorporates the notion of health assets by recommending a new mental health system that has a vision of mental health and wellbeing for all at its heart: where a good level of mental wellbeing is attainable for everyone. Encouragingly, the World Health Organisation further state that given the long duration of chronic disease manifestation, there are numerous opportunities for prevention and intervention with appreciable economic benefits (World Health Organization, 2005b). As such, there is ample research and analysis of the high levels of poor health, disease and disorder and also a sizeable body of work on attributable risk factors and potential solutions. The main gap in the research is the implementation and analysis of effective interventions.

1.2.3.2 Sleep as a Resource

Similar to most health research, sleep science and sleep medicine have focussed on what can go wrong with sleep. While this approach has been important in advancing our understanding of the role of sleep in the development of ill health and disease, there is growing acknowledgement that healthy sleep is more than just an absence of sleep problems or a sleep disorder. A sufficient amount of good quality sleep is being acknowledged as one of the fundamental components of good health, along with diet and physical activity.

Consistent with the health as a resource model described above, several researchers have begun to suggest that sleep may be a valuable resource for dealing with challenging and stressful situations (Zohar, Tzischinsky, Epstein, & Lavie, 2005). So too, the Australian Sleep Health Foundation asserts this notion, stating: *“Sleep in many respects is a built in biological source of resilience and the ability to bounce back”* (Australian Sleep Health Foundation, 2019b). Optimal sleep is necessary for not only the prevention of chronic illness (N. F. Watson et al., 2015), but has the potential to positively improve distal outcomes of health. Health care strategies that promote good health and wellbeing, should therefore incorporate a focus on sleep health. This could provide crucial downstream health benefits in individuals, families and communities, engagement in social and work opportunities, while limiting the demands on treatment focused resources (Williamson & Carr, 2009).

1.2.4 Conceptual model of sleep health

To date, only one conceptual model of sleep health has been proposed, by Buysse (2014) who offers the following definition:

“Sleep Health is a multidimensional pattern of sleep-wakefulness, adapted to individual, social and environmental demands, that promotes physical and mental well-being. Good sleep health is characterised by subjective satisfaction, appropriate timing, adequate duration, high efficiency and sustained alertness during waking hours.”

This definition is important in three ways. Firstly, sleep health is expressed as a positive component of health and a key resource to health improvement, through intermediary processes at the genetic, molecular, cellular and system level (figure 1.4). The concept of positive health view is highly appropriate in the context of pregnancy, because for many women pregnancy is a positive life stage.

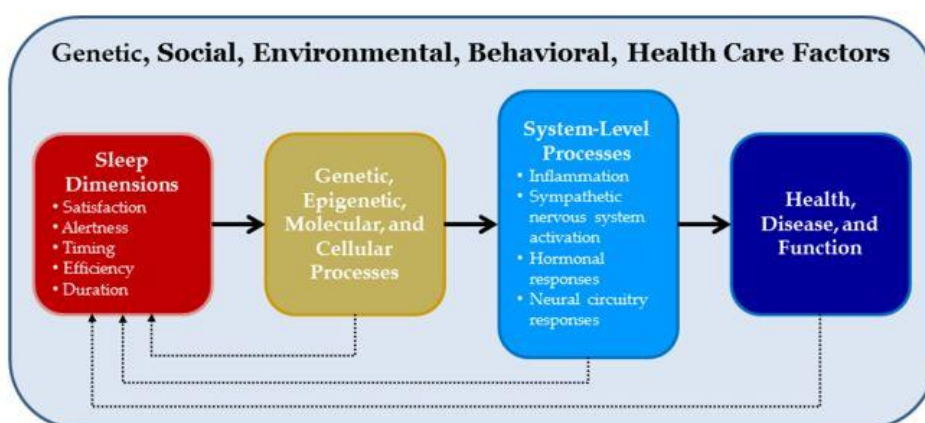


Figure 1.4 Sleep dimensions and intermediary processes (Buysse, 2014).

Secondly, in Buysse's model sleep health is a multidimensional construct. While a majority of sleep research has concentrated on either sleep quality or sleep quantity, Buysse argues for five dimensions of sleep health; sleep duration, sleep quality, sleep timing, sleep continuity, and daytime sleepiness. These dimensions are all associated with differing health outcomes, can be measured both quantitatively and qualitatively (although difficulties remain for defining and quantifying sleep quality – see below) and can all be readily understood by healthcare professionals and the individual.

Thirdly, Buysse's definition of sleep health recognises that good sleep health may not be identical for every individual or in every situation and therefore allows for flexibility around social/environmental contexts and intrinsic/extrinsic influences. Buysse's framework is a relatively new concept and is untested in the fields of pregnancy and depression. Previous research has usually examined one or two aspects of sleep in association with mood at different stages of pregnancy.

To the researcher's knowledge, the studies in this research are the first to examine all five aspects of sleep health in this context. The following sections will explore these sleep aspects in more detail and briefly describe their association with pregnancy, however a more thorough description of trimester changes to sleep throughout pregnancy will be discussed in section 1.4.2.

1.2.4.1 Duration

Sleep duration is the total amount of sleep an individual gets either in a nighttime period or in a 24-hour period. The National Sleep Foundation recommends that adults should sleep seven or more hours per night on a regular basis (Hirshkowitz et al., 2015) although it is also acknowledged that sleep duration is a highly individual requirement.

In recent years, research has consistently indicated that habitual short sleep among adults is an independent predictor of poor mood, negative motor and cognitive performance, obesity, cardiovascular disease, diabetes, hypertension, respiratory diseases, learning difficulties, increased mortality risk and an increased risk of accidents (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Ferrara & De Gennaro, 2001; Gangwisch et al., 2006; Krueger & Friedman, 2009; Magee, Caputi, & Iverson, 2011; Stranges et al., 2008). Habitual long sleep is also associated with many of the same negative health outcomes (Cappuccio et al., 2010; Steptoe, Peacey, & Wardle, 2006). A systematic review and meta-analysis of prospective studies showed consistent patterns of both short (less than seven hours) and long sleep duration (more than eight to nine hours, depending on the study) being associated with a 12% and 30% increased risk of all-cause mortality respectively (Cappuccio et al., 2010). Long and short sleepers may be at higher risk for a range of medical comorbidities, which would contribute to these associations (National Institutes of Health, 2011; Stranges et al., 2008). It is important to note that regularly sleeping more than nine hours may be appropriate for young adults or those recovering from illness (N. F. Watson et al., 2015). Even so, it remains that short and long habitual sleepers represent higher risk population groups.

There is increasing evidence that short sleep is highly prevalent in modern Western culture. Approximately one in five New Zealand adults have insufficient sleep (Paine & Gander, 2016) and similarly in Australia, two large studies investigating sleep quantity found comparable prevalence of short sleep durations. Bartlett et al. (2008) analysed 3300 responses from adults between the ages of 18 to 64 living in New South Wales and found that 18.4% were sleeping less than six and a half hours per night, while in the 2010 Australian Sleep Foundation poll that surveyed 1512 Australian adolescents and adults, 23.7% of respondents were reporting insufficient sleep (less than seven and a half hours), mostly women and younger to middle-aged

men (Hillman & Lack, 2013). While demographics, data collection, analysis and definitions of short sleep vary between these studies, collectively, they indicate that a percentage of the population are potentially significantly sleep deprived.

In a study comparing 1075 third trimester pregnant women to 958 women in the general population, Signal et al. (2014) found that pregnant women averaged 30 minutes less sleep than women in the general population, but were also three times more likely to be either short sleepers (less than six hours) and nearly twice as likely to be long sleepers (longer than nine hours). Evidence suggests that long and short sleep durations may affect pregnancy outcomes. Lee & Gay (2004) found that pregnant women with sleep durations under six hours had significantly higher rates of caesarean section compared to those with sleep durations over seven hours, though no additional studies have replicated these findings. In a cohort of 1,272 pregnant women, Williams et al. (2010), found that short sleep (less than six hours) and long sleep duration (more than nine hours), were associated with pregnancy-induced hypertension and pre-eclampsia, while Facco et al. (2017) reported that a short sleep duration (less than seven hours) was associated with an increased risk of gestational diabetes but not hypertensive disorders. A recent meta-analysis reviewing the relationship between pregnancy sleep and poor fetal outcomes concluded that short sleep duration, and in some cases long sleep duration, was associated with preterm birth and stillbirth (Warland, Dorrian, Morrison, & O'Brien, 2018). This finding is particularly important as preterm delivery accounts for 75% of perinatal mortality and more than half of long-term morbidity (Goldenberg, Culhane, Iams, & Romero, 2008).

1.2.4.2 Sleep Quality

Though sleep quality is a widely accepted construct of sleep, it is a “*complex phenomenon that is difficult to define and measure objectively*” (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

Researchers and clinicians have suggested a number of quantitative metrics for sleep quality to allow for the assessment, evaluation and comparison of sleep complaints and disorders. These include sleep duration (total sleep time (TST)), how long it takes to fall asleep (sleep onset latency (SOL)), the level of sleep fragmentation or sleep disturbance during the sleep period (wake after sleep onset (WASO)) or sleep efficiency (TST divided by time in bed (TIB), expressed as a percentage). However, sleep quality also includes less quantifiable aspects of sleep satisfaction. Subjective indices, such as; 'depth of sleep', 'how rested one feels after awakening' and 'satisfaction with sleep' (Pilcher, Ginter, & Sadowsky, 1997) are crucial considerations. Differences between individuals also complicate the definition of sleep quality. One person may find a specific number or duration of awakenings or length of time to fall asleep to be problematic, while someone else with the same objective sleep structure, may not. Indeed, it has been noted that individuals with insomnia cannot be differentiated from normal sleepers based on these objectively measured aspects of sleep (Krystal & Edinger, 2008).

There is substantial evidence linking the subjective perception of unrefreshing sleep, poor or inadequate sleep to adverse health outcomes, such as inflammation, metabolic syndrome, insulin resistance and Type 2 diabetes (Okun et al., 2012). Poor quality sleep is also associated with accident, error and poor mood (Okun et al., 2012; Volkovich, Tikotzky, & Manber, 2016; Weaver, Stutzman, Supnet, & Olson, 2016), and is a commonly reported in pregnancy. This is evidenced by Yang et al. (2017) who examined the self-reported sleep quality of 500 pregnant women in all trimesters and found that poor sleep quality was experienced by 82%, 87% and 87% of women in trimesters one, two and three respectively.

Importantly, previous research has shown that the feedback an individual receives about their sleep is a key influence on their mood and daytime functioning. Semler & Harvey (2005) discovered that when individuals with insomnia were provided with negative comments about

their sleep quality, they were more likely to report daytime sleepiness, negative thoughts, monitoring for sleep-related threat, and daytime safety behaviours, compared to those who received positive feedback about their sleep quality.

1.2.4.3 Sleep Timing

The timing of sleep is an important sleep health factor that has received much less attention than sleep duration and sleep quality. Emerging research suggests chronic disruptions to sleep timing contribute to diabetes and obesity as well as immune, cardiovascular and endocrine disorders (Scheer, Hilton, Mantzoros, Shea, & Takahashi, 2009; Zee & Turek, 2013). Sleep timing is related to an individual's chronotype, but also highly dependent on environmental factors and lifestyle choices. Social, work and family demands increasingly dominate over our genetic predisposition to sleep at certain times, highlighted by the fact that a growing number of adults use substances to help them fall asleep and stimulants (such as caffeine) during the day (Foster et al., 2013) and over 80% use an alarm clock to wake on workdays (Roenneberg, Allebrandt, Merrow, & Vetter, 2012).

'Social Jetlag' describes the discrepancy between an individual's circadian and social clocks (Roenneberg et al., 2012), as measured by the difference in the amount and timing of sleep on scheduled days versus free days (Wittmann et al., 2006). A global on-line survey using the Munich Chronotype Questionnaire (MCTQ) questionnaire (approximately 150,000 entries) has found that 69% of participants experience at least a one-hour social jetlag shift, and 33% experience a shift of two hours or more (Foster et al., 2013).

Social jetlag can cause chronic sleep restriction and circadian disruption (Foster et al., 2013) and is strongly associated with chronotype, with evening types more greatly affected than morning types (Takahashi et al., 2018). Importantly, 'eveningness' has been associated with greater risk

of depression symptoms (Hidalgo et al., 2009). Greater social jetlag is also independently associated with increased risk of metabolic disorders, diabetes and elevated BMI (Foster et al., 2013; Roenneberg et al., 2012). Of particular significance is the relationship between social jetlag and depression. In a study of 4051 rural Brazilians, Levandovski et al. (2011) found that two or more hours of social jetlag was associated with significantly higher depression scores on the Becks Depression Inventory (BDI), especially in 31-40 year-olds.

Data on sleep timing and social jetlag in pregnant women are very limited. Tsai et al. (2011) found that pregnant women had significantly different wakeup times on weekdays compared to weekends, while also having longer sleep durations on weekends. A recent study by Martin-Fairey et al. (2019) reported that women in their first and second trimesters have significantly earlier sleep onset times compared to pre-pregnancy, in conjunction with decreased levels of activity.

1.2.4.4 Sleep Continuity

Sleep continuity refers to the amount and distribution of sleep versus wakefulness in a given sleep period and includes both sleep initiation and sleep maintenance (Mezick, 2013). Poor sleep continuity is typical in individuals with insomnia and commonly reported in those with mood disorders or medical conditions, such as sleep apnea, chronic pain, asthma and respiratory conditions, chronic renal disease, infectious diseases, and cancer (Mezick, 2013).

Frequent nocturnal awakenings and symptoms of insomnia are common pregnancy sleep complaints (Facco, Kramer, Ho, Zee, & Grobman, 2010). Okun (2019) suggests that sleep architecture may not be dissimilar between pregnant and non-pregnant states, but arousals and awakenings more frequent. Emphasising the magnitude of sleep disturbance some women experience during this time, Kohn & Murray (2008) state, "*Sleep fragmentation and disruption*

during the normal physiological changes of pregnancy are as significant as some medical diseases”.

Findings from cross-sectional studies of postnatal women suggest sleep disturbances and daytime dysfunction are associated with depression after delivery, (Dørheim, Bondevik, Eberhard-Gran, & Bjorvatn, 2009; Huang, Carter, & Guo, 2004). This is consistent with the results from Park et al. (2013), who found that both self-reported (and actigraphic measures to a lesser extent) of sleep maintenance were significantly associated with postnatal depressive symptoms.

1.2.4.5 Daytime Sleepiness

Excessive daytime sleepiness is characterised by difficulty staying awake and alert during daytime hours. It has been associated with a range of cardiovascular, metabolic, neurological and mental health disorders and can have significant social, economic (Jaussett, Dauvilliers, Morin, & Ivers, 2017), safety and quality of life (Young, 2004) implications.

Approximately one in five adults experience daytime sleepiness (Young, 2004), however, there are limited studies investigating the relationship between daytime sleepiness and mood in perinatal women. Tsai et al. (2016) investigated maternal characteristics associated with daytime sleepiness in all three trimesters and found that 15% of women had persistent daytime sleepiness across all three trimesters and a further 15% developed new-onset daytime sleepiness with advancing gestation, which was associated with being nulliparous (first time mothers), working long hours, snoring and having elevated depressive symptoms. Bei et al. (2010) examined sleep and mood in 44 healthy women from the third trimester to one week postnatal and found that poorer subjective nighttime sleep, greater daytime dysfunction, and more daytime napping were significantly associated with poor mood in the third trimester and

one week postnatal, however actigraphic sleep quality or duration were not strongly associated with mood at either time point. Increased awareness of sleep's impact on waking hours is important in understanding mood disturbances (Bei et al., 2010) and since daytime sleepiness can be a symptom of depression, it is not surprising that the two are correlated (Bais et al., 2019).

1.3 Measuring Sleep

1.3.1 Polysomnography

The gold standard for objectively measuring sleep is polysomnography (PSG), as it is the only method that provides detailed information on the structure of sleep and physiological events that occur during sleep. PSG requires the placement of surface electrodes on the head and body to measure cortical activity, eye movements and muscle activity and in some instances also heart physiology and respiratory function. In addition to providing comprehensive information to definitively quantify sleep and wake it is also used to diagnose many types of sleep disorders.

PSG normally takes place in a laboratory making it time-consuming, resource-intensive and costly. It requires specialist personnel to apply, monitor, and score. This renders PSG impractical in many situations, including large research cohorts or when long term measurement is needed.

Ambulatory PSG can be performed in an individual's own home, and does allow a familiar sleeping environment, but this method still requires specialist equipment, application and scoring. Another downside of PSG is the 'first-night effect' (Agnew, Webb, & Williams, 1966).

Because of the unfamiliar environment of the sleep laboratory and the equipment used, sleep can be significantly disturbed on the first night of PSG recording, thus more than one night of PSG recording is typically needed to get a more accurate representation of normal sleep. PSG

also cannot generate information about perceived sleep quality, daytime sleepiness, and it is limited in assessing sleep patterns over time.

1.3.2 Actigraphy

Actigraphy involves wearing a compact wrist-worn, battery operated device (similar to a wrist-watch) that utilises a motion sensor, known as an accelerometer, to measure the occurrence and degree of movement. Because immobility is a key characteristic of sleep (relative to wakefulness), actigraphy is a widely used objective sleep measurement tool. Data are stored in the device's memory for the length of the recording and then downloaded for analysis.

Actigraphy can be used in the study of larger research populations as it does not require technicians to set up, is relatively inexpensive and unobtrusive. A key benefit of actigraphy is continuous and long-term (up to a month at a time) monitoring in a familiar environment, which provides important information on night-to-night/weekday-weekend variability and sleep patterns over time. Compared to PSG, actigraphy estimates sleep based solely on movement so cannot detect sleep stages or sleep disorders, such as apneas, snoring or parasomnias. Furthermore, actigraphy can overestimate sleep and underestimate wake since still wakefulness can be misinterpreted as sleep (Ancoli-Israel et al., 2003). Nonetheless, actigraphic sleep parameters have been validated against PSG (de Souza et al., 2003; Kosmadopoulos, Sargent, Darwent, Zhou, & Roach, 2014; Kushida et al., 2001; Marino et al., 2013). Current best practice recommends that actigraphy is used concurrently with a sleep diary to properly identify and confirm periods of sleep and inactive wake (Littner et al., 2003), such as reading or watching television, or indeed off-wrist periods.

Comparisons have been made between PSG and actigraphy in women of child-bearing age (Ancoli-Israel et al., 2003) and actigraphy has often been used as a non-invasive measure of sleep

in pregnant and postnatal women (Bei et al., 2010; K. A. Lee & Gay, 2004; Montgomery-Downs, Insana, Clegg-Kraynok, & Mancini, 2010; Reid et al., 2017; Tsai et al., 2011). In pregnancy research, actigraphy allows considerable data to be collected from many women over an extended period of time (Okun, 2019), and may be a valid and reliable way to help inform clinical decisions and improve sleep hygiene (Ferraro, Chaput, Gruslin, & Adamo, 2014). Actigraphy has been validated against PSG in healthy adults (Marino et al., 2013), adolescents and children (Meltzer, Hiruma, Avis, Montgomery-Downs, & Valentin, 2015), but has not been validated against PSG in pregnant and postpartum women.

In a critical review of sleep in pregnancy, Ross et al. (2005) identified significant gaps in objective sleep measures. Many pregnancy studies have assessed sleep through self-reported measures at either one or two time points, typically in the second and third trimester. In a systematic review and meta-analysis of non-pharmacological interventions for improving postnatal sleep only three of the 11 studies employed objective measures of sleep (Owais, Chow, Furtado, Frey, & Van Lieshout, 2018). Researchers have suggested that a valuable contribution to sleep and pregnancy literature would be more prevalent use of objective measures to assess sleep (Howe et al., 2015; K. A. Lee & Gay, 2004) with repeated measures across different stages of pregnancy (Howe et al., 2015; Yang et al., 2017), while other researchers have recommended comparing both objective and subjective measures and multidimensional sleep-aspects (Felder et al., 2018).

1.3.3 Subjective sleep measures

Subjective or self-report measures of sleep are most often acquired from sleep diaries, questionnaires and structured sleep scales. Self-report measures are easy to administer, are minimally intrusive, low-cost and provide a good reflection of an individual's overall perception

of sleep (Bei, Coo, & Trinder, 2015). It is also an effective way of collecting long-term data or acquiring pilot data to inform further enquiry (Okun, 2019). Self-report measures have also been used extensively in assessing sleep patterns of pregnant women.

There are several self-report measures with adequate reliability and criterion validity for adults and numerous sleep scales have been developed to obtain personal accounts of habitual sleep. Because subjective measures typically rely on a retrospective account of sleep and a reliance on memory, they can introduce recall bias and therefore undermine the accuracy of the data. Wilson et al. (2013) compared self-reports to PSG and found that while women in the third trimester were equally likely to slightly over or under estimate their sleep duration, women in the first trimester and non-pregnant women underestimated sleep duration by almost one hour on average. This is similar to Herring et al. (2013) who noted that women in the second trimester underestimated self-reported sleep time by nearly 30 minutes when compared to actigraphy, and McIntyre et al. (2016) who found that women in the third trimester underestimated self-reported sleep time by nearly 60 minutes when compared to video recording. McIntyre et al. (2016) also found there was poor agreement between self-reports and video for sleep latency, however caution needs to be applied when interpreting the results of this study, as sleep onset was defined as the participant lying still for more than three minutes. This is much less than the 10 minutes of inactivity required for actigraphically measured sleep onset.

Many studies have found that subjectively measured sleep disruption, but not objective sleep measures, are more strongly associated with depressive symptoms (Bei et al., 2010; Okun et al., 2013; Park et al., 2013; Volkovich et al., 2016) thus, the perception of sleep quality may be an important clinical indicator of low mood in new mothers (Stremmler, McMurray, & Brennenstuhl, 2019).

1.4 Pregnancy

A society that places a low value on its mothers and the process of birth will suffer an array of negative repercussions for doing so. Good beginnings make a positive difference in the world, so it is worth our while to provide the best possible care for mothers and babies throughout this extraordinarily influential part of life.

Ina May GASKIN, *A Midwife's Manifesto*,
Seven Stories Press, New York, 2011

The future of a child is shaped the moment he or she enters the world, as pregnancy and birth are typical entry points into a country's healthcare system (World Health Organization, 2005a). This provides a unique opportunity to survey the wellbeing of the family, and monitoring of maternal and fetal/newborn health should form an integral part of monitoring the health of the overall population (New Zealand Ministry of Health, 2019b).

A typical pregnancy gestation lasts around 40 weeks from the first day of a woman's last menstrual period. It is generally divided into trimesters, each lasting about 12–13 weeks (or about 3 months), though specific days throughout pregnancy are also recorded. A pregnancy that is "36 and 3/7 weeks" means 36 weeks and 3 days of pregnancy. The American College of Obstetricians and Gynecologists (ACOG) (Spong, 2013) define trimesters accordingly to the following timeframes:

- First trimester: 0 weeks to 13 and 6/7 weeks (1–3 months)
- Second trimester: 14 and 0/7 weeks to 27 and 6/7 weeks (4 –7 months)
- Third trimester: 28 and 0/7 weeks to 40 and 6/7 weeks (7–9 months)

In this thesis, the term antenatal is used synonymously with pregnancy, and postnatal used interchangeably with postpartum.

Current research advocates for the fundamental importance of a child's first 1000 days, specifically, from conception to the child's second birthday. Cusick & Georgieff (2019) describe this time frame as the 'brain's window of opportunity', a unique period of rapid developmental plasticity and programming in a child's brain, but also the foundation for optimal health and growth across the lifespan. This rapid physiological development shows a level of connectivity throughout the developing brain that far exceeds that of adults (Innocenti & Price, 2005) and while both gene expression and environmental input are vital for normal brain development, the disruption of either can fundamentally alter neural outcomes (Stiles & Jernigan, 2010). Hence, health, relationships and behaviour such as nutrition, attachment and sensory encounters, all affect brain development and lay the foundation for the rest of the child's life (Moore, Arefadib, Deery, & West, 2017). Misra (2007), states: *'The first 38 weeks of life spent in the allegedly protected environment of the amniotic sac are medically more eventful and more fraught with danger and accident than the next 38 years in the life span of most human individuals.'* This highlights just how critical the mother's physical and mental state are in shaping a healthy fetus, infant and young child. It 'predicts' the world they will be born into, and how they adapt to relationships and environments, either beneficially or detrimentally (Moore et al., 2017).

It is prudent to note that even in a normal physically healthy pregnancy, a women's level of worry or fear of childbirth may be high. A large qualitative study of 202 Australian pregnant women found that nearly a quarter of pregnant women used the words "terrifying" and "petrifying" to describe their approaching birth (Fenwick, Hauck, Downie, & Butt, 2005). Fear of childbirth has been bidirectionally linked to both depression during pregnancy and postnatally

(Räisänen et al., 2013; Soderquist, Wijma, Thorbert, & Wijma, 2009), such that depression can reinforce the fear, or the fear may be a symptom of the depression (Storksens, Eberhard-Gran, Garthus-Niegel, & Eskild, 2012).

1.4.1 Maternity care in New Zealand

Birth rates in New Zealand and average age of women giving birth have increased between 2008 and 2017. The vast majority of women gave birth at a maternity facility (approximately 87% at a secondary or tertiary facility, 10% at a primary maternity facility and 3% at home). Over 90% of New Zealand mothers have a midwife as their lead maternity carer (LMC) (New Zealand Ministry of Health, 2019b), with most LMC's being registered midwives. This midwife-led continuity of care is defined as one in which *"the midwife is the lead professional in the planning, organisation and delivery of care given to a woman from initial booking to the postnatal period"* (Sandall, Soltani, Gates, Shennan, & Devane, 2016). A recent co-designed survey by the New Zealand Ministry of Health and New Zealand College of Midwives (New Zealand Ministry of Health and New Zealand College of Midwives, 2017) showed that a registered midwife spends an average time per woman of up to 53hrs, which included a booking visit, antenatal visits, labour, birth and immediate postnatal care, postnatal visits, travel and other non-contact requirements. These services are free to all New Zealand citizens and permanent residents. If the mother requires care outside the LMC's scope of practice, it is the LMC's responsibility to refer the woman to an appropriate clinician, either a state-funded obstetrician or doctor, but private obstetric care can be an option at a greater financial cost. After six weeks post birth, health care for mother and baby reverts to the family doctor or general practitioner and Well Child Tamariki Ora provides free health and development monitoring for all New Zealand children up to the age of five years.

The New Zealand Perinatal and Maternal Mortality Review Committee (PMMRC) guidelines recommend that all women should register with maternity care before 10 weeks gestation (Perinatal and Maternal Mortality Review Committee, 2012) which is similar to other developed countries recommendations (National Collaborating Centre for Mental Health, 2014). This offers the opportunity to screen for sexually transmitted infections, family violence, mental health issues and congenital abnormalities. In 2017, over two thirds of New Zealand women register with a LMC as soon as the pregnancy is confirmed, an increase from 2008 when only half registered within the first trimester (New Zealand Ministry of Health, 2019b).

In addition to health care, New Zealand women also receive 10 days unpaid special leave during pregnancy to attend medical appointments, antenatal classes etc. and are also eligible for 22 weeks of government funded paid parental leave, plus an additional 22 weeks un-paid leave, to care for the child after birth (based on 12 months service with the same employer for more than 10 hours a week) (leave entitlements increase to 26 weeks from July 2020).

Spouses or partners are also eligible for up to two weeks leave or have maternal entitlements transferred if the partner is the primary care giver (Employment New Zealand, 2018).

1.4.2 Sleep during pregnancy

Investigating sleep during pregnancy is a relatively new field of research, but one that is gaining rapid traction. A ‘Discover’ search using the term “sleep” and “pregnan*” revealed an exponential growth in the number of publications found in the last 60 years (see figure 1.5).

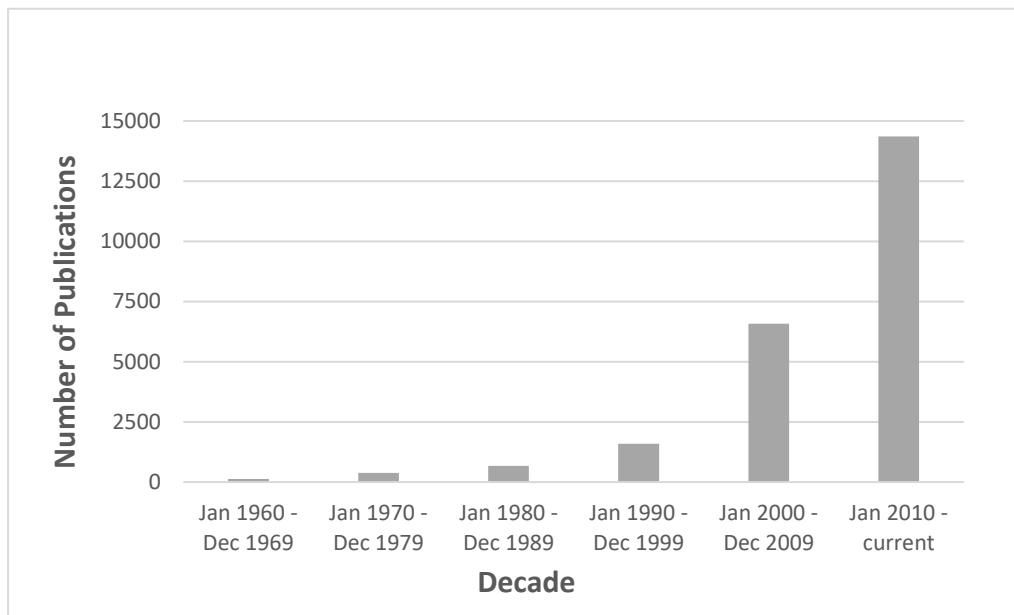


Figure 1.5 Publications investigating sleep and pregnancy from 1960 to 2019.

It is important to note from the outset that sleep in pregnancy is highly variable among women, with some experiencing little change, while for others the profound physiological, psychological and hormonal change occurring in pregnancy makes sleep a significant challenge (Howe et al., 2015; Mellor, Chua, & Boyce, 2014). Though the reason for the differences is unclear, it appears the factors that intensify sleep changes and fatigue during pregnancy are gestational-age dependent (Bialobok & Monga, 2000; J. J. Chang, Pien, Duntley, & Macones, 2010). The following sections examine the sleep changes that occur across trimesters.

1.4.2.1 First Trimester

Significantly high levels of sleep disruption and fatigue are often felt early in pregnancy (K. A. Lee & Zaffke, 1999) and may well be the first symptom of pregnancy (Pien & Schwab, 2004). Total sleep time increases compared to pre-pregnancy levels (Hedman, Pohjasvaara, Tolonen, Suhonen-Malm, & Myllylä, 2002), suggesting that sleep need may increase in early pregnancy (J. J. Chang et al., 2010). Other studies investigating first trimester sleep have found that women have difficulty in initiating and maintaining sleep (Haney, Buysse, Okun, Rosario, & Chen, 2014), experience reduced sleep continuity, less SWS (K. A. Lee, Zaffke, & McEnany, 2000) and higher levels of daytime sleepiness and fatigue (Bai et al., 2016; J. J. Chang et al., 2010; K. A. Lee, Zaffke, et al., 2000; Tsai, Lee, Lin, & Lee, 2016b). Martin-Fairey et al. (2019) reported that women in their first and second trimesters have a significantly earlier sleep onset time compared to pre-pregnancy while they also have significantly decreased levels of waking activity, further endorsing the suggestion that women in early pregnancy experience more fatigue or sleepiness during the day. Okun et al. (2009), have suggested that significant consequences of poor sleep are most likely to be established within the first 20 weeks of pregnancy, but there is a dearth of objective and subjective information from this period.

Up to 70% of women report nausea and vomiting in the first trimester (commonly known as 'morning sickness'), which is likely to be a side-effect of rapidly increasing hormones or stress (Bai et al., 2016). Though symptoms are generally limited to the first trimester, a small majority of women will experience this for the entirety of pregnancy. Because first trimester nausea is often present throughout the day and night, restricted sleep duration, poor continuity, daytime sleepiness and fatigue are a common experience (Pien & Schwab, 2004). A recent paper by Yildirim & Demir (2019) found that 61% of pregnant women experiencing severe nausea and vomiting in pregnancy (referred to as hyperemesis gravidarum (HG)) in the first trimester had

poor sleep as compared to 8% who did not have HG and furthermore, for women with HG, there was also a positive correlation between depressive symptoms and poor sleep. Similar associations have been found between nausea, vomiting, insomnia and depression (Swallow, Lindow, Masson, & Hay, 2004), and nausea, vomiting, fatigue and depression (Bai et al., 2016; Chou, Lin, Cooney, Walker, & Riggs, 2003). While nausea and vomiting are not likely to be the result of a psychological disorder, it is well understood that affected women have psychological symptoms that become entwined with, and possibly intensify, their physical symptoms (N. M. Lee & Saha, 2011).

Short or long sleep durations and subjective poor sleep continuity in early pregnancy have also been associated with cardiometabolic risk factors (Haney et al., 2014; Qiu, Frederick, Sorensen, Enquobahrie, & Williams, 2014; Williams et al., 2010), an increased risk of gestational diabetes (Zhong et al., 2018), premature labour (Klebanoff, Shiono, & Rhoads, 1990) and short infant birth length (W. Wang et al., 2017). Poor sleep continuity and quality during the first trimester can also be a result of increased need for urination (Baratte-Beebe & Lee, 1999), nasal congestion (Caparroz, Gregorio, Bongiovanni, Izu, & Kosugi, 2016; Ellegård & Karlsson, 2006), hot flashes during sleep (Thurston, Luther, Wisniewski, Eng, & Wisner, 2013), back pain (Ray-Griffith, Wendel, Stowe, & Magann, 2018; Sabino & Grauer, 2008), indigestion or heartburn (Vazquez, 2015) and breast pain (Nazik & Eryilmaz, 2014).

The first trimester of pregnancy is accompanied by a dramatic rise in hormones throughout the body and while these are vital for creating and sustaining a healthy fetal environment, they can have an adverse effect on sleep and circadian rhythms (Pien & Schwab, 2004).

Progesterone is a key hormone in pregnancy. Dramatic increases in progesterone are secreted by the placenta and are vital for maintaining a pregnancy. Progesterone is also soporific (K. A.

Lee, 1998) and thermogenic, increasing the core body temperature (Wolfson & Lee, 2005). This, along with the body's lack of thermoregulation during REM, may cause overheating, leading to sleep fragmentation. Elevated progesterone levels having an inhibitory effect on the smooth muscle in the urinary tract (Wolfson & Lee, 2005) and may be why women experience frequent urination in early pregnancy. Increased progesterone also increases minute ventilation and ventilatory drive (Jensen, Webb, & O'Donnellz, 2007).

Estrogen levels also rise significantly in the first trimester and while this is necessary to improve vascularisation in the placenta and uterus, the rapid increase in estrogen levels can cause nausea. Increases in estrogen alter the vascular tissue in the nasal passages, increasing mucosa, and hence leading to hypersecretion and nasal congestion. This predisposes pregnant women to increased upper airway obstruction and snoring, both of which are independent risk factors for OSA in the general population, and a common effect of increased estrogen levels in pregnancy (Wolfson & Lee, 2005). There is some evidence that increased estrogen levels contribute to Restless Leg Syndrome (RLS), however evidence is inconsistent (Manconi et al., 2012). Dzaja et al. (2009), found that pregnancy-related RLS was associated with increased estradiol levels, but no other hormone, which supports evidence of a higher incidence of RLS in the third trimester when estrogen levels are maximal, however, this result has yet to be replicated. In animal studies, estrogen has been shown to suppress REM sleep (Pien & Schwab, 2004).

Human chorionic gonadotrophin (hCG) is an indispensable pregnancy hormone that stimulates progesterone production in the corpus luteum in early pregnancy (Rahman & Rao, 2009). It is one of the first proteins synthesised after conception (Rull & Laan, 2005) and as such, is the hormone with the highest sensitivity and specificity for detecting a pregnancy (Buyalos et al., 1992), being detected as early as six days after conception (Braunstein, Rasor, Danzer, Adler, &

Wade, 1976). Research has shown that hCG reaches its maximum levels at the end of the first trimester between days 56-68 and dramatically reduces after this time (Braunstein et al., 1976). Recent findings suggest that although levels are low in trimesters two and three, hCG may also contribute to myometrial quiescence (active relaxation of the uterine smooth muscle) during these trimesters (Rahman & Rao, 2009).

Interestingly, hCG is only found in humans, primates and equines, and this may be why there is minimal research on the effects of hCG on sleep behaviour. While the soporific hormone, progesterone, is considered to be associated with sleep changes during pregnancy (and indeed hCG promotes progesterone production), Toth et al. (1994), suggests that the levels of progesterone do not correlate with the sleep changes throughout the trimesters (i.e. sleepiness is lower in the second trimester, but progesterone levels are higher), however hCG correlates better with sleep changes. This is also supported by findings that found hCG receptors are present in the brain centres that control sleep (Toth et al., 1994). However, the effects of hCG on human sleep are not yet well understood (Bourjeily, 2009).

1.4.2.2 Second Trimester

Compared to the first three months, the second trimester sees a significant increase in NREM3 sleep but may also be accompanied by increased restlessness (Pien & Schwab, 2004). Although the mechanisms are not fully understood, both subjective and objective reports of sleep are improved during the second trimester compared to the first (Okun et al., 2012), and many women find they have higher levels of daytime energy (Wolfson & Lee, 2005). Once again, it must be emphasised that this is highly variable from woman to woman.

Conversely, there is a marked increase in the prevalence of snoring in the second trimester compared to pre-pregnancy levels. Wolfson & Lee (2005) state that 30% of women report the

onset of snoring that did not exist prior to pregnancy, while Franklin et al. (2000) found that 23% of pregnant women reported snoring every night and 25% occasionally snoring, compared with only 4% prior to pregnancy. Snoring is also an indicator for pre-eclampsia and hypertension in the mother, as well as growth retardation and lower APGAR (appearance, pulse, grimace, activity, and respiration) scores in the infant (Franklin et al., 2000; Wolfson & Lee, 2005).

As discussed earlier, melatonin plays an important role in sleep physiology, but also has a crucial part in normal fetal development (Carlomagno, Tilotta, Minini, & Unfer, 2018) and is a highly effective antioxidant in the ovaries, placenta and fetus (Reiter, Tan, Korkmaz, & Rosales-Corral, 2014). Night-time concentrations of melatonin begin to increase after 24 weeks gestation, with significantly higher levels after 32 weeks (Voiculescu, Zygouropoulos, Zahu, & Zagrean, 2014). Melatonin crosses through the placenta without modification, providing photoperiodic information to the fetus thereby influencing circadian rhythms (i.e. sleep/wake cycles) of the offspring (Carlomagno et al., 2018; Voiculescu et al., 2014). These rhythms have been shown to be interrupted if mothers are kept in continuous light environments (Carlomagno et al., 2018). Circadian disruption due to shift work changes melatonin production and is associated with adverse obstetric conditions such as pre-eclampsia and growth restriction, prematurity and spontaneous abortion (Nakamura et al., 2001; Reiter et al., 2014; Voiculescu et al., 2014), as well as neurological disability in the fetus (Carlomagno et al., 2018).

Relaxin levels increase in the first trimester and reach a stable elevated state in the second trimester. Because relaxin serves as a muscle and blood vessel relaxant, it may also increase upper airway softening during sleep. This can increase the likelihood of snoring or breathing problems, especially later in pregnancy. The relaxant properties of relaxin on the back muscles and ligaments are also believed to be one reason why women experience increased back pain during this trimester.

Cortisol levels increase around the 25th week of pregnancy and by the end of pregnancy levels are about two to three times higher than pre-pregnancy. Cortisol has a circadian rhythm, typically with a nadir close to midnight. Levels begin to increase two to three hours after sleep onset and continue to rise into the early morning hours. Cortisol peaks approximately 30 minutes after waking and then continues a steady decline until the nadir (Bleker, Roseboom, Vrijkotte, Reynolds, & de Rooij, 2017). The cortisol awakening response is attenuated as pregnancy progresses, however a less pronounced attenuation or higher cortisol levels have been associated with adverse birth outcomes, such as lower birth weight and a shorter gestation period (Bublitz, Bourjeily, D'Angelo, & Stroud, 2018). Elevated cortisol levels are associated with poor sleep and sleep disturbances (Bublitz et al., 2018). There is evidence that elevated cortisol is associated with being nulliparous (Bleker et al., 2017), preterm delivery (Sandman et al., 2006) and depression in pregnant women (Peer, Levitan, Soares, Steiner, & Streiner, 2013), though depression findings are mixed, with some authors finding associations in the early third trimester (Voegtline et al., 2013) but not in the first trimester (Bleker et al., 2017). A small study by Suzuki et al. (1993) found a significant relationship between sleep and women's cortisol/melatonin ratio in late pregnancy, where poor sleep was associated with lower ratios and good sleep associated with higher ratios.

Restless legs syndrome (RLS) or Willis-Ekbom disease is a neurological disorder characterised by an urge to move the legs due to unpleasant sensations. Women with pre-existing RLS often find pregnancy exacerbates symptoms (Manconi et al., 2004), which are most commonly felt at night when lying at rest, typically when trying to fall asleep. It is therefore unsurprising that RLS in pregnancy has been found to be associated with poor sleep quality, daytime sleepiness (Dunietz et al., 2017) and shorter sleep duration (Manconi et al., 2004). The onset appears to be most common in the third trimester, though some authors have noted increased rates in the second

trimester (Srivanitchapoom, Pandey, & Hallett, 2014). A review of RLS in pregnancy noted a prevalence of up to 32%, approximately two to three times higher than in non-pregnant women. Fortunately most pregnancy-related RLS cases fully resolve within a month after birth (Srivanitchapoom et al., 2014). Leg cramps are involuntary muscle contractions which also often occur at night and are commonly felt by women in their second and third trimesters (K. Zhou, West, Zhang, Xu, & Li, 2015). Prevalence of leg cramps in pregnancy and subsequent adverse sleep issues are similar to those of RLS (Hensley, 2009).

1.4.2.3 Third Trimester

Sleep in the third trimester is characterised by decreased SWS, REM sleep (Brunner, Münch, Biedermann, & Huch, 1994) and total sleep time (J. J. Chang et al., 2010). For some women, the third trimester is also distinguished by high levels of sleep fragmentation which continues to increase through to the last week of pregnancy (M. L. Evans, Dick, & Clark, 1995).

The growth of the fetus, placenta, uterus, breast tissue, blood volume, amniotic fluid and nutrient storage equate to a weight gain of approximately 11.5-16 kilograms for a woman with a healthy BMI range (Rasmussen et al., 2010). This places a large energy demand on the body to supply oxygen and nutrients to the fetus, placenta and uterus and places a significant load on the cardiac system (Yosefy et al., 2012). For a healthy woman with a normal-sized fetus, blood plasma volume increases during pregnancy by almost 50%, in turn increasing cardiac output (Hyttén, 1985). Increased demand on heart and lung capacity requires an increase in metabolism, which can have a fatiguing effect on the body (K. A. Lee & Zaffke, 1999). The enlarged abdominal girth causes upward pressure on the diaphragm, resulting in increased effort to breath, increased minute ventilation and a decrease in functional residual capacity

(Butkov & Lee-Chiong, 2007). Additionally, the recumbent position reduces the mechanical efficiency of breathing, increasing dyspnea and precipitating sleep fragmentation.

Many other factors contribute to poor sleep quality in the last trimester, such as uterine contractions, abdominal pain, frequent urination, cramps, feeling uncomfortable, feeling hot, having bad dreams and gastroesophageal reflux (Ursavas, 2009; Wolfson & Lee, 2005). Increased uterine size and fetal movements can make finding a comfortable sleep position difficult later in pregnancy. Joint and muscle pain, fluid retention and breast tenderness can be painful enough to prevent sleep onset or cause frequent arousals from sleep (Baratte-Beebe & Lee, 1999). Nocturia and reflux can cause awakenings as the uterus compresses the bladder, reducing its capacity (resulting in frequent nocturia) and as the uterus squashes the diaphragm, the intestines and oesophageal sphincter are displaced (causing reflux). Iron deficiency anaemia, of which tiredness is a symptom, can also result from the increased blood volume (K. A. Lee & Zaffke, 1999).

Poor sleep in pregnancy has been linked to increased pain sensitivity, inflammation, discomfort during labor, and preterm labor (Beebe & Lee, 2007; Blair, Porter, Lelebicioglu, & Christian, 2015; K. A. Lee & Gay, 2004). Bourjeily et al. (2010) found sleep disordered breathing is associated with adverse pregnancy, delivery and fetal outcomes, specifically, gestational diabetes (even after controlling for body mass index), unplanned caesareans and low one-minute APGAR scores but not five-minute APGAR scores. Similarly, short sleep duration in pregnancy is associated with significantly longer labour, higher rates of caesarean births (K. A. Lee & Gay, 2004), more pain and discomfort in labour, higher rates of preterm labour (J. J. Chang et al., 2010), excessive weight gain (Althuisen, van Poppel, Seidell, & van Mechelen, 2009) and psychiatric disorders (Qiu, Gelaye, Fida, & Williams, 2012). Interestingly, long sleep durations in

pregnancy have also been associated with psychiatric disorders (Qiu et al., 2012) and hypertension (Williams et al., 2010).

Sleep position appears to have a considerable effect on pregnancy outcomes. Recent studies have investigated the associations between third trimester sleep practices and late stillbirth. In a meta-analysis of six case-controlled studies, Cronin et al. (2019) identified that supine going-to-sleep position after 28 weeks gestation was associated with increased odds of stillbirth, while going-to-sleep position on the left or right side appeared equally safe. While stillbirth is most commonly associated with supine sleep position, O'Brien et al. (2019) found that long nighttime sleep durations (greater than nine hours), having long periods of undisturbed sleep and waking on the right side in the last pregnancy month, to be associated with late stillbirth (≥ 28 weeks gestation). This is similar to two other studies (Heazell et al., 2018; Stacey et al., 2011) that found that both long and short sleep durations, one or fewer awakenings to use the bathroom and frequent daytime napping were also more common in women experiencing stillbirths, though two additional studies have found no associations between frequent daytime napping and stillbirth (McCowan et al., 2017; O'Brien et al., 2019). The mixed results from these studies, highlight the need for more research in this area.

Studies investigating sleep and parity in the perinatal period are limited. Both Signal et al. (2007), and Lee (2000) found that multiparous (experienced) mothers have more disrupted sleep in pregnancy compared to nulliparous mothers, although the latter study did not find any difference by parity for sleep duration. Similarly, Coo Calcagni et al. (2012) found that nulliparas napped more often and experienced worse sleep in the third trimester and one week postnatally compared to multipara. A recent study by Christian et al. (2019) found that nulliparas experienced declining sleep quality from the first to the third trimester while multiparas had poorer overall sleep quality compared to nulliparas during the first and second

trimesters but no significant change over the course of pregnancy or in early postnatal period. These authors suggest that multipara have poorer sleep quality in early pregnancy due to caregiving for additional children, but the fewer parity-related differences in sleep quality in later pregnancy and the early postnatal period may be due to both groups of women experiencing greater sleep disruption from pregnancy related symptoms and the demands of having a newborn child.

1.4.3 Lack of first trimester data

There is a small body of literature that supports the importance of investigating sleep in early pregnancy (Haney et al., 2014). As described previously, there are clear changes in sleep during the first trimester, however there is an under-representation of first trimester data, with common summaries of maternal sleep trajectories stemming from data primarily focussed on the second and third trimesters. This absence has fuelled common statements such as “sleep declines with advancing gestation” (Ferraro et al., 2014) or study design justifications such as “participants were recruited in the second trimester, since sleep is more affected by pregnancy in the third trimester” (Bais et al., 2019). Conclusions such as “Our study confirmed previous findings that general sleep quality declines as pregnancy proceeds” when data collection only commenced in week 18-20 does not provide an accurate representation of the current research (Polo-Kantola, Aukia, Karlsson, Karlsson, & Paavonen, 2016).

In a meta-analysis by Sedov et al. (2018) examining the sleep quality of over 11,000 women throughout pregnancy, the authors acknowledged there was a low representation of first trimester data, stating that the low sample numbers made it impossible to accurately summarise the changes in sleep quality from trimester one to trimester two. In a systematic analysis by Pamidi et al. (2014) looking at maternal sleep disordered breathing and adverse pregnancy

outcomes, only three of the 31 articles examined first trimester participants, however closer assessment identified that two of these had small sample sizes (n=9 & 15), while the third had a larger sample (n=202) but gestations ranged from six to 20 weeks, which encroaches well into the second trimester. Another recent meta-analysis by Xu et al. (2018) investigating the association between sleep duration and gestational diabetes stated that all seven studies in the analysis included 'early' pregnancy data, however importantly only three of these seven studies were conducted in the first trimester. This highlights the complexities and importance, of defining pregnancy timeframes in research studies.

It is not only sleep research that is lacking in the first trimester. Other pregnancy reviews that focus on other aspects of gestational risk are underrepresented at this time point. Only one study could be located that has examined the links between sleep quality and suicidal ideation in the first trimester (Gelaye et al., 2017), and similarly in a meta-analysis investigating maternal smoking and fetal measurements of over 70,000 women only 5.2% of the cohort were studied in the first trimester.

A systematic review with over 1500 citations by Bennett et al. (Bennett, Einarson, Taddio, Koren, & Einarson, 2004), examined 21 articles (n=19,284 patients) to estimate depression prevalence in pregnancy and found rates of 7.4%, 12.8% and 12.0% in the first, second and third trimesters respectively. However, calculations revealed that only 1.3% of the review's data were collected within the first trimester. The authors did acknowledge that rates must be interpreted with caution because few studies were available with small samples and the small cohort precluded the assessment of publication bias. However, on closer investigation of the five studies included in the first trimester assessment, only two studies identified women prior to 14 weeks gestation, with the remaining three studies reporting gestations of <20 weeks (Pajulo, Savonlahti, Sourander, Helenius, & Piha, 2001), "early pregnancy" (Areias, Kumar, Barros, & Figueiredo,

1996) and <16 weeks (Birndorf, Madden, Portera, & Leon, 2001). Interestingly, this latter study found a major depression prevalence of 24.6% for women at less than 16 weeks gestation. The two studies with representative data from the first trimester also found relatively different outcomes from the main finding. One study found that 16% of their sample experienced an affective disorder throughout the entirety of pregnancy, but importantly, 68% of these women experienced it prior to 12 weeks gestation (Kitamura, Shima, Sugawara, & Toda, 1993). The other study that clearly reported first trimester data (<14 weeks), also found that total prevalence of depression was reasonably low (5%), but trimester one and trimester three prevalence were the same, with lower prevalence in trimester two (Affonso, Lovett, Paul, & Sheptak, 1990). This study also used a non-standard questionnaire, instead modifying the 'Schedule for Affective Disorder and Schizophrenia' (SADS) assessment by deleting items that 'had nothing to do with depression' and furthermore, scoring guidelines were modified for somatic items as well as loss of interest, social withdrawal, anger, irritability and psychomotor retardation. Clearly, this review is not representative of first trimester depression rates, however the conclusions from this paper have been used extensively, including being used in other systematic reviews (Dennis, Ross, & Grigoriadis, 2007).

This is not a unique finding. In another systematic review examining the prevalence of depression among over 30,000 pregnant women, only 528 women were studied in the first trimester, totalling only 1.7% of the cohort (Gavin et al., 2005). These statements and conclusions perpetuate the myth that women in the first trimester are relatively immune to, or less effected by, pregnancy related issues. While difficulties in recruiting are present and data are scarce, care still need needs to be taken in using broad statements about the trajectories of sleep and mood in pregnancy until sufficient research focussing on the first trimester is available and conclusions can be justified.

Difficulty recruiting women in the first trimester is understandable, given the small window between when mothers have a pregnancy confirmed and the beginning of the second trimester. A range of reasons may lead to delayed announcement of pregnancy, including previous miscarriage or termination, family or friends struggling with infertility, discussions about whether to terminate the pregnancy, couples wishing to keep the first trimester as a special time between themselves, fear of employment discrimination against pregnant women, and women not recognising they are pregnant until later in pregnancy.

Studies with narrow eligibility criteria or complex protocols face additional recruitment obstacles. Recruiting nulliparous women could be seen as more challenging, as they and their partners are experiencing an unfamiliar, and quite possibly overwhelming life event, though multiparous women may decide research studies create a further burden in an already challenging environment of looking after multiple children. Furthermore, women with a history of depression may be hesitant to reveal their psychiatric history. By no means an extensive list, these illustrate important considerations when recruiting pregnant women in the first trimester.

1.4.4 Sleep from pregnancy to the postnatal period

Typically, sleep is disrupted through the early postpartum period. This is highly variable, with sleep returning to pre-pregnancy levels within three months postpartum for some women (Hedman et al., 2002), while for others sleep continues to be a challenge (Richter, Krämer, Tang, Lemola, & Montgomery-Downs, 2019). One early study by Lee et al. (2000), assessed 29 women with home-based (ambulatory) PSG for two nights during pre-pregnancy, once per trimester, and during the first and third months postpartum. The authors found no significant variation in sleep duration throughout pregnancy (though a declining trend), but there was a significant decrease at one month postnatal and improvement by the third month back to pre-pregnancy

values. A similar significant pattern was seen in sleep efficiency, though improvements did not return to pre-pregnancy levels.

Coo et al. (2014) examined 29 pregnant women late in the third trimester, 15 days postpartum, and 10 to 12 weeks postpartum. Objectively measured sleep duration (via actigraphy) declined significantly in the immediate postpartum but recovered by three months postpartum to late pregnancy levels, while subjective reports (as measured by the Pittsburgh Sleep Quality Index (PSQI)) also declined but did not improve to late pregnancy levels. They found a greater impact on sleep efficiency and though there was some improvement by three months postnatal, sleep did not return to pregnancy levels. This is similar to Montgomery-Downs et al. (2010), who also found that sleep efficiency improved from the first month to fourth month postpartum, however they did not see a significant change in nocturnal sleep duration over the three months.

1.5 Depression

For women of childbearing age, mental illness (specifically depression) is the leading cause of disease burden globally (World Health Organization, 2009) and women are twice as likely to become depressed than men (Buist et al., 2002). Importantly, depression is a highly recurrent disorder, with more than 75% of depressed patients having more than one depressive episode, usually within two years of recovery (Gotlib & Joormann, 2010).

Depression is a condition that primarily involves a disturbance of mood, characterised by being sad, hopeless, discouraged, or simply depressed (American Psychiatric Association, 2010). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013), major depressive disorder (MDD) requires five or more symptoms to be present within a two-week period. One of the symptoms should at least be either a depressed mood or anhedonia (loss of interest or pleasure). The secondary symptoms of MDD are appetite or weight changes, sleep difficulties (insomnia or hypersomnia), psychomotor agitation or retardation, fatigue or loss of energy, diminished ability to think or concentrate, feelings of worthlessness or excessive guilt, and suicidality.

Among all age groups in New Zealand, depressive and anxiety disorders are the second leading cause of health loss behind heart disease, but of greater prevalence than obesity. For childbearing aged women (aged between 15-44 years) mental health disorders are the leading cause of health loss, accounting for over 25% overall and nearly three times the rate of cancer or injury (New Zealand Ministry of Health, 2016). Based on 2013 Organisation for Economic Co-operation and Development (OECD) figures, New Zealand women aged 15-24 had the highest suicide rates from the 34 countries (New Zealand Ministry of Health, 2017a).

1.5.1 Sleep and depression

A ruffled mind makes a restless pillow.

Charlotte BRONTË, *The Professor*, (1857), 1st Ed., Smith Elder & Co., London, England

One of the most consistent symptoms or risk factors for depression is poor sleep (Murphy & Peterson, 2015). In all types of sleep disorders, 25-58% of patients exhibit some form of depression (Vandeputte & de Weerd, 2003). Conversely, it is well established that those diagnosed with psychological disorders typically have disturbed sleep (Benca et al., 1997). Up to 90% of depressed patients reporting poor sleep quality (Drago, 2008) and approximately 40% suffering from insomnia related complaints, such as difficulties with sleep onset, sleep maintenance and early morning awakenings (Murphy & Peterson, 2015; Perlis, Giles, Mendelson, Bootzin, & Wyatt, 1997), daytime sleepiness and fatigue (Franzen & Buysse, 2008), subjective sleep disturbances and poor sleep quality (Nutt, Wilson, & Paterson, 2008; Thase, 2006). Multiple disturbances in sleep are evident in about 45% of depressed outpatients and 80% of more severely depressed inpatients (Tsuno, Besset, & Ritchie, 2005). Furthermore depressive disorders are often associated with hypersomnia or long sleep durations (van Mill, Hoogendijk, Vogelzangs, van Dyck, & Penninx, 2010) and changes to sleep architecture, such as decreased latency to REM, increased REM and decreased SWS (Finan, Quartana, & Smith, 2015). The association between psychological disorders and sleep is so strong that the DSM-5 classified mental health disorders, such as depression and anxiety, list sleep disruption as a diagnostic criteria (R. Cooper, 2014).

On reflection, it is not surprising that suboptimal waking function is associated with disrupted sleep and vice versa, since these are interdependent states of the same brain. Sleep disturbance can pre-date the onset of depression (Meerlo, Havekes, & Steiger, 2015) and depression is

associated with sleep disruption (Kempler, Sharpe, & Bartlett, 2012). Evidence also suggests that sleep strongly influences not only the development of depression but also the trajectory of depression; that is, episode frequency, severity and duration (Franzen & Buysse, 2008). Moreover, people with persistent sleep problems have elevated risk of developing major depression within one year (Breslau, Roth, Rosenthal, & Andreski, 1996; Eaton, Badawi, & Melton, 1995; Paunio et al., 2015), more than for any other depression symptom (Franzen & Buysse, 2008). Conversely, improving sleep in those suffering depression has been found to improve health-related quality of life in non-pregnant samples (Franzen & Buysse, 2008; McCall et al., 2010). However, because the relationship between sleep and depression is bidirectional and complex, it remains poorly understood.

1.5.2 Pregnancy and depression

All I could think about were the weeks stretching out in front of me. Sixteen of them, and nothing I could do to speed them up. It reminded me of the feeling I had on flights, which had also become a source of deep anxiety for me. I was stuck in the mid-air of pregnancy, and I couldn't force the plane to land... My mind played on a loop, fixating on the days and weeks that I had left. The kicks and flips that I had treasured not long before became taunting reminders of the mental distress I was in. I couldn't eat or sleep. I walked everywhere, in an attempt to distract myself from the monotonous loop of thoughts playing repeatedly in my head. At night, I lay in the bath and had frightening thoughts of suicide. I didn't want to die but I couldn't bear the low hum of terror that had become my unwelcome companion.

Clementine Ford, *"I steeled myself for postnatal depression, but it struck earlier"*,

Sydney Morning Herald, Sydney Australia, 18th Nov 2016

The majority of maternal mental health research has concentrated on the postnatal period, leaving depression in pregnancy relatively neglected. 'Postnatal depression' was first presented as a field of research in the early 19th century, however the psychiatric community did not officially recognise this disorder until 1994 (American Psychiatric Association, 1994). Moreover, it has only been since 2013 that the American Psychiatric Association (APA) have broadened the time period to include pregnancy, demonstrated by changes in terminology (perinatal instead of postnatal) and based on insufficient evidence to distinguish between pregnancy and postnatal depressive episodes (Alhusen & Alvarez, 2016). It is only in the last decade that it has been more intensively investigated. This may be in part due to the long-held belief that pregnancy had a protective effect on mental health (Oates, 2003).

Mental health disorders disproportionately affect women (Yonkers, Vigod, & Ross, 2011), and women of childbearing years' (25-34 years) experience higher rates of depression than at any other time (J. Evans, Heron, Francomb, Oke, & Golding, 2001) with some suggesting that peak risk is in pregnancy (O'Keane & Marsh, 2007). Perinatal depression prevalence rates vary greatly. Mellor (2014) recently summarised worldwide rates of depressive symptomology in pregnancy as varying from 5% to 39%, with lower rates in economically developed countries and higher rates in poorer countries, though the opposite was seen in a review of postnatal depression, where prevalence ranged from 4% to 64% but was higher in high-income countries (Arifin, Cheyne, & Maxwell, 2018; Parsons, Young, Rochat, Kringelbach, & Stein, 2012). The American College of Obstetricians and Gynaecologists state that major and minor depression in pregnancy or postnatal affect one in seven women (Gavin et al., 2005), though a report from the same organisation four years later concluded that one in five women will experience pregnancy depression (Yonkers, Wisner, et al., 2009). An Australian study, reviewing antenatal depression rates of over 17,000 women in two localised areas in New South Wales, found a lower

prevalence in its cohort of 6.2%, however the authors posit this may be due to the occurrence of well-received, government funded, in-patient and community-based interventions that aim to identify and support mothers with probable depressive episodes quickly (Ogbo et al., 2018). Though recent meta-analyses have been published in various countries and regions, such as Bangalore (Nath et al., 2019), Ethiopia (Ayano, Tesfaw, & Shumet, 2019), and South Asia (Mahendran, Puthussery, & Amalan, 2019), prevalence figures are often outdated. Even a 2019 systematic review investigating perinatal depression interventions from the United States of America (USA) Preventive Services Task Force, used prevalence data from 2012 (O'Connor, Senger, Henninger, Coppola, & Gaynes, 2019). A current systematic review and/or meta-analysis focusing on depression prevalence in pregnancy is warranted because perinatal depression is thought to be under-recognised (Hight, Gemmill, & Milgrom, 2011), under-diagnosed and suboptimally treated (Biaggi, Conroy, Pawlby, & Pariante, 2016).

Studies in New Zealand investigating the prevalence of antenatal depressive symptomology, confirm rates between 11.9% and 15% (Signal et al., 2016; Waldie et al., 2015), with rates for Māori women higher at 22% (Signal et al., 2016). According to Statistics New Zealand, with just over 61,000 births in New Zealand in 2015, approximately 10,000 New Zealand women are likely to have their health compromised each year by antenatal depression. By comparison, prevalence rates for postnatal depression range from 9% to 20% (Coverdale, McCullough, Chervenak, & Bayer, 1996) and though less well documented, antenatal depression appears to be at least as common as postnatal depression (J. Evans et al., 2001).

Gestational age appears to be a significant factor. A systematic review by Bennett et al., (2004) which utilised data from 21 studies and over 19,284 pregnancies, found that depression in pregnancy had a prevalence rate of 7%, 14% and 12% for the first, second and third trimesters respectively. This is similar to the findings by Evans et. al (2001), who found rates to be 11.8%

and 13.5% at 18 weeks and 32 weeks gestation respectively. However, it must be emphasised again that reviews on gestational prevalence may not be accurate. “There is a painful lack” of first trimester, and indeed longitudinal data across pregnancy (Kozinszky & Dudas, 2015) and the perinatal period (Gaynes et al., 2005). This is despite researchers nearly 25 years ago appealing for more studies to collect and evaluate first trimester data (Coverdale et al., 1996).

The limited literature available in early pregnancy suggests that the incidence of antenatal depression appears to increase in the first trimester (Coverdale et al., 1996; Fan et al., 2009; Maschi et al., 2008). Yu et al. (2017) analysed data from women in trimester one, two and three (n=3645, n=2320 and n=2109 respectively) and found that the prevalence of depression was highest in trimester one (36%), compared to trimester two (24%) and three (26%). Similarly, Truijens et al. (2017) found that, of the number of women presenting with persistent depression throughout pregnancy, 83% could be detected in the first trimester. These findings suggest that this period may be a time of high vulnerability to depression, though further studies are greatly needed.

1.5.2.1 Risk Factors for Depression in Pregnancy

A systematic review by Lancaster (2010) identified the following key risk factors for depression in pregnancy: A history of depression; life stress and/or negative life events and belonging to an ethnic minority as well as other psychosocial factors such as low socioeconomic status, lack of social or partner support, intention to get pregnant, pregnancy anxiety, domestic violence and young age.

Previous History of Depression

One of the primary risk factors for developing depression in pregnancy is having a previous history of depression (Marcus, Flynn, Blow, & Barry, 2003). In a systematic literature review of 111 articles, Rich et al. (2013), identified that women with previous personal or family mental health problems were significantly more likely to experience pregnancy-related depression. Similarly, a review by Lancaster et al. (2010), found a significant relationship between a personal history of depression and depressive symptoms in pregnancy. Consistent with these review findings, studies by Jeong et al. (2013), Deitz et al., (2007) and O'Keane (2007) all found that having both a history and familial history of depression presented a two-fold increase in risk for antenatal depression. Forty et al. (2006), has shown that 42% of women with a family history of postnatal depression experienced postnatal depression themselves, compared to only 15% of women who had no family history.

Antenatal depression is also a strong predictor of postnatal depression (Leigh & Milgrom, 2008; Robertson, Grace, Wallington, & Stewart, 2004), and also increases the risk of developing depression later in life (McMahon, Trapolinia, & Barnett, 2008). A large Swedish cohort study of over 700,000 women from 1997 to 2008 found that the risk of postnatal depression was 20 times higher for women with a history of depression. A Brazilian study of 831 pregnant women, found that women who experienced antenatal depressive symptoms were 2.4 times more likely to present with postnatal depressive symptoms than women who had no pregnancy depressive symptoms (Faisal-Cury & Menezes, 2012). A similar finding was reported by Deitz et al. (2007) in a study of 4,398 pregnancies. Of the women that experienced postnatal depressive symptoms, 54% had a depression diagnosis either during or preceding pregnancy. Choi et al. (2014) also found 59% of women with antenatal depression experienced postnatal depression.

While these findings underscore the recurring nature of depression, what is unclear is whether the high levels of depression in pregnancy are due to a high relapse rate or an overall increased incidence of depression (O'Keane & Marsh, 2007). While there is a consensus that pregnancy depressive symptoms are generally associated with postnatal depressive symptoms, there is some suggestion that each may have their own, or multifactorial, aetiology and set of risk factors (Kettunen, Koistinen, & Hintikka, 2014; Putnam et al., 2015; Wikman et al., 2019).

To further explore this, recent studies have examined the trajectories in the occurrence of depression over these timeframes. English et al. (2018) found that while pregnancy and postnatal depression are correlated, different factors predicted depression at each time point. Pregnancy depression was better explained by socioeconomic and lifestyle factors, such as worry, lack of support, younger age, and adverse lifestyle habits (such as sleep). Postnatal depression, however, was mostly associated with a personal or family history of depression and less reliably predicted by all other available covariates in the analysis. These findings are similar to those of Kinser et al. (2014), who suggest that environmental factors are related to depression in pregnancy, but biologic-genetic components are associated with the occurrence of postnatal depression. This has important implications for the development, timing and content of interventions aimed at minimising perinatal depression.

Ethnicity

Women that identify as coming from an ethnic minority group have considerably higher rates of pregnancy and postnatal depression, with studies demonstrating prevalence rates of up to 50% in studies focusing on Hispanic, African-American populations (W.-H. Kuo et al., 2004; Zayas, Cunningham, McKee, & Jankowski, 2002). In New Zealand, the most recent reports from the Ministry of Health reveal Māori are approximately one and a half times more likely to experience

depressive disorders than non-Māori (New Zealand Ministry of Health, 2018b). Moreover, Māori women have a higher prevalence of perinatal depression, higher mortality (Perinatal and Maternal Mortality Review Committee, 2018) greater severity of depressive symptoms and often experience onset of mental health conditions at an earlier age and (New Zealand Ministry of Health, 2008). Māori suicide rates are significantly higher than other New Zealand ethnic groups (Durie, 2017).

The Māori mental health strategy for the period 2002–2007 “Te Puawaitanga Māori Mental Health National Strategic Framework”, indicates significant disparities between the mental health of Māori and non-Māori, including differences in access to care and inequities in health services (greater deprivation, social isolation and discrimination). This results in Māori women being less likely to be detected or treated for depression by maternal care providers. Māori women are also more likely to have simultaneous risk factors, such as younger age, lower socioeconomic status, poorer access to services and less partner support (New Zealand Ministry of Health, 2012). Furthermore, at least two in five Māori report feeling socially isolated or lonely which significantly exacerbates the mental distress they are experiencing as well as feeling significantly higher levels of psychological distress related to their depressive symptoms (Russell, 2018).

Psychosocial Risk Factors

Major meta-analyses and systematic review studies have stressful life events, social and partner support, low self-esteem, low income and education and other measures of low socioeconomic status are additional key predictors of perinatal depression (Dennis et al., 2007; Lancaster et al., 2010; O'Hara & Swain, 1996; Smorti, Ponti, & Pancetti, 2019). Unintended pregnancy, history of domestic violence and marital status have also been found to have a strong association with

depressive symptoms (Dennis & Dowswell, 2013; Lancaster et al., 2010). Inconsistent findings have been found for smoking, alcohol and drug use, parity and employment status (Dennis & Dowswell, 2013). Moreover, a systematic review and meta-analysis of 15 studies demonstrated that immigrant women have a two-fold risk of developing postnatal depression as compared to non-immigrant women (Falah-Hassani, Shiri, Vigod, & Dennis, 2015). A review by Biaggi et al. (2016) noted mixed findings about the role of parity as a risk factor for antenatal depression with five studies finding that multiparous mothers had more risk than nulliparous, three studies finding the reverse and 10 studies finding no difference. Gravidity was also examined and found to be just as inconclusive.

1.5.3 Consequences of depression in pregnancy

While pregnancy depression prevalence is not dissimilar to the general population (English et al., 2018), it is the consequences of depression in pregnancy that can lead to considerable problems for both mother and baby. In extreme cases, suicide is the most devastating consequence. Sadly, maternal suicide is the leading cause of death in the year after birth (Oates, 2003) and has higher rates than haemorrhage as a cause of mortality (American College of Obstetricians and Gynecologists., 2015). Estimates reveal that 56% of all women committing suicide have a known mental health disorder with a mood disorder being the most common (Koslow, Ruiz, & Nemeroff, 2014). Furthermore, a study of 1298 women in the third trimester found that depressed women with poor sleep quality had 13.56-fold increased risk of suicidal ideation (Gelaye et al., 2017). This author also reported on a separate cohort of 641 women in the first trimester and similarly, depressed women with poor sleep quality had 3.48-fold increased odds of suicidal ideation (Gelaye et al., 2015). Sadly, on a national basis, New Zealand

has maternal suicide rates seven times higher than those in the United Kingdom (Perinatal and Maternal Mortality Review Committee, 2012).

Depressed women may have a diminished ability to make good health decisions, so are more likely to have a poor diet, smoke, misuse illicit substances (Buist et al., 2002) or overuse prescription drugs (Newport et al., 2012). They may also be less compliant with prenatal care (Leigh & Milgrom, 2008) and feel less invested in the care of the fetus (Marcus & Heringhausen, 2009). Depression in pregnancy has been shown to be associated with adverse gestation and birth outcomes, such as small-for-gestational age, maternal preeclampsia, low birth weight, smaller head circumferences, increased risk of premature delivery, increased surgical delivery interventions, lower APGAR scores, and more admissions to the neonatal intensive care unit (Marcus & Heringhausen, 2009), as well as increased risk of infant mortality (Goedhart et al., 2010).

Nicholson et al., (2006) found that in a group of 175 women in the first trimester, those with elevated depressive symptoms had significantly poorer health-related quality of life compared to those with minimal depressive symptoms, even after controlling for sociodemographic factors. This is similar to the work by Da Costa et al. (2010) who found that experiencing sleep problems in the third trimester was linked with poorer health-related quality of life which was also then independently associated with elevated depression scores. Moreover, Setse et al. (2009) found that quality of life scores improved in consecutive trimesters if depression scores improved compared to those who remained depressed.

A strong correlation between maternal and paternal depression is evident, with up to 50% of fathers developing paternal depression if their partner is depressed (Goodman, 2004). Critically, infant outcomes and developmental milestones are more greatly impaired when both parents

are depressed (Kerstis et al., 2016). Marital conflict and dissatisfaction are also associated with maternal depression (Dennis & Ross, 2006).

Depression during pregnancy can also have detrimental effects on infant development (Barker, Kirkham, Ng, & Jensen, 2013; Meijer et al., 2011). A study of nearly 800 women in their early first trimester (approximately 10 weeks gestation) found that over 40% of the sample had significant depressive symptoms, with this group having a 60% increased risk of preterm delivery (Li, Liu, & Odouli, 2009). Maternal depression is associated with disruptions in mother-infant bonding (Hairston, Solnik-Menilo, Deviri, & Handelzalts, 2016), with evidence demonstrating that depressed mothers are less engaged, less responsive and more inconsistent to their infant needs and are less likely to interact through reading, singing, and playing games (Campbell et al., 2004). Depressed mothers also exhibit other compromised parenting behaviours such as less compliance with infant safety practices, such as using car seats and childproof latches on cupboards (Field, 2010). Infants of mothers who had depression during pregnancy are more likely to cry regularly, are more difficult to console, have more irregular sleep patterns (Marcus & Heringhausen, 2009; Zuckerman, Bauchner, Parker, & Cabral, 1990), more sleep problems (Armitage et al., 2009; Field et al., 2007), have reduced social interaction and poor fear regulation (Feldman et al., 2009). Maternal depression decreases the likelihood of breastfeeding initiation (Grigoriadis et al., 2013) and can lead to the cessation of breastfeeding (Cato, Sylvén, Lindbäck, Skalkidou, & Rubertsson, 2017; Nishioka et al., 2011).

Toddlers of depressed mothers have delayed developmental milestones (Tuovinen et al., 2018), while pre-school and school-aged children often have deficits in social, behavioural, neurophysiological and cognitive areas (Burke, 2003; Kingston, McDonald, Tough, & Austin, 2015; O'Connor, Monk, & Fitelson, 2014). Long-term parental depression has been found to be associated with a substantial increase in the child presenting at emergency departments and

using secondary healthcare services (Dreyer, Williamson, Hargreaves, Rosen, & Deeny, 2018; Sills, Shetterly, Xu, Magid, & Kempe, 2007). Longitudinal studies have found that children of depressed parents and / or mothers have a higher risk of substance abuse (Weissman et al., 2006) and a five-fold increase of experiencing depression themselves into adolescence and middle age (Murray et al., 2011; Weissman et al., 2006). Furthermore, the trans-generational effect of depression is becoming more apparent, with depressed mothers having a 50% higher chance of having a grandchild with psychopathology (Weissman et al., 2005). Whether this is via behavioural or mental programming or genetics, is not yet understood. Because depression impacts are extensive, severe and enduring, maternal depression is now considered the most common non-obstetric complication related to childbirth (English et al., 2018). Pregnancy represents a crucial time where “there is no health without mental health” (Sattler et al., 2017), and therefore needs urgent attention.

Beyond Blue (an independent Australian federal government mental health initiative), contracted Price Waterhouse Cooper in 2012 to analyse the cost of untreated perinatal depression and anxiety to the Australian community (PricewaterhouseCoopers Australia, 2012). They found the societal cost to be \$728 million over a 20-year period, a figure that considered adverse birth outcomes, the cost of medical care and lost productivity to mothers, fathers and the child. Because of the recognised long-term cost, this figure included reduced educational attainment, long term health impacts and reduced earning potential of the child. Beyond Blue recommended early intervention for perinatal depression and has estimated that reducing perinatal depression by just 5%, total costs could be reduced by \$136 million/\$178 million/\$203 million over two years/10 years/20 years respectively. The productivity loss effect is more pronounced for antenatal depression than postnatal depression due to greater workforce participation during pregnancy than the immediate year following childbirth.

1.5.4 Screening and treatment for depression in pregnancy

There are few psychiatric events as predictable as depression in pregnancy and understanding women's past and current mental situation should be as essential as asking questions about diabetes and epilepsy (Oates, 2003). The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) recommends that all perinatal care providers are aware of the risks of perinatal depression and screen their patients at least once during the perinatal period using a standardised, validated screening tool and refer for early intervention as required (Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2018).

The under-recognition of antenatal depression is concerning. In a small study of 76 women by Whitton et al. (1996), 55% of the women thought their symptoms were bad enough to amount to depression, but 89% of this group had not reported their symptoms to any health care provider. Similarly Yazici et al. (2015) found that in a sample of 73 women in the first trimester experiencing depressive symptoms, only 29% sought treatment. In a New Zealand sample, Signal et al. (Signal et al., 2016), found that less than 50% of pregnant women sought help after experiencing two weeks of poor mood. Relatedly, Mellor et al. (2014) found that of the pregnant women that screened positive for probable depression, 48% did not consider themselves depressed. These findings suggest that 1) prevalence rates may be higher than previously evidenced, and/or 2) women themselves are unable, or perhaps apprehensive, to recognise symptoms. However, a number of studies have shown that healthcare professionals are also not recognising depressive symptomology in pregnant women. For example, Marcus et al. (2003) found that, of the 20% of pregnant women who screened positive for likely depression by a healthcare professional, 86% were not receiving any formal treatment.

1.5.5 Postnatal depression

Postnatal depression refers to the development of a depressive illness following childbirth (Musters, McDonald, & Jones, 2008). Although the DSM-5 does not recognise postnatal depression as a separate condition in its current classification system, it can be specified as being perinatal-onset if the onset of a depressive episode is within four weeks of childbirth (American Psychiatric Association, 2013).

“Postnatal blues” typically occurs for a short period of few hours up to seven days following delivery and includes symptoms such as irritability, restlessness, despondency, mild confusion and/or hypochondriasis (Pitt, 1973). Postnatal depression is a more prolonged and serious condition, with many authors suggesting that the DSM-5 specifier of within four weeks of childbirth is too conservative, since prevalence appears to peak two to six months after birth (Gavin et al., 2005) and propose that depressive episodes occurring up to 12 months post birth may be considered a more accurate timeframe (O'Hara & McCabe, 2013; Sit & Wisner, 2009). Women who experience postnatal depression have more than twice the risk of experiencing future episodes of depression (Llewellyn, Stowe, & Nemeroff, 1997), which is consistent with a review of 23 longitudinal studies by Vliegen et al. (2014). They established that 50% of mothers from clinical samples remained depressed at one-year post birth, while 30% of mothers from community samples were still experiencing depression up to three years post birth.

A review by Arifin et al. (2018) of 124 studies with data from more than 50 countries, found that global postnatal depression prevalence ranged from 4% to 64%, with Japan recording the lowest rates and America reporting the highest. These findings are similar to another review by Halbreich which analysed 143 studies from 40 countries and found a prevalence of between 0% and 60%. Both studies stated that study design, sampling methods, measurement tools and cut-

offs, point prevalence and cultural and socio-demographic diversity are broad, hence it was meaningless to generate a mean prevalence.

Evidence shows that the consequences of postnatal depression are similar to that of pregnancy depression in terms of the adverse impact on the mother, baby, partner and extended family, though depression that occurs in the baby's first year of life would be considered to have a greater impact on the child's development (González et al., 2017). This is congruent with the previously discussed 'first 1000 days' of a child's life.

1.6 Sleep, pregnancy and depression

Changes in sleep across all perinatal time points appears to coincide with the occurrence of mood disturbances and likely share a reciprocal causal relationship (Baiardi et al., 2016), though directionality is unclear (Bei, Coo, Baker, & Trinder, 2015), with both cross sectional and longitudinal studies showing that insufficient and poor sleep quality are associated with depressive symptoms at the same time point (Bais et al., 2019; Jomeen & Martin, 2007; Sattler et al., 2017; Yang et al., 2017), and additionally, poor sleep predicts worsening depressive symptoms in later pregnancy (M.-W. Chang, Brown, Nitzke, Smith, & Eghtedary, 2015; Eichler, Schmidt, Hiemisch, Kiess, & Hilbert, 2019; Skouteris, Wertheim, Germano, Paxton, & Milgrom, 2009). To illustrate, Mellor et al. (2014) found that among women with low mood in pregnancy, 87.5% of women who attributed this to sleep-related causes and did in fact have poor sleep quality according to the PSQI. In addition, studies have found associations between poor sleep in late pregnancy and an increased risk of postnatal depression (Lawson, Murphy, Sloan, Uleryk, & Dalfen, 2015; H. Zhou, Li, & Ren, 2018).

Studies examining multiple sleep aspects have found a relationship with depression. Pietikäinen et al. (2018) found that poor sleep quality, daytime sleepiness, short sleep duration, difficulty getting to sleep in late pregnancy and postnatally were all associated with postnatal depressive symptoms, even after adjusting for demographic characteristics and prenatal depression. Severity of poor mood has been found to be associated with the severity of sleep disturbance (Khazaie, Ghadami, Knight, Emamian, & Tahmasian, 2013). Poor sleep quality, even in the absence of pregnancy depression, places women at increased risk of suicide ideation in the postnatal period, though experiencing depression greatly increases that risk (Gelaye et al., 2017).

Although reviews examining sleep in the perinatal period suggest a relationship between the severity and frequency of sleep disturbances and associated psychological conditions (Lawson et al., 2015; Ross et al., 2005), there are studies that have not found such associations. Coocagni et al. (2012) did not find a relationship between self-reported sleep in pregnancy and postnatal depressive symptomatology. Similarly, in a larger study of 217 nulliparous women, Stremmer et al. (2019) collected retrospective self-reported sleep data on pregnancy sleep and additional actigraphic and self-reported sleep measures and depression score were repeated at six and 12 weeks postnatal. While no relationship was found with the pregnancy sleep parameters and depressive symptoms, a strong association was demonstrated with self-reported sleep at six weeks postnatal and postnatal depressive symptoms at six or 12 weeks (there were not enough participants with an EPDS score greater than nine to allow for an examination of these time points separately). This association was particularly prominent with women who reported having a “big problem” with their sleep. No significant findings were found between actigraphic sleep and depressive symptoms, which is similar with other studies that have found associations with self-reported sleep but not objectively measured sleep (Bei et al., 2010; Okun et al., 2013; Park et al., 2013; Volkovich et al., 2016).

Krawczak et al. (2016) found that circadian rhythm disruption, rather than sleep quality, predicted worsening of postnatal depressive symptoms, both in women with or without previous history of depression. This was similar to the findings of Sharkey (2013) who found that most women experienced circadian phase delays from late pregnancy to six weeks postnatal, which were associated with greater depressive symptom severity. Additionally, Wolfson et al. (2003) found that mothers who experienced worse depressive symptoms at two to four weeks postnatal had significantly different sleep schedules (later rise times, longer naps, and more total sleep) in late pregnancy compared to mothers with minimal depressive

symptoms. This is intriguing, given that both groups of women reported similar sleep patterns postnatally. Kamysheva et al. (2010) found that in a healthy sample of 257 pregnant women, second trimester physical discomfort predicted third trimester depressive symptoms, mediated by poor sleep.

Poor sleep in the postnatal period has been shown to be associated with depression (Aksu, Varol, & Sahin, 2017), worse maternal/infant attachment, premature weaning, impatience, less ability to concentrate, fatigue, reduced daytime functioning and impaired infant development (Coo, Milgrom, Kuppens, Cox, & Trinder, 2014; Doering, Morin, & Stetzer, 2009; Goyal, Gay, & Lee, 2009; Kennedy, Gardiner, Gay, & Lee, 2007; Tikotzky, 2016). Indeed, in a study by Aksu et al. (2017) of 400 women at six weeks postnatal, found that of women (77%) reporting fatigue, 96% had elevated depressive symptoms. This is similar to the work of Brown and Lumley (2000), who reported that 74% of women between six and seven months postnatal with elevated depressive symptoms reported higher levels of fatigue. Postnatal maternal daytime sleepiness is associated with increased psychiatric problems, Attention Deficit Hyperactivity Disorder (ADHD) symptoms and poorer executive function (attention, working memory and inhibitory control) in pre-school children (Lahti-Pulkkinen et al., 2018), though this finding was attenuated when controlling for pregnancy depression and anxiety.

Examining a different but pertinent angle, Finnbogadóttir & Persson examined 532 expectant fathers whose partner was in their first trimester. They found that nearly 10% of fathers had a high risk of depression, but importantly fathers with sleeping difficulties were 5.7 times more likely to have elevated EPDS scores. While having high stress was strongly associated with experiencing depressive symptoms, sleep was also significantly associated and had a stronger effect than hazardous alcohol consumption, sexual dissatisfaction and having an unfavourable lifestyle or socioeconomic position. While expectant fathers were not included in this thesis,

interventions aimed at both mother and partner could provide additional information and should be considered in any further research in this area (Da Costa et al., 2017; Finnbogadóttir, Svalenius, & Persson, 2003).

Some researchers have recognised the importance of early identification of both poor sleep and depression in pregnancy (Buist et al., 2002; Jeong et al., 2013; Jomeen & Martin, 2007; Sharp & Lipsky, 2002). But despite strong evidence of links between sleep and depression, and indications that early pregnancy is a critical time for depression and sleep problems to emerge, few studies have explored depression and sleep longitudinally beginning early in pregnancy. Indeed, the International Federation of Gynecology and Obstetrics (FIGO) have recently stated that the first trimester is a window of opportunity to predict and prevent many pregnancy complications (Poon, McIntyre, Hyett, da Fonseca, & Hod, 2018). Early detection and effective treatment of antenatal depression could result in fewer, less severe symptoms and faster recovery. Thus, there is an urgent need to better understand the causal links between pregnancy, sleep and depression.

1.7 Sleep and depression interventions in pregnancy

1.7.1 Pharmacological treatments

With increasing awareness of the importance of treating perinatal depression and the gamut of risks a mother faces with untreated depression, the rates of pharmacological treatment has more than doubled in recent years (W. O. Cooper, Willy, Pont, & Ray, 2007). One Danish study, representing a cohort of nearly one million women, reported a 16-fold increase in antidepressant use from 1997 to 2010 (Jimenez-Solem et al., 2013). However, decisions around the use of pharmacology treatments throughout pregnancy and postnatal is problematic for mothers and clinicians due to conflicting evidence about the safety of antidepressant use during pregnancy and breastfeeding (Scime, 2016). It requires a careful weighing of the risk of medication exposure to both mothers and their unborn babies. While antidepressant medication appears to decrease the risk of depression relapse (Cohen et al., 2006), many women report that antidepressants would be an unacceptable treatment option in pregnancy (Battle, Salisbury, Schofield, & Ortiz-Hernandez, 2013). In a study investigating women's depression treatment preferences, only 7% of women stated that pharmaceuticals would be their first choice of intervention (Goodman, 2009). Mothers who use antidepressant medications report anxious and regretful feelings (Bonari et al., 2005) or have poor adherence (Boath, Bradley, & Henshaw, 2004). Over two thirds of women will have a depression relapse if they discontinue antidepressant therapy during pregnancy (Armstrong, 2008). So while women may be concerned about their mental health, their desire to protect their unborn baby, even at the expense of their own needs may be greater (Condon & Corkindale, 1997).

It appears only one pharmacological study has been completed with the joint aim of improving pregnancy sleep and postnatal depression symptoms (Khazaie et al., 2013). In this randomised

controlled trial, 54 women in the third trimester with insomnia, were assigned trazodone or diphenhydramine or placebo. Actigraphic sleep efficiency (the ratio of total sleep time to the amount of time spent in bed) and sleep duration were improved for the two treatment groups, compared to the placebo groups, at six weeks postpartum. Similarly, depression symptoms as measured by the EPDS also significantly improved in the two treatment groups, compared to placebo, at two and six weeks postpartum. Even with promising results, ACOG have classified trazodone as a 'C' class medication, meaning that the risk of adverse effects cannot be ruled out (Armstrong, 2008).

These improvements are not consistent with results of the next two studies. Okun et al. (2011) found that at 20, 30 and 36 weeks gestation, depressed women using a Selective Serotonin Reuptake Inhibitor (SSRI) antidepressant medication spent more time awake at night, more time napping and had poorer sleep efficiency than depressed women not taking SSRI's. Stone et al. (2017) examined the longitudinal course of antidepressant use with sleep quality and depression severity, in 215 women at trimester two, as well as one and six months postnatal. The results showed disturbed sleep from pregnant women with a depressive disorder and using antidepressants had greater depressive symptom severity throughout the study period and women with remitted depression who continued using antidepressants had elevated levels of sleep disturbance. This could suggest that sleep disturbance as a symptom of depression is not adequately addressed by antidepressant use or equally that the sleep disturbance they are experiencing is not related to depression.

While non-pharmacological treatments are becoming increasingly sought, there are minimal options for women that are safe, cost-effective, readily accessible and non-intrusive. Indeed, the New Zealand Guidelines Group (NZGG) have stated that non-pharmacological interventions should be considered before antidepressant treatment especially if symptoms are mild or if the

mother is in early pregnancy (NZGG 2008). This is consistent with a recent review study on antidepressant use in pregnancy, which recommended that antidepressant medications should only be prescribed after trying other proven non-pharmacological treatments and alternative depression interventions should be more actively pursued (Campagne, 2018).

1.7.2 Behavioural interventions

Similar numbers of pregnant women are using natural/complementary/non-invasive therapies compared to antidepressant medication to treat depressive symptoms (Dennis & Dowswell, 2013), and because the demand for non-pharmacological treatment is growing in pregnant populations, behavioural interventions are increasingly being sought.

In a review of the potential cost benefit of 24 early interventions that prevent or reduce perinatal depression (defined as being conducted during pregnancy and up to one year postpartum) (Bauer et al., 2016), interventions were categorised into five groups: universal interventions; selective preventive interventions (targeted high-risk groups); interventions addressing mild or sub-threshold symptoms; interventions addressing moderate to major symptoms; and interventions addressing major symptoms only. Interventions included yoga, exercise, cognitive behavioural therapy, healthy lifestyle, parenting and peer support. Overall, interventions were shown to be effective in helping prevent or recover from mood disorders and led to positive net benefits from a societal perspective. Women in the universal or selective preventative intervention categories also saw health benefits. Groups that targeted women with mild or sub-threshold symptoms achieved health care benefits only if initiated in pregnancy or long term throughout pregnancy and the postnatal period. Interventions addressing only moderate and major symptoms required significant investment but appeared to have a substantial positive

impact on both mother and child. Specifically, the review suggests that parent education and infant sleep interventions are likely to provide good value for money.

Alternative therapies, such as psychotherapy and cognitive behavioral therapy (CBT) are promising (Sockol, Epperson, & Barber, 2011) but are generally associated with high cost, logistical hurdles, attitudinal barriers and waitlist times (Kim, Hantsoo, Thase, Sammel, & Epperson, 2014). Bright light therapy, acupuncture and herbal remedies are also being increasingly researched, but are far from mainstream or easily available. A study investigating mindfulness training (Felder et al., 2018) found that women who slept poorly at baseline suffered from increasing depression regardless of intervention group and similarly mindful yoga was found to improve the sleep of pregnant women if they started in their second trimester, but not in their third (Beddoe, Lee, Weiss, Kennedy, & Yang, 2010). Both studies suggest that early intervention would be highly valuable.

1.7.3 Availability of pregnancy sleep information

Women are hungry for pregnancy-related health information. In a Canadian study by Hall et al. (2012), 39 women in the third trimester were equally keen to receive information about what interfered with sleep in pregnancy (73%) as understanding concerns, fears, and anxieties regarding pregnancy and labor (73%). Interestingly, the authors indicated that sleep may be an area where women lacked knowledge, either because it has not received adequate research attention, or the transfer of knowledge from existing evidence was not available to pregnant women, and that mothers were looking for reassurance that their sleep experiences were shared by other pregnant women. Similarly, a study by Da Costa et al. (2017) explored the web-based search behaviour of 174 men, whose partners were pregnant or had recently given birth. Ninety-eight percent of the men had spent approximately six hours per month searching for

information on pregnancy and the top three information topics within the psychosocial domains were emotional adjustment (60%), managing sleep problems (58%) and stress-management tools (56%).

Over 90% of pregnant women use the internet as an information source (Huberty, Dinkel, Beets, & Coleman, 2013). A systematic review on the internet use of pregnant women also found that women search for pregnancy information most often during the early stages of pregnancy and not unexpectedly, nulliparous women search more than multiparous (Sayakhot & Carolan-Olah, 2016). A further review on 27 Australian Government and leading industry websites reported that only two websites included information on sleep during pregnancy but neither communicated evidenced based guidelines (Cannon, Lastella, Vincze, Vandelanotte, & Hayman, In press). There is mixed evidence about women's trust in the accuracy or reliability of pregnancy information, with some studies saying that a majority of women perceive the health information they read on the internet to be trustworthy, reliable and useful (Lagan, Sinclair, & Kernohan, 2010; Sayakhot & Carolan-Olah, 2016), while also feeling concerned that information could be wrong or misleading (Lagan et al., 2010). Pregnant women, who can often find themselves confused and worried about how their actions might affect their baby, may have difficulty ascertaining the accuracy and trustworthiness of websites and whether they are current and regulated.

A simple perusal through best-selling pregnancy books and pregnancy guidance material on government and similar websites shows a huge lack of sleep information. Searches on the Australian Sleep Health Foundation website resulted in limited information as to how or why sleep changes from trimester to trimester and a list of five bullet points for improving sleep (Australian Sleep Health Foundation, 2019a). The Australian Government supported parenting website "raisingchildren.net.au" has a separate section for pregnancy information, and though

it covers diverse topics (such as exercise, nutrition, alcohol use, mental health), the only information relating to sleep is a statement on sleep position (Raising Children Network, 2019). The New Zealand Ministry of Health website provides another illustration of the scarcity of pregnancy sleep information. Pregnancy-related health information covering nutrition, smoking, dietary supplements and alcohol consumption is presented but information on sleep is absent, with the exception of a brief statement on sleep position (New Zealand Ministry of Health, 2019a). The New Zealand Health Navigator provides a simple one page fact sheet on sleep in pregnancy with brief information on avoiding fluids at bedtime, snacking options, sleeping comfortably on either side, relaxation routines at bedtime, getting regular exercise and asking for help if tired (Health Navigator, 2019).

1.7.4 Sleep education

Sleep education involves learning about healthy sleep and strategies to improve sleep. In a recent systematic review and meta-analysis comparing sleep education to cognitive behavioural therapy for insomnia (CBTi), Chung et al. (2018) found that sleep education was an efficacious insomnia treatment option, produced significant small to medium effects, although CBTi treatments were more effective, showing medium to large effects. The authors also state that sleep education intervention studies suffer from methodological and implementation issues, such as the level of practitioner training and coverage of material (basic leaflet vs comprehensive program). Nevertheless, they recommend that sleep education may be a sound first-option treatment, especially if CBTi is unavailable or too expensive, though implementation should encompass broad and complete sleep education material.

A study by Tsai et al. (2016) investigating the relationship between sleep hygiene knowledge and sleep quality found that pregnant women with poor sleep quality engaged in poor sleep hygiene

practices, and suggested that poor sleep hygiene can either exacerbate or perpetuate existing sleep problems. The authors also specifically noted a relationship between arousal related behaviours and sleep quality, such as watching television before bed, sleep stress, vigorous exercise and not relaxing before bed and suggested that education to reduce these behaviours before bedtime could be a target for a sleep education intervention.

While the overall efficacy of sleep education appears promising, some specific findings and critical gaps were noted in the Irish et al. (2015) review which evaluated the empirical evidence for several common sleep hygiene recommendations. These authors rightly emphasise that direct extrapolation and evaluation of specific sleep hygiene recommendations are mostly limited to sleep disruption studies and not sleep improvement studies. Furthermore, there is mixed evidence on the timing, mode and dose of many recommendations. For example, “limit caffeine intake before sleep”. Does that mean that abstaining from caffeine improves sleep? What dose of caffeine is required to impair sleep? What if caffeine has a beneficial impact for specific behaviours (increasing alertness to drive home safely after a night shift)? What recommendations apply to individuals consuming large amounts of caffeine during the day, but not at bedtime (is there a cumulative affect)? What is the negative impact of withdrawal and does withdrawal need to be staged? Simply providing brief sleep hygiene statements with minimal guidance on implementation is not always advisable or effective. Depending on knowledge, resources and the situation, this may prove challenging and result in abandoning efforts to change. Irish et al. (2015, p. 32) further state, *“sleep hygiene education has the potential to be a key strategy for improving sleep in the general population, and future research has the potential to extend its utility”*, especially when applied at an personalised level while investigating other behavioural and environmental factors involved.

1.7.4.1 Pregnancy sleep education interventions

Sleep is one of only a handful of modifiable risk factors for numerous health problems, so contains a unique utility for behavioural change interventions. Sleep education interventions in pregnancy are limited and only a handful of reviews examining non-pharmacological interventions for improving pregnancy-related sleep have been published. Hollenbach et al. (2013) completed a systematic review of seven non-pharmacological pregnancy interventions (acupuncture, physical activity, mindfulness/yoga and massage) with sleep as an outcome measure. Findings supported trends for improving sleep, however, the authors concluded that studies were generally low quality, and none focused on sleep hygiene or sleep education. No direct sleep education interventions were identified in a review by Carroll et al. (2019), even though the authors were assessing maternal sleep interventions in pregnancy and the postnatal period. The authors discussed limited intervention options, such as CBTi, mindfulness, yoga/tai chi and nutrition and family focused strategies. Though sleep hygiene/education was addressed within the CBTi intervention, the review only provided a description of the intervention and no appraisal of the studies or effect.

An additional handful of recent sleep-based interventions were discovered in the literature post these reviews. An Iranian study by Sanaati et al. (2017), provided sleep hygiene information as part of a broader lifestyle education intervention to pregnant women and their partners in their second trimester. Of the 189 women in the study, 126 generally healthy women (including having no history of depression) were allocated to two intervention groups, one group had husbands/partners attending and the other were women on their own. The remaining 63 women were in a routine care group. EPDS scores were not statistically significant different between groups at baseline, but both groups receiving the lifestyle (and sleep) intervention had significantly lower EPDS scores at the conclusion of the eight-week intervention.

In another Iranian study by Rezaei et al., (2015), specifically examined a sleep health education intervention with 96 women in the second trimester with poor sleep (≥ 5 on the PSQI). A group of 48 intervention participants received sleep hygiene training between 22- and 25-weeks gestation in four, one-hourly fortnightly sessions. Sessions included general sleep concepts, changes to sleep in pregnancy, providing strategies for disturbed sleep, sleep hygiene habits and diet, exercise, alcohol and tobacco use. Consistent with the findings of Sanaati et al. (2017), there were no significant differences at baseline (16-20 weeks gestation), but significantly lower BDI scores four and eight weeks post intervention (29 and 33 weeks gestation respectively), compared to the control group, who received no sleep education.

Tomfohr-Madsen et al. (2016) used CBTi to treat 15 women in the third trimester suffering insomnia. Treatment consisted of 90-minute group sessions (three to four participants in each group) over five weeks. Included in the psychoeducation were; review of sleep diaries, stimulus control, strategies to examine attitudes about sleep, and infant sleep information. Post-intervention measurement showed that women in the intervention group had significant improvement in EPDS scores, insomnia symptoms, total sleep time and sleep efficiency, sleep latency, all while having a decreased time in bed, compared to controls. Women also reported positive experiences about their participation in the intervention, including enjoyment from learning about sleep and knowing they were not alone in their sleep experiences. Psychological treatments, such as CBTi, have been researched and validated for use in non-pregnant populations (Parikh et al., 2009) and hold promise for pregnant women, but lengthy waitlists and high costs make this a restrictive option outside the research context.

Sleep hygiene training was also trialled on 128 women in the third trimester suffering from RLS (Sönmez & Aksoy Derya, 2018). Women in the intervention group (n=64) received a one-off sleep session guided by booklet information (pregnancy sleep, benefits of sleep, factors

affecting sleep and sleep hygiene principles) and were followed up two weeks later to revisit the material if problems were arising or material misunderstood. Delivery information (length or format) was not provided by the authors. Pre-intervention PSQI scores were not significantly different between intervention and control groups, however post-intervention PSQI scores were significantly lower compared to pre-test scores for the intervention group, indicating that sleep education had benefit in this population.

A recent study by Lee et al. (2017) found that 25 women who were hospitalised for a high-risk pregnancy in the third trimester and participated in a hospital-based behavioral intervention (including elements of sleep hygiene and CBTi) had significantly lower sleep disturbance than controls. Importantly, the authors have suggested that promoting healthy sleep hygiene behaviours would be beneficial in early pregnancy during routine prenatal visits.

Another study by the same lead author, Lee et al. (2016) evaluated the feasibility and efficacy of a four-week CBT based sleep enhancement program for women in late pregnancy and one to two months postnatally. The intervention program included auditory and reading relaxation programs, sleep diaries and dietary recommendations, while the control group only received dietary information. Though adherence to the program was variable, the intervention group reported positive feedback about their experience, and they also had significantly longer sleep duration and better sleep continuity than two comparison groups, particularly at the postnatal assessment. A specific recommendation from this study was initiating sleep interventions earlier in pregnancy so women have greater opportunity to practice skills prior to the onset of sleep problems.

It appears that sleep education in pregnancy is rapidly becoming a popular choice of intervention. Hawkins et al. (2019), has published an randomised controlled trial (RCT) study

protocol examining the use of a 12 week sleep education program including the use of a personal health monitor to achieve sleep goals, starting in the mid to late second trimester. The study aimed to increase sleep hygiene knowledge, however there was no mention of providing trimester specific information. Results from the study have not yet been published. Kempler et al. (2012) also focused on the third trimester to implement a psychoeducational sleep intervention in an effort to improve mothers sleep and mood in the early postnatal period, but did not look at improving sleep throughout pregnancy. Again, results for this study are not yet published.

1.7.4.2 Postnatal sleep education interventions

Postnatal sleep interventions have been studied more, with some placing a greater emphasis on the mother-infant dyad and/or managing infant sleep rather than trying to improve maternal sleep. A systematic review by Douglas et al. (2013) showed that educational sleep interventions focusing on infant sleep had limited success, though studies looking at maternal sleep as an outcome had more positive results (Hiscock, Bayer, Hampton, Ukoumunne, & Wake, 2008; J. Phillips, Sharpe, & Nemeth, 2010; Smart & Hiscock, 2007). A recent review assessing the current status of non-pharmaceutical management of perinatal depression, including novel interventions under investigation, did not discuss any studies examining sleep education intervention in pregnancy (Johansen, Robakis, Williams, & Rasgon, 2019).

A systematic review and meta-analysis of 15 non-pharmacological sleep-focused interventions found that, collectively, non-pharmacological interventions exerted moderate effect on improving postnatal maternal sleep, with massage and exercise having the largest effect on maternal subjective sleep quality (Owais et al., 2018), though there are not enough studies to compare relative effectiveness. The review also concluded that sleep interventions were most

likely to see significant improvements in the first three weeks after birth but not with interventions administered from four to 12 weeks postnatal, concluding that because the immediate postnatal period is characterised by the most disturbed sleep, it makes sense that this time may produce the largest effect sizes. Five of the 15 studies reviewed in the meta-analysis, examined the impact of sleep interventions on maternal mood, including drinking chamomile and lavender tea and implementing CBTi, both of which showed significant improvements in mood compared to controls.

Similarly, the American Academy of Sleep Medicine (AASM) completed a comprehensive review of 52 scientific articles examining behavioural treatment interventions for parents to manage sleep problems of infants and young children. The review found that 94% of the studies reported clinically significant improvements in infant and child sleep and concluded that sleep training and education not only improves infant and child sleep, but also improves parental sleep, parental mood and parent-child bonding in the short to medium term (Hiscock et al. 2008; Price et al. 2012; Symon et al., 2005)

Lastly, a systematic review and meta-analysis evaluated the results of nine psychosocial sleep intervention studies in the postnatal period (Kempner, Sharpe, Miller, & Bartlett, 2016). Although primarily focussed on infant sleep outcomes, it also examined the interventions' effect on maternal mood and found small but significant improvements following sleep-based interventions, although only a small number of studies were assessed. Notably, this review recommended that future research would benefit from investigating interventions in groups at high risk of depression (which concurs with recommendations by Mihelic (2018) and further understanding when the most effective time period is in terms of intervention administration (pregnancy versus postnatal).

1.7.4.3 Considerations for sleep interventions in pregnancy

Felder et al. (2018) explains that while decreases in sleep quality during pregnancy may be inevitable due to normal physiological changes, how women respond to those changes may provide the protective effect for depression. Zhou et al. (2018) further promotes this idea, by stating that sleep interventions that normalise sleep changes in pregnancy and help women to develop effective coping strategies to prevent depressive symptoms from occurring would be a valuable contribution to the field.

Another aspect to consider in a pregnancy sleep intervention is timing. In a systematic review of pregnancy and parenthood preparation by Entsieh & Hallstrom (2016), participants reported wanting early and realistic information about parenting skills, and to have the opportunity to seek support and help from health professionals when need arose. This idea was discussed in two pregnancy interventions described above by Lee et al. (2017; 2016) who promoted early, rather than late gestational intervention.

This last recommendation is important due to the results of a pilot study and subsequent randomised controlled trial by Stremmler et al. (2013; 2006) who implemented a behavioural-educational sleep intervention that incorporated information on sleep hygiene, strategies for improving sleep, relaxation techniques and infant sleep. Interestingly, the authors found a positive effect on maternal and infant sleep in the pilot study but not in the full RCT. The authors theorised the non-effectiveness may be due to less support women received (or 'dose') in the RCT compared with the pilot or that the immediate postnatal period may be one of too much change and adjustment to implement a sleep education intervention and suggested waiting until several months into the postpartum.

This was consistent with findings reported by Verbiest et al. (2018) that a majority of pregnant women wanted tailored education appropriate for their particular stage so that it could provide relevant, timely guidance, but not so far in advance that it was overwhelming. A particular note by these authors was the need for more evidence-based information to expand knowledge around sleep, specifically around napping, sleep duration and sleep hygiene principles. Similarly, Pinquart & Teubert's (2010), meta-analysis concluded that preventive parenting education programs with expectant and new parents should ideally start before problems develop.

This notion of intervention timing is illustrated well in a study by Beddoe et al. (2010). The authors demonstrated that sleep improvements in second trimester pregnant women were possible after participating in mindful yoga. However, the same improvements were not seen for women who completed the same program in the third trimester. This similar notion of "early is better" is noted by Hickie et al. (2013) who stated that early identification and care for those at risk of developing mood disorders, or those with lower severity of illness, has to be prioritised, due to the risk of negative affect and the large amount of resources needed if depression lingers. Therefore, there is a strong case that preventative sleep and depression programs that begin in early pregnancy would have a higher chance of success.

There is a growing list of researchers advocating the benefits of treating sleep problems or investing in sleep education in pregnancy, as a way of improving perinatal depression and health outcomes (J. J. Chang et al., 2010; Christian, Carroll, Teti, & Hall, 2019; Felder et al., 2018; Hickie et al., 2013; Mindell, Cook, & Nikolovski, 2015; Stone et al., 2017; Stremler et al., 2019; Toffol et al., 2018; Tsai, Lin, et al., 2016; G. Wang et al., 2018; Yang et al., 2017; H. Zhou et al., 2018; Zsomboky, 2017) with emphasis on implementing these programs in early pregnancy (Da Costa et al., 2010; Haney et al., 2014; K. A. Lee & Gay, 2017; K. A. Lee et al., 2016; Qiu et al., 2014; Ryan, Milis, & Misri, 2005; Williams et al., 2010; Zhong et al., 2018).

Tsai et al. (Tsai, Lee, Wu, et al., 2016) suggests that evaluating maternal sleep hygiene knowledge and identifying poor sleep practices would benefit a sleep intervention in pregnant women. The same lead author in a subsequent publication states, *“improving sleep would likely be associated with a reduction in depression symptom severity and an attenuation of the prevalence of depression in pregnant women”* (Tsai, Lin, et al., 2016). In a review article titled *“The Potential Value of Sleep Hygiene for a Healthy Pregnancy: A Brief Review”*, by Ferraro et al. (2014, p.4), the authors specifically state:

“The high prevalence of pregnancy-related sleep complaints and the limited number of efficacious pharmacological treatments indicate that behavioural management of sleep hygiene is essential in early gestation when sleep quality is optimal. Thus, encouraging sleep early in pregnancy and/or behaviours which facilitate improved sleep (e.g., regular physical activity participation) may help attenuate pregnancy-associated deterioration in sleep hygiene and improve maternal-fetal outcomes... It is theorized that a consequence of better sleep may be greater engagement in healthy lifestyles”

Such implementation is possible in both primary and secondary health care settings and importantly, may identify low threshold depression issues in women early in gestation (Sattler et al., 2017). Similarly, it is acknowledged that recognition of early pregnancy depression is required to reduce later pregnancy depressive symptoms (Nicholson et al., 2006) and prevent the harmful health consequences to both mother and baby (Sattler et al., 2017).

Crucially though, there is limited understanding about maternal sleep hygiene (Verbiest et al., 2018) and longitudinal studies are required (J. J. Chang et al., 2010; Sattler et al., 2017). Though interest and intent are high, no one has yet developed an early implementation, longitudinal

intervention that promotes sleep among pregnant women. A sleep intervention also has the potential to be easily and cost-effectively disseminated in community or clinical settings.

Interventions can make a difference. Ross et al., (2005, p. 255), concludes their critical review on sleep and perinatal mood disorders by stating:

“Reduction of sleep deprivation during the perinatal period may offer a cost-effective method for the prevention, and potentially treatment, of postpartum depression and psychosis. Studies that measure both sleep and mood during the perinatal period, particularly those that employ objective measurement tools such as polysomnography or actigraphy, will provide important information about the causes, prevention and treatment of perinatal mood disorders.”

Pregnancy is often a time when women have greater access to health services and is thus an ideal time for a sleep health intervention, especially as women are motivated to improve their health for the benefit of their child. Despite it being opportune, women are frequently given little or no advice or instruction on managing their sleep and they are seldom afforded the time to explore their sleep habits and patterns.

Simple and early behavioural interventions may ameliorate the negative effects of depression (Okun et al., 2012). Providing education and emotional support also has the potential to reduce birth interventions, such as caesarean deliveries (Toohill et al., 2014). While some may argue that screening and intervening with depressed women may be financially unviable, the benefits to both the individual and community far outweigh to costs associated with it (Buist et al., 2002).

1.8 Reasons for the current research

From the background information presented in this chapter, critical gaps in knowledge are clear:

- There is little understanding of normal sleep characteristics throughout pregnancy;
- Early and longitudinal sleep and depression data are needed throughout pregnancy, especially those that incorporate objective and subjective measures;
- Longitudinal depression data from pregnancy to postnatal are needed, especially in a New Zealand context;
- Evidenced based pregnancy sleep information is needed for women and healthcare providers;
- Interventions that normalise and optimise sleep in pregnancy are greatly needed, especially those commencing in early pregnancy and those attempting to prevent or minimise depression;
- Given the increased risk for women with a history of depression, more information about their sleep and mood over the course of pregnancy and the postnatal period is required.

1.8.1 Research questions

This program of research aimed to investigate the relationship between sleep and depressive symptoms throughout an extended perinatal period, namely early pregnancy to three years post birth, and was prompted by three key questions.

1. What does sleep health look like for healthy women in each trimester of pregnancy?
 - 2a. What are the patterns of depressive symptoms from late pregnancy through to three years post birth?
 - 2b. What is the relationship between these patterns of depressive symptoms and sleep health during this timeframe?
- 3a. Is an early and longitudinal sleep education intervention feasible and acceptable to pregnant women?
- 3b. Is an early and longitudinal sleep education intervention effective in optimising sleep and minimising depressive symptoms for nulliparous pregnant women with a history of depression?
- 3c. How do sleep and depressive symptoms change over a nine-month period, from 12 weeks gestation to 12 weeks postnatal?

1.8.2 Thesis components

To answer these key research questions, this thesis was constructed around three separate studies, as illustrated in figure 1.6, each respective to the questions above. Study 1 is a scoped review to explore what normal sleep looks like for a healthy pregnant woman (Chapter 3). Study 2 examines the trajectories of maternal depressive symptoms from late pregnancy to three-year post birth and investigates sleep dimensions related to those trajectories (Chapter 4), and Study 3 develops and implements a sleep education intervention and assesses the feasibility, acceptability (Study 3a, Chapter 5) and efficacy (Study 3b, Chapter 6) of an early and longitudinal intervention aimed minimising depression symptoms throughout pregnancy.

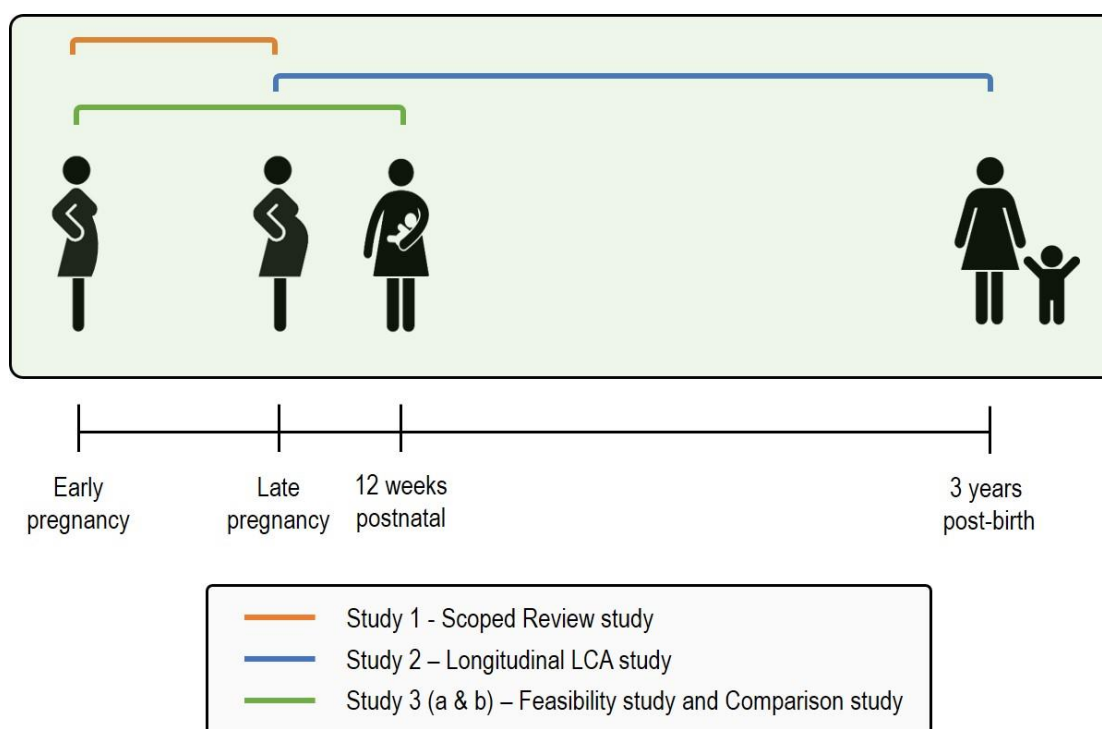


Figure 1.6 Thesis study design.

2 METHODOLOGY

2.1 Overview

This chapter provides a more thorough description of the study aims, study design, and methodology used in this doctoral research than is possible within the scope of the journal manuscripts due largely to prescribed word limits. In particular this chapter outlines why each study was conducted, the methodological approaches and explanations of measurement tools and more detailed description of the *Sleep HAPi* intervention.

The first section of this chapter describes the *E Moe, Māmā study* which was used in Studies 2 (Chapter 4) and 3 (Chapter 6), while the second section describes the *Sleep HAPi* study which was used in Study 3 (Chapters 5 and 6).

2.2 *E Moe, Māmā* and *Moe Kura* Research Studies

From October 2009 to October 2012, the Sleep/Wake Research Centre at Massey University conducted a large community based, Health Research Council (HRC) funded project entitled *E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand*, with a cohort of 1144 women: 406 Māori and 738 non-Māori women. Kaupapa Māori epidemiological principles informed the study design, which situates Māori at the centre of the research and allows for Māori participation and control at all stage of the research (including processes relating to recruitment and retention), appropriately classifies different ethnic groups to identify and monitor health disparities and allows for equal explanatory and analytical power (Paine & Gander, 2013). Leadership was shared through Māori and non-Māori co-principal investigators and expertise from senior Māori health researchers was provided by an expert advisory panel.

E Moe, Māmā was a questionnaire-based project designed to investigate relationships between sleep and mood changes across the perinatal period. Comprehensive questionnaires were administered at 35-37 weeks gestation and at 12 weeks postnatal. A brief phone interview was completed between four and six weeks postnatal, but the number of measures collected was limited and not used in this research.

Between December 2012 and April 2015, a second phase of the study, entitled *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand* (hereafter referred to as *Moe Kura*), was conducted. Women from the original *E Moe, Māmā* study were invited to participate in a follow up data collection round when the *E Moe, Māmā* child was three years of age. The follow-up questionnaire investigated the sleep and mood of the same mother-infant dyads using near identical measures as *E Moe, Māmā*. Participants also completed a 'Child Sleep and Health' questionnaire at this time point, but data from that questionnaire are not used in this thesis. The *Moe Kura* cohort included 912 women (281 Māori and 629 non-Māori).

Data from three time points are used in this research; 36 weeks gestation, 12 weeks postnatal and three years post birth.

2.2.1 The E Moe, Māmā and Moe Kura Names

In Te Reo Māori the *E Moe, Māmā* study name translates to “*sleep mother, go to sleep mother*”. Dr Te Huirangi Waikerepuru (Taranaki) from Te Matahiapo gifted the name “*Moe Kura*” to the study in 2013 “*Moe Kura is based in the concept of te au Moe Kura i te ao mārama: the peaceful treasured sleep as of the child into the world of ancient wisdom, wonderment and light*”. Dr Waikerepuru also named the Open Lab creative design (see figure 2.1) *Te Aioiotanga: kia aioio te moe, e au te moe* (restful, peaceful sleep). The name and design signify the importance of the mother and child relationship to health, wellbeing and sustainable nurturing environments.



Figure 2.1 *Moe Kura* Logo

2.2.2 Study teams

The *E Moe*, *Māmā* & *Moe Kura* studies were led by a team of researchers from the Massey University's Sleep/Wake Research Centre, in collaboration with researchers from New Zealand and international institutions and a panel of Māori and non-Māori advisors. The advisory team had expertise in child and maternal sleep, indigenous health, mental health, and epidemiology, the advisory panel and collaborators provided advice on study development and implementation.

2.2.3 Researcher role

At the time of my commencement at the Sleep/Wake Research Centre in February 2016, all *E Moe*, *Māmā* data from the late pregnancy, six weeks and 12 weeks postnatal time points had been entered (using Epi Info, version 3.5.1), double entered, cleaned and variables had been created. *Moe Kura* data from the three-year time point had been entered, then double entered, into a database (using LimeSurvey open source software) but had not been cleaned or had variables generated.

It is at this point that my involvement with these studies began. I checked and cleaned the *Moe Kura* data in accordance with data entry rules and discussions with the study team. I further created and reviewed descriptive statistics, checked data anomalies and identified outliers in collaboration with colleagues at the Sleep/Wake Research Centre, Dr Lora Wu and Dr Diane

Muller. Upon finalisation of the three-year post birth dataset, Dr Edgar Santos Fernández provided statistical support to create a number of variables, based on the same variable creation rules used in the *E Moe, Māmā* datasets.

After a number of variables were created, I merged the *E Moe, Māmā* and *Moe Kura* datasets to obtain one consolidated dataset with each time point; late pregnancy, 12 weeks postnatal and three years post birth. A final dataset was then created with participants that had responses at each of those time points (total n=856; Māori n=262 and non-Māori n=594). I then created further variables required for the longitudinal analysis and completed descriptive analyses using this dataset. Dr Mona Jefferies provided statistical support to complete the latent class analysis. A subset of the *E Moe, Māmā* sample was identified and used in the comparison analyses, which I completed and are presented in Chapter 6.

2.2.4 Ethical procedure

The New Zealand Central Health and Disability Ethics Committee (HDEC) granted ethical approval to the original *E Moe, Māmā* study in October 2009 (CEN/09/09/070) (Appendix 1). The ethics approval for *Moe Kura* was granted as an amendment in November 2012 (CEN/09/09/070/AM02) (Appendix 2).

2.2.4.1 High scorer protocol

A protocol was in place for participants showing elevated depressive symptoms or self-harm ideation which included women providing consent for the researchers to contact their doctor or maternity health care provider (Lead Maternity Carer or Obstetrician). This protocol was used in the *E Moe, Māmā* study and was additionally used in *Sleep HAPi* study (described below), with updated contact information (the *Sleep HAPi version* is outlined in Appendix 6).

2.2.4.2 Miscarriage and stillbirth protocol

An additional protocol was also available in the event a participant had a miscarriage or stillbirth. The protocol involved acknowledging the gravity of loss and recognising how difficult the situation is for women. This protocol was used in the *E Moe, Māmā* study and was additionally used in *Sleep HAPi* study (described below), with updated contact information (the *Sleep HAPi version* is outlined in Appendix 6).

2.2.5 Recruitment

In the initial *E Moe, Māmā* study, women were recruited from the lower North Island of New Zealand, however recruitment was subsequently expanded nationwide, in the hope of achieving equal explanatory and analytical power for Māori. Recruitment of non-Māori participants was also closed in the later stages of recruitment as a secondary method of attaining sufficient Māori participants (Paine & Gander, 2013). The *Moe Kura* study participants were given the opportunity to opt out of the age three follow-up. A flow diagram of study participants, including the merging of studies, is detailed in figure 2.2.

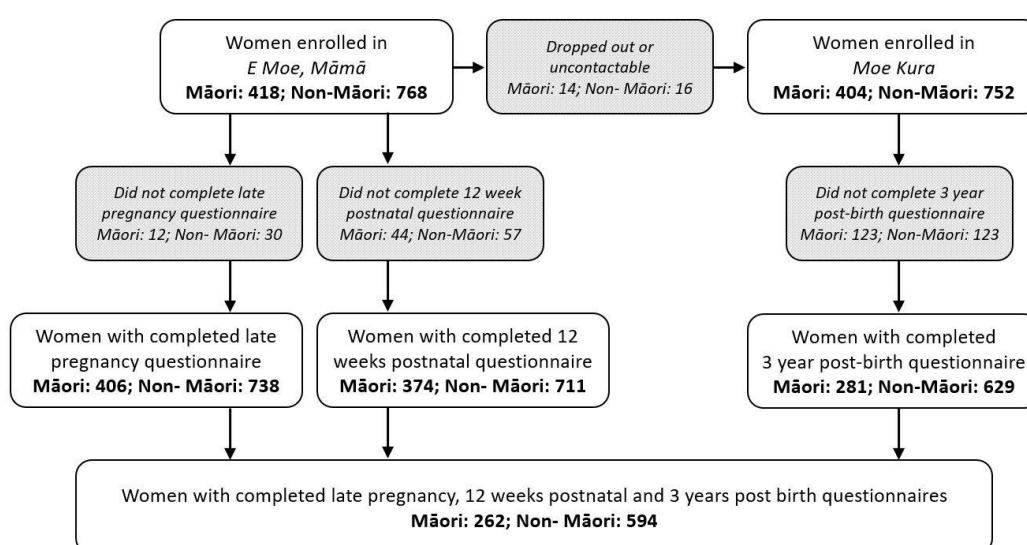


Figure 2.2 Flow diagram of *E Moe, Māmā* and *Moe Kura* participants.

2.2.6 Inclusion criteria

Minimal inclusion and exclusion criteria were established in an effort to obtain the most representative sample of self-selected, community-based women. To participate, women needed to be 16 years of age or older, carrying a single fetus and able to answer questions in English.

2.2.7 Late pregnancy questionnaire

The Sleep and Health during Pregnancy questionnaire was developed and pre-tested in 2009 with careful attention to question selection and language, as it was understood that the questionnaire would be completed by women of varying literacy abilities, including having English as a second language. The final version was a 58 item, 12-page questionnaire (Appendix 3) which women were asked to complete between 35-37 weeks gestation. It included questions on demographics, sleep, general health, mental health and obstetric history and also included limited retrospective questions on sleep and mental health. The demographic information collected included information on maternal age, parity, gestational weeks, ethnicity, socioeconomic position, partner support, stressful life events and employment details.

2.2.8 12-week postnatal questionnaire

Women were asked to complete the Postnatal Sleep and Health Questionnaire between 11-13 weeks postnatal. The final version was a 91-item, 27-page questionnaire (Appendix 4) and included repeated questions from the pregnancy questionnaire on demographics, sleep, general health and mental health. Items relating to the birth experience and the infant were also collected, however given the focus of the current program of research on maternal sleep and mood relationships, only infant age was included from these items

2.2.9 Three-years post birth questionnaire

Moe Kura data collection commenced on 21 December 2012 and finished on the 30 April 2015. The women from *the E Moe Māmā* study were contacted no earlier than five weeks before their child's third birthday. While the questions varied slightly from those used in the *E Moe Māmā* study, the same demographic, sleep and mental health questions from the late pregnancy and 12 weeks postnatal questionnaire were used at the three-year post birth time point (Appendix 5).

2.2.10 Measures

2.2.10.1 Demographic information

Maternal Age was calculated by subtracting the mother's date of birth from the completion date of the questionnaire.

Parity was assessed by asking the total number of times a woman had given birth to an infant, alive or not, after 20 weeks gestation.

Gestational weeks was calculated using mother's self-reported estimated due date subtracted by the questionnaire completion date.

Ethnicity was reported using the New Zealand Census 2006 question (Statistics New Zealand, 2006). Women were classified as of Māori ethnicity if they selected Māori as a single choice or as part of multiple responses. Women that selected any ethnicity except Māori were defined as non-Māori.

Socioeconomic position was defined using a neighbourhood-level index of relative deprivation (NZDep 2006 and NZDep 2013) based on small geographical units called 'meshblocks'. The

NZDep indices incorporate dimensions of social and material deprivation, including; home ownership, support (non-means tested benefits or benefits not necessarily associated with economic deprivation such as student allowances), communication (access to a telephone), income, employment status, educational qualifications, living space (bedroom occupancy) and access to transport (access to a car). An index is derived from these variables and a ten point ordinal scale is created from one to ten, where decile one represents the 10% of areas that are least deprived and decile ten represents 10% of areas that are most deprived (Atkinson, Salmond, & Crampton, 2014). In analyses, NZDep was utilised as quintiles (i.e. five levels, each representing 20% of small areas).

Relationship happiness was used as a proxy for the broader construct of social support. Women reported on a 0-7 likert scale item, "If you have a partner, how is your relationship with them at the moment?", where 0 signifies being perfectly happy and 7 signifies being extremely unhappy. Women also had the option of selecting "not applicable". A dichotomous variable was created, where less than three signifies greater satisfaction, and greater to or equal to three signifies less satisfaction or not applicable.

Stressful life events were measured using the 13-item Pregnancy Risk Monitoring System (PRAMS) phase 5, 2004-2008, questionnaire which was developed by the Centers for Disease Control and Prevention in the USA (Centers for Disease Control and Prevention, 2018). Women were asked if they had experienced any of the following over the past 12 months: Arguing with partner more than usual; partner did not want pregnancy; or separation from partner; being homeless; partner went to jail; someone close had alcohol/drug problems; they or their partner lost a job, could not pay bills; moved to a new address; was in a physical fight; a close family member was very sick and had to be admitted to hospital; or experiencing the death of a close family member. Low stress was considered less than two stressors, and high stress considered

greater than or equal to two stressors) (Mukherjee, Fennie, Madhivanan, Trepka, & Coxe, 2017). Da Costa et al. (2009) found that greater stressful life events experienced in the previous year was a predictor of poorer mental health scores.

Employment details items included questions asking participants if they currently work for pay, profit or income, and if answered yes, they were asked for the average number of hours per week they worked and how often they worked between midnight and 5am. If women were not currently working, they were asked about their plans to return to paid work in the future.

2.2.10.2 Sleep measures

Sleep quality was measured by the three-item General Sleep Disturbance Scale (GSDS) Quality Subscale; “How often in the last week did you feel rested upon awakening at the end of a sleep period?”, “How often in the last week did you feel satisfied with the quality of your sleep?” and “How often in the last week did you sleep poorly?” The first and last items are reversed scored. Each item is rated on a 0 (never) to 7 (every day) numeric rating scale and the mean of the three items is calculated (K. A. Lee, 1992; K. A. Lee & Gay, 2004).

Sleep duration was measured by self-reported nighttime total sleep time (TST), as well as sleep in a 24-hour period (including naps) in the last week.

Sleep continuity was measured by the GSDS Maintenance Insomnia Subscale. The two items that form this subscale are, “How often in the last week did you wake up during your sleep period?” and “How often in the last week did you wake up too early at the end of your sleep period?” Each item is rated on a 0 (never) to 7 (every day) numeric rating scale and the mean of the two items is calculated (K. A. Lee, 1992; K. A. Lee & Gay, 2004).

Sleep Onset Insomnia was measured by the GSDS Onset Insomnia Subscale. The item that forms this subscale is, “How often in the last week did you have difficulty getting to sleep?” This item is rated on a 0 (never) to 7 (every day) numeric rating scale (K. A. Lee, 1992; K. A. Lee & Gay, 2004).

Daytime Sleepiness was measured by the ESS. The ESS assess daytime sleepiness in eight everyday situations using the question “How likely are you to doze off in the following situations, in contrast to feeling just tired...?” The ESS has been deemed reliable and valid for use in pregnant populations (Baumgartel, Terhorst, Conley, & Roberts, 2013) and excessive daytime sleepiness is typically defined as a total score greater to or equal to ten (Johns, 1991).

2.2.10.3 Depressive symptoms measures

Because of the serious and long-term effects of perinatal depression, screening and identification of the disorder are increasing. Though there are both concerns about non-identification and mis-identification, it is important to acknowledge that that screening techniques are not designed to diagnose depressive disorders, but to identify women that require further clinical assessment (Kerr & Kerr, 2001).

The EPDS is a well-validated and widely used assessment tool for depression screening in pregnancy and the postnatal period. As there has been no assessment tool specifically developed for assessing depression in pregnancy, the EPDS has been used by many research studies by default in screening and identifying depression (Ji et al., 2011) and has been validated for use in pregnancy (Gibson, McKenzie-McHarg, Shakespeare, Price, & Gray, 2009). It excludes somatic symptoms of depression, such as sleeping issues, that are prevalent in antenatal and postnatal periods (American College of Obstetricians and Gynecologists., 2015).

The EPDS is a ten-item questionnaire rated on a four-point scale that is sensitive to changes in the severity of depression over time (Cox, Holden, & Sagovsky, 1987). Higher scores usually reflect a higher level of symptom severity and scores at or above 13 are considered clinically significant (Cox et al., 1987; National Collaborating Centre for Mental Health, 2014). Studies that have used a score of greater than or equal to 13 to identify major depression have reported good sensitivity (68-95%) and specificity (78-96%) (Cox, Chapman, Murray, & Jones, 1996; Dennis, 2004; Murray & Carothers, 1990). While a decision was made to use the author's recommendation of scores at or above 13 as the cutoff, it should be noted that some studies have demonstrated that a lower cutoff score can be used to detect major depression (Eberhard-Gran, Eskild, Tambs, Opjordsmoen, & Ove Samuelsen, 2001; Smith-Nielsen, Matthey, Lange, & Væver, 2018; Stuart, Couser, Schilder, O'Hara, & Gorman, 1998) and clinical cut-offs for the EPDS in Māori populations have not been established.

2.2.11 Statistical analyses

Descriptive statistics (means, medians, standard deviations, range, and proportions) and univariate analyses were generated and conducted in SPSS, which included histograms, probability plots and boxplots to check their distribution and identify any outliers. All further statistical analysis descriptions, including latent class analyses, are described in Chapter 4 and 6.

2.3 *Sleep HAPi* pilot study

The *Sleep HAPi* pilot study was a prospective community-based sleep education intervention, developed for nulliparous women with a history of depression. The aim of the study was to implement and assess the feasibility, acceptability of trimester specific sleep education intervention aimed at optimising sleep and minimising depression symptoms throughout pregnancy. The findings of this study are described in Chapter 5.

While the *Sleep HAPi* participants completed a greater number of measures during the intervention arm of the study, all participants completed the same late pregnancy written questionnaire as the *E Moe, Māmā* participants. To measure the *Sleep HAPi* intervention efficacy, a matched subset of women from *E Moe, Māmā* was used as a comparison group. They were matched on parity, a prior history of depression and ethnicity (all were non-Māori) (n=76). The findings of this study are described in Chapter 6.

2.3.1 The *Sleep HAPi* name

Sleep HAPi is an acronym for “Sleep Health and Pregnancy Information”. The title and logo were developed by the researcher (figure 2.3).



Figure 2.3 *Sleep HAPi* logo.

2.3.2 Study team

Sleep HAPi was led by the researcher, in conjunction with the supervisory team, Associate Prof T. Leigh Signal, Prof Philippa Gander, Dr Bronwyn Sweeney and Dr Mark Huthwaite, all of whom have extensive experience in conducting research protocols on sleep and/or mental health issues across the perinatal period. Dr Sweeney, a clinical Psychologist and Dr Huthwaite, a consultant maternal mental health psychiatrist, provided guidance and clinical support when addressing mental health aspects of the study design, protocols and referrals of women to their health care provider.

2.3.3 Researcher role

As *Sleep HAPi* was a key focus of my thesis, my role in this research component was comprehensive. With guidance and input from my supervisory team, my contribution was; concept formulation, study design and development, design and creation of recruitment and intervention material, participant recruitment and liaison, and education session implementation. I also entered, cleaned the data, developed the statistical analysis plan, coded and analysed the data which involved substantial self-directed learning. All statistical procedures were guided and reviewed by supervisor Dr Leigh Signal, fellow Sleep/Wake Research Centre colleague Dr Margo van den Berg and biostatistician Dr Mathangi Shanthakumar, of the Centre for Public Health Research, Massey University, Wellington.

Two manuscripts on the *Sleep HAPi* intervention which are detailed in Chapters 3 and 4 were also first authored with involvement from my supervisory team.

2.3.4 Recruitment

Recruitment for *Sleep HAPi* occurred over a 12-month period, from February 2017 to February 2018. A study poster and flier were designed (Appendix 8) and distributed to medical centres, midwifery clinics, mental health clinics, hospitals, parent and community centres, book and toy libraries, primary schools and colleges, crèches/kindergartens, supermarkets and community fairs. Massey University communications department assisted in the development of media releases and other material to promote the study through social and traditional media channels. The researcher conducted a national radio interview with Radio New Zealand discussing pregnancy sleep and depression while also promoting study recruitment. Presentations were also given to hospital staff at the Wellington Hospital, the New Zealand College of Midwives, WellSleep continuing medical education (CME) workshop, Fertility Associates (assisted reproduction / fertility clinic) and various community midwifery groups to encourage medical professionals to pass fliers on to patients and/or clients. Additional ethical submissions (to those described in 1.3.6) were completed for Fertility Associates, the Capital and Coast District Health Board (CCDHB) and the Hutt Valley District Health Board (HVDB) to allow medical professionals from these organisations to endorse the study. Endorsement and promotion were also afforded by community and non-government agency websites, such as Perinatal Anxiety and Depression Aotearoa (PADA), Neonatal Trust, The Parents Centre and Family Planning New Zealand.

Initially women were recruited from the Greater Wellington Region (Wellington, Porirua, Hutt Valley, Kapiti areas) due to the ease of meeting women in a 50km proximity of the Sleep/Wake Research Centre. After six months of recruitment, advisements were extended to Palmerston North (140km proximity) in an effort to increase numbers, however this only resulted in one further woman completing the study.

The posters and fliers provided a brief outline of the study; what study involvement required, the key eligibility criteria, and the koha (a Māori term which means 'gift of appreciation') provided on completion. Advertisements provided contact details in the form of a free "0800" phone number, a free text messaging service and a designated email address. The text messaging service generated an automated reply and texts were followed up with a phone call to discuss the study. Emailing was the most popular method of contacting the research team, with 32 women using this option. Text messaging was used by 12 women and phone calls by seven women.

Once a potential participant contacted the research team, the researcher would phone the woman, complete a screening questionnaire (Appendix 9), discuss details of study involvement, including explanation of the study timeline, equipment and questionnaires and go through any questions or concerns the women may have. If women were eligible to participate and expressed interest in the study, the researcher organised to meet the woman at an initial study visit (further described in 2.3.7).

2.3.5 Participant eligibility

Prior to commencing the study, women were screened to ensure they met the eligibility criteria. Women needed to have a history of diagnosed depression, to focus the study on a group that are understudied and at high-risk of depression relapse in the perinatal period. They were required to be symptom- and medication-free for at least three months prior to study enrolment, to ensure sleep was not being confounded by current depressive symptoms. Women also needed to be at or less than 14 weeks pregnant (first trimester), carrying a singleton pregnancy, at least 16 years of age, proficient in English, have a primary health care provider (a Lead Maternity Carer (LMC) or General Practitioner (GP) that they could

be referred back to) and living in the Greater Wellington area or Palmerston North. Lastly, women needed to be nulliparous and have no children under three years of age living in the home. This was considered important as it ensured women's sleep was not being affected by additional childcare responsibilities. Women were excluded if they had diagnosed sleep disorders, uncontrolled medical conditions or a severe mental health disorder (other than depression) known to contribute or be associated with sleep abnormalities.

Fifty-one women responded to study advertisements and 47 completed an initial screening questionnaire. Of the 22 women were eligible to enrol, all commenced the study. Table 2.1 details reasons why initial respondents did not take part in the study. Of the 29 women that responded but did not enrol in the study, 23 did not meet the eligibility criteria. Of the other six, four women did not return future contact attempts and two women thought the study burden would be too great.

Table 2.1 Reasons for ineligibility in the *Sleep HAPi* study (Note: two respondents had dual reasons for ineligibility).

n	Reason for ineligibility
8	Multiparous
7	Currently experiencing depressive symptoms
4	No response to follow up
4	Advanced gestational age
3	No history of depression
2	Participant burden too great
2	Lived outside of Greater Wellington region or Palmerston North
1	Medical condition that affected sleep
31	Total

Table 2.2 illustrates the location where the 22 women enrolled in the study saw study advertisements. Over half of the women found out via clinician channels (midwives, antenatal groups, hospitals or medical centres). The remaining women found out through media and social media platforms or from friends.

Table 2.2 How enrolled participants found out about the study.

n	Recruitment channel
6	Poster in medical centre/hospital/midwife clinic
3	Antenatal Group at Wellington Hospital
4	Directly from Community Midwife
4	Word of mouth
1	Radio Interview
1	Poster in library
1	Twitter post
1	Eventfinder
1	CME Presentation
22	Total

Figure 2.4 shows the flow diagram of study recruitment and retention. Six women dropped out of the study. Notably, three of these women dropped out for reasons outside their control (two women miscarried prior to their first week of actigraphy recording, and one woman had an extreme pre-term birth at 22 weeks gestation). Three women chose to discontinue their involvement in the study. One was non-contactable at the beginning of the second trimester despite numerous attempts. The remaining two women dropped out after the first trimester and second sleep education sessions, stating that burden was too great when combined with employment commitments and other activities occurring for them at the time.

An additional participant was excluded from analyses as she had a multiple and moderate preterm birth. Therefore, complete data sets were analysed for 15 women during pregnancy (68% retention rate) and 14 in the postnatal period (64% retention rate). All questionnaires, education sessions and actigraphy were completed except for one woman who did not complete her trimester two sleep education session due to work travel (99.7% completion rate).

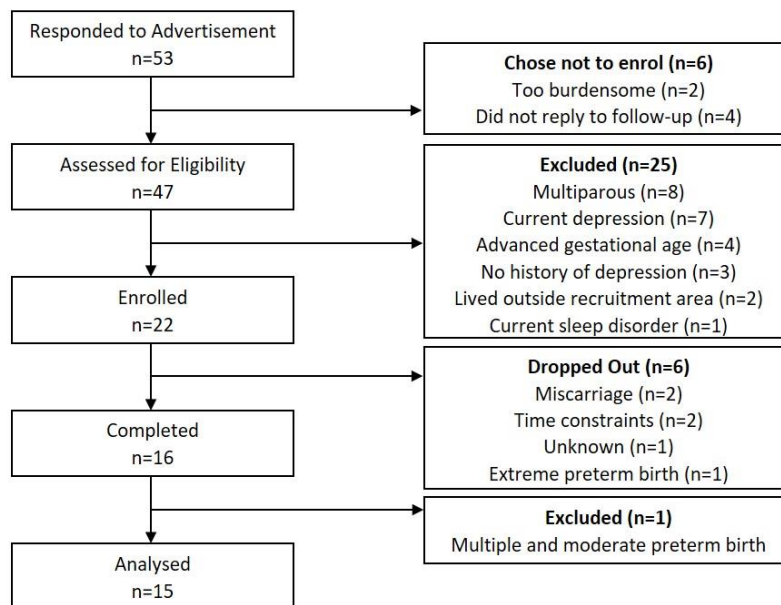


Figure 2.4 Flow diagram of *Sleep HAPI* recruitment and retention.

2.3.6 Ethical procedure

A Health and Disability Ethics Committee (HDEC) ethics application was submitted. HDEC Central Region reviewed the application and deemed that HDEC approval was not necessary due to the study involving no more than minimal risk ("that is, potential participants could reasonably be expected to regard the probability and magnitude of possible harms resulting from their participation in the study to be greater than those encountered in those aspects of their

everyday life that relate to the study”). An out-of-scope letter was issued and HDEC recommended institutional review (Appendix 10). Full ethical review was then undertaken and approved by the Massey University Human Ethics Committee: Southern A Committee (SOA 16/29). The study was also reviewed and registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12617000055303) (Appendix 11).

Supporting pregnant women and being sensitive to their needs was considered in the ethics process and study design. Measures included:

- Face-to-face and one-on-one contact.
- Allowing time in meetings to discuss patient confidentiality, data security and anonymity.
- Meeting women for education sessions at times and places that were convenient, safe and private for the participant. This meant that extra time was often needed to allow meetings to be schedule on weekends or weeknights. Extensive travel was sometimes required and protocols were put in place to ensure researcher safety.
- Sensitivity when calling and meeting participants, especially at workplaces and in public meeting areas, such as text messaging a participant and asking them to call back at a time that is convenient and private so as not to create awkwardness or intrude on privacy. This was especially critical at study enrolment as women had not often told work colleagues they were pregnant.
- Approaching the material with respect and non-judgement, which is especially needed when women are discovering their own notions of mothering and parenthood.
- Participation in the study was voluntary and women had the option to withdraw at any time.

Women were given two koha; one at the completion of the pregnancy intervention (\$50 value) and another at the completion of both postnatal questionnaires (\$20 value). Women were either posted or hand delivered a gift card of their choice (either fuel, supermarket, book or department store voucher).

2.3.6.1 Participant consent

Written consent was obtained prior to study commencement and ongoing consent was completed at each time point. (Initial Consent form – Appendix 12; Consent and Checklist forms for trimester two and three are identical as are postnatal six and 12 weeks. Examples of each are provided in Appendix 13 and 14 respectively).

2.3.6.2 High scorer protocol & miscarriage and stillbirth protocol

The same high scorer protocol and miscarriage or stillbirth protocol described for *E Moe, Māmā* above, were used for *Sleep HAPi* participants (Appendix 6 and 7).

2.3.6.3 Cultural considerations

During study development, members of the research team met with Dr Kara Mihaere (Rangitāne, Ngāti Kahungunu ki Wairoa, Ngāti Rakaipaaka, Rangitāne ki Tamaki-nui-ā-Rua) a Clinical Psychologist with Te Whare Marie ki Puketiro (Specialist Māori Mental Health Services), at the CCDHB. Dr Mihaere completed her doctorate in Sleep Science at the Sleep/Wake Research Centre so has significant knowledge of both sleep and mental health.

Dr Mihaere provided feedback on the proposed research methodology, including identifying important issues in recruiting and retaining Māori women, and offered valuable advice on the support networks and services available to Māori women with mental health concerns. Dr

Mihaere confirmed the CCDHB Te Haika (Mental Health Contact Centre) is the one point of contact for all mental health services within the Greater Wellington Area whether Māori or otherwise. This service is available 24 hours a day, seven days a week (including public holidays) for any general mental health questions, referrals/appointments to mental health services based (including specific Māori and Pacifica services) at CCDHB and mental health emergency phone calls. This contact was included in the High Scorers Protocol and contact details for women experiencing mental health issues including dedicated support for Māori women.

2.3.7 Study design

The study covers six time points: Pre-pregnancy (PP), pregnancy (first trimester (T1), second trimester (T2) and third trimester (T3)) and postnatal (six weeks postnatal (P1) and 12 weeks postnatal (P2)) (see figure 2.5).

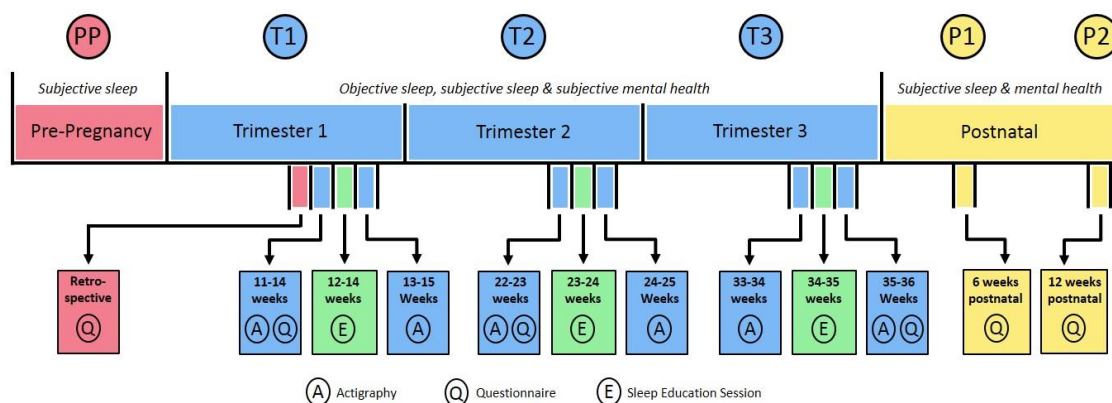


Figure 2.5 *Sleep HAPi* study design.

Questionnaires were used to collect sleep (all time points) and subjective mental health data (T1, T2, T3, P1 and P2). Actigraphy was used to obtain objective sleep data (T1, T2 and T3). Sleep education sessions were completed in between actigraphy weeks in each trimester.

Women commenced the study between 11- and 14-weeks gestation (T1). After an initial phone call to complete the screening questionnaire, women were met by the researcher and given the following paperwork to read, discuss and fill out:

- An information sheet (Appendix 15)
- An initial consent form (Appendix 12)
- An instruction sheet detailing the use of the actiwatch and sleep diary (Appendix 16)
- A sleep diary (Appendix 17)
- A sheet detailing the dates of the first and subsequent education sessions, drop-offs and pick-ups of actigraphy watches and diaries
- A checklist of study documentation and equipment provided
- A retrospective pre-pregnancy sleep questionnaire (Appendix 18)
- Trimester one questionnaire (taken home to fill out during the week) (Appendix 19)

The researcher read through the information sheet with the participant and any questions about the study were answered. Informed consent was obtained. At the conclusion of this meeting, women were asked to commence wearing the actigraphy watch and filling out the diary. After seven days of recording, the researcher organised collection of the watch, diary and questionnaire. Data was analysed and printouts of actigraphy recordings were produced and then presented at the sleep education session. Immediately after the education session, the participant commenced another actigraphy week for that trimester.

The process for T2 and T3 were identical (questionnaires for T2 and T3 are detailed in Appendix 20 and 21 respectively). P1 and P2 consisted only of sleep and mental health questionnaires (detailed in Appendix 22 and 23 respectively). The first education session at T1 was 60-90 minutes in length and sessions at T2 and T3 lasted 45-60 minutes.

When women finished the pregnancy component of the study, they were asked to fill out a feedback questionnaire (Appendix 24), which asked for information on their sleep knowledge, the structure, content and helpfulness of the intervention and views on their participation. To gauge women's level of sleep knowledge prior to enrolling in the study, women were asked how much they knew about sleep in general, trimester specific changes to sleep, sleep strategies to employ in pregnancy and what their own sleep was like. They were also asked how helpful the information on those topics was. At the completion of the study, participants were provided with a summary of the study findings (Appendix 27).

2.3.8 Sleep education intervention

To the best of the researcher's knowledge, a sleep intervention developed for early pregnancy and continued throughout pregnancy has not yet been developed or implemented, so the sleep education intervention was not based on other studies, but instead on a review of the existing literature.

2.3.9 Sleep education sessions

Sleep HAPi is a multidimensional evidence-based sleep education package developed by the study researchers. A four-section sleep education booklet was developed to provide evidence-based information on sleep in pregnancy. The first section of the booklet explained sleep and circadian principles, while the remaining three sections provided specific sleep information respective to the three gestational trimesters. Participants were guided in one-on-one, face-to-face sessions through the material in three separate sessions, once per trimester, reflecting the participants pregnancy stage. The aim of the sessions was to:

- Increase women's knowledge of sleep and circadian principles;
- Increase women's understanding of the benefits and consequences of good and poor sleep;
- Provide information to 'normalise' the considerable sleep changes possibly experienced in each specific trimester;
- Provide ideas and advice for improving sleep health in each specific trimester.

See figure 2.6 for detail on layout and content.

In addition to the booklet and to make the interventions personalised, a summary of each woman's subjective and objective (actigraphic) sleep data from the pre-intervention week were presented and discussed. It was anticipated this would provide greater self-awareness of sleep behaviour and patterns, with further exploration of pertinent healthy sleep principles on an individual basis. The women retained their booklet and were encouraged to reference it in future and share the contents with their family/social supports.

Based on the available literature and the potential challenges of recruiting in early gestation, a unique sample from a relatively small population area, and trialling un-tested intervention material and strategies, this intervention was designed as a pilot study. This was to allow exploration of the feasibility and acceptability as well as efficacy. A control group was not recruited because of the feasibility focus of the study.

Verbal information was concurrently presented via hardcopy booklet in an insertable folder so that subsequent trimester information could be added, as well as their actigraphy printouts, to progressively build a comprehensive and personalised 'Sleep in Pregnancy' booklet. After each

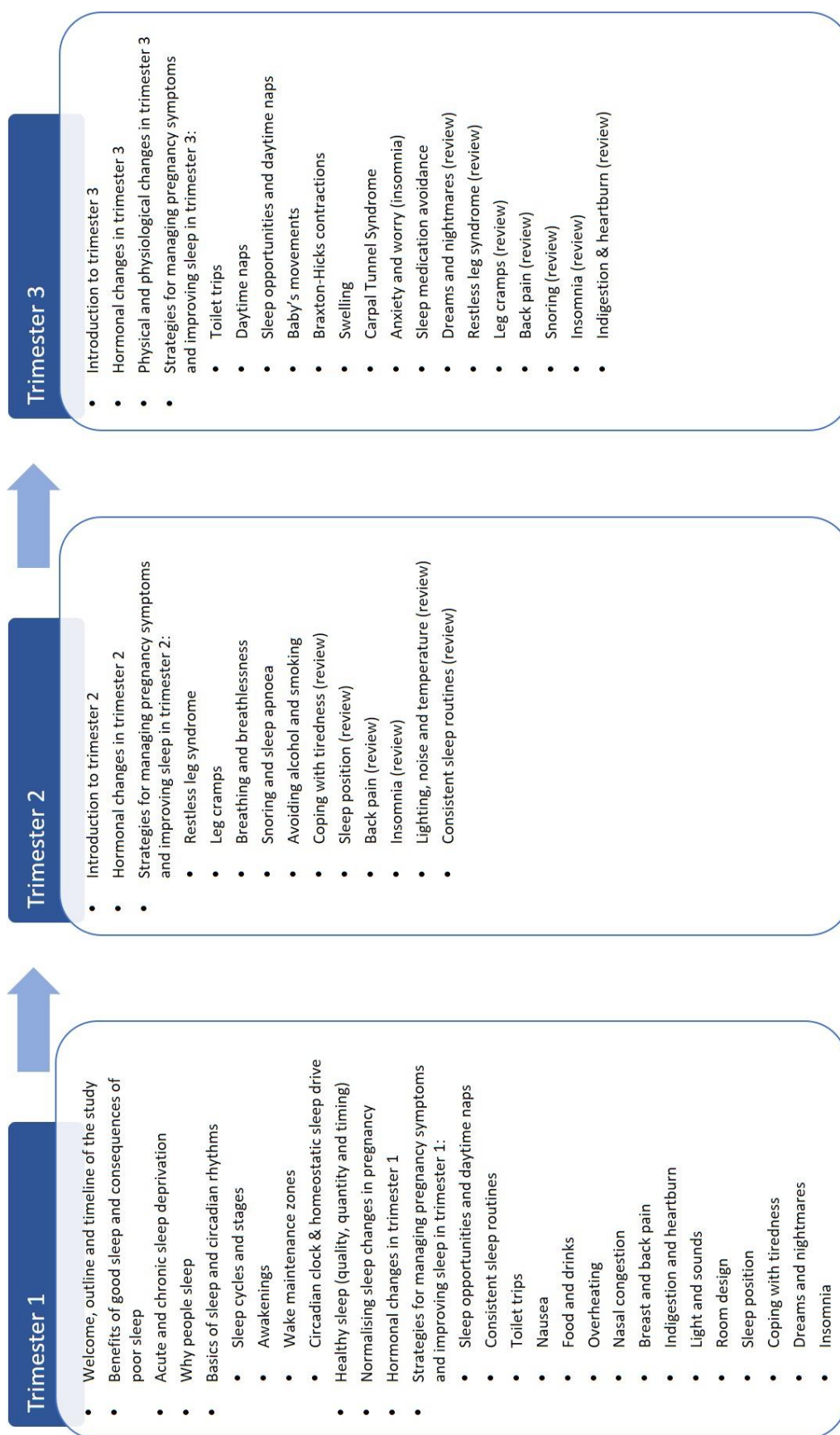


Figure 2.6 Content of sleep education sessions. References for material is detailed in Appendix 26.

education session, women were encouraged to refer to the information and/or share with their family/social supports.

The intent was to increase women's understanding of the benefits of good sleep and consequences of poor sleep, practices and factors that either promote or hinder sleep, 'normalise' the sleep changes experienced in pregnancy and to improve overall sleep health. Stremmer et al. (2019) discusses the concept of normalising sleep in interventions during the perinatal period to allow women to have reasonable expectations of what "normal" sleep is during this period. There was no expectation that all of the information and advice would be used by all women, rather that they would have a 'tool kit' of knowledge to use when necessary.

It should be noted that while efforts were made to 'normalise' the sleep changes (i.e. confirming that sleep changes are common), the symptoms were by no means trivialised. That is, their impact was acknowledged. Pregnant women may often hear, "you think your sleep's bad now, wait until after the baby is born", or "it's just your body's way of getting you ready for having a baby". Evidence suggests that this type of public discourse and stigma is often experienced in relation to a number of pregnancy related changes, not just sleep (Da Costa et al., 2010) but with nausea (Chou et al., 2003), and depression (Manber, Blasey, & Allen, 2008). Women often believe that unless there is a genuine medical concern, the enormous changes in pregnancy are to be 'put up with' or dismissed as a side effect, or a mere complaint of pregnancy (Han, 2013). This may cause mothers not raise the subject again, misread symptoms or stop them seeking help for symptoms, which is of utmost importance when experiencing pregnancy complications (Kavanaugh & Hershberger, 2005). This is also highly pertinent because many of the discomforts of pregnancy are similar to depressive symptoms (Gaynes et al., 2005).

In the *Sleep HAPi* study, all meetings and communication were scheduled at a time and place convenient to the women (homes, café, community library, university meeting spaces), and were one-on-one, face-to-face to ensure confidentiality and personalisation. The researcher delivering the education program was careful to approach the information in a sensitive way, mindful of the volume of advice and information that pregnant women receive. To maintain consistency and personalisation of the intervention, and confidentiality of the participant, all education sessions and communication were performed by the same researcher.

2.3.10 Measures

As the demographic, subjective sleep and mental health questions reported for this study were identical to those in the *E Moe Māmā* study described above, they will not be repeated here, however additional measures are described below.

2.3.10.1 Sleep measures

Objective sleep measures were obtained from the Ambulatory Monitoring Inc. (AMI) wrist-worn actigraph. This model of actigraph has a functional time display (making it easier for the wearer to record bedtimes and rise times in the sleep diary), event marker button for the wearer to push to denote start and end of sleep periods and a light sensor for recording light exposure. This actigraph also has the ability to detect if the watch is being worn against skin which provides additional information for scoring. Prior to issue, each actigraph was cleaned, a new battery inserted, and the device was initialised. Participants were instructed to wear the actigraph continuously (except during water-based activities) for seven nights on the non-dominant wrist, recording movement in one-minute epochs to quantify their sleep and wake patterns across both weekends and weekdays. Current best practice recommends actigraphy is used concurrently with a sleep diary to properly identify and confirm periods of sleep and inactive

wake (Littner et al., 2003). Thus, participants completed a sleep diary developed during previous Sleep/Wake Research Centre studies with a modified version of the Core Consensus Sleep Diary (CSD) added (Carney et al., 2012). Participants were asked to record bedtimes ('lights off'), rise times and at the same time, press an event marker button on the device. Participants also noted the times when the actiwatch was removed. Full actigraph and diary instructions are detailed in Appendix 16 and 17.

The data were visually inspected for any discrepancies between the sleep diary, event markers, and physical activity data. The data was scored with reference to a scoring protocol (Appendix 25) then analysed with Action-W (Version 2.7; Ambulatory Monitoring, Inc) software using the Cole Kripke algorithm. Actigraphic sleep onset was defined as 10 minutes of immobility, with no more than one epoch containing activity, a setting with the greatest agreement and least bias in comparison with PSG for sleep measurements in a pregnant population (Tsai et al., 2011; Zhu et al., 2018).

Guided by Buysse's Sleep Health model, the following measures were calculated:

Sleep duration was calculated from the actigraphy data.

Sleep timing was calculated using the sleep midpoints from actigraphic sleep periods, while subjective social jetlag scores were calculated using questions on bedtime and wake time from the Munich Chronotype Questionnaire (Roenneberg, Pilz, Zerbini, & Winnebeck, 2019). Using these data, weekday and weekend midpoints were computed, and weekday midpoint was subtracted from weekend midpoint to calculate an absolute social jetlag, as a continuous and categorical variable (0-60mins, 61-120mins, and 120+ mins) (Wittmann et al., 2006).

Sleep quality was assessed using two further measures in addition to the General Sleep Disturbance (GSDS) quality subscale described in the *E Moe, Māmā* study above. The Pittsburgh Sleep Quality Index (PSQI) is a 19-item measure of sleep quality over the past month, yielding a total score ranging from 0 to 21 with the higher total score indicating worse sleep quality. In distinguishing good and poor sleepers, a global PSQI score of greater than five yields a sensitivity of 89.6% and a specificity of 86.5% (Buysse et al., 1989), a cutoff that has been validated in a pregnant population investigating associations between sleep and mood (Qiu et al., 2016) and has good internal consistency, convergent, and divergent validity in early pregnancy (Jomeen & Martin, 2007). The second sleep quality measure was a single question asking, “In the last week, how often did you get a good night’s sleep?” This was then dichotomised into good (greater than three nights a week) or poor (less than or equal to three nights a week) in line with the GSDS quality subscale.

2.3.10.2 Other sleep aspects

Insomnia symptoms were measured by the Insomnia Severity Index (ISI), a seven-item questionnaire validated against sleep diaries and polysomnography, with excellent internal consistency in both population-based and clinical samples (Morin, Belleville, Bédard, & Ivers, 2011). A cut off score of ten has been identified to classify insomnia cases in a population-based sample (Morin et al., 2011).

An additional measure of sleep disturbance was assessed by the total GSDS score. The GSDS asks about frequency of various poor sleep experiences in the previous week on a numerical scale of 0 (never) to 7 (every day). It has shown good internal consistency in pregnant women (Cronbach = .81) (K. A. Lee & Gay, 2004) and concurrent validity has been demonstrated using sleep logs and wrist actigraphy (S.-Y. Lee, 2007).

Other sleep items assessed in the *Sleep HAPi* study were: Reasons for awakenings; getting a comfortable sleep position (nights per week); frequency of napping (days per week); frequent snoring (greater than or equal to three nights per week); frequent breathing pauses (greater than or equal to three nights per week); frequent leg twitching (greater than or equal to three nights per week). Restless Legs Syndrome (RLS) was also identified if all four of the following criteria were met: 1) the urge to move the extremities usually accompanied by unpleasant sensations; 2) worse symptoms at night; 3) more noticeable at rest; and 4) relieved by movement (Allen, Picchiatti, Hening, Trenkwalder, Walters & Montplaisir, 2003)¹.

2.3.10.3 Depressive symptom measures

As well as the EPDS total score described above (section 1.2.10.3), the *Sleep HAPi* study also used two EDPS subscales; a three-item anxiety subscale (EPDS-3A; 3A items 3, 4 & 5) and a seven-item depression subscale (EPDS-7D; items 1, 2, 6, 7, 8, 9 & 10). Phillips et al. (2009) identified a two-factor model of the EPDS to be a superior fit of data compared with a uni-dimensional model in a postnatal sample. For detecting major depression, the depression subscale with a cut-off of 8 has the same sensitivity and specificity as the cut-off of 13 on the total score indicating that the subscale alone would be acceptable to screen for depression. The depression subscale was also found to have a high correlation with the Becks Depression Inventory II (BDI-II) ($r=.68$).

¹ The 2003 International Restless Legs Syndrome Study Group (IRLSSG) diagnostic criteria was the relevant diagnostic criteria at the time of *E Moe Māmā* study development. These criteria were used in the *Sleep HAPi* study to ensure comparisons could be made between the two data sets.

The BDI-II was also utilised in the *Sleep HAPi* study². The BDI-II is a revision of the original BDI designed to have better correlation with the DSM criteria for depressive disorders. The questionnaire has 21 multiple choice questions scoring from 0 to 3, with total scores ranging from 0 to 63. The BDI-II is also a well validated measure used in previous studies to assess the relationship between sleep and depression (Isaac & Greenwood, 2011; Swanson, Flynn, Wilburn, Marcus, & Armitage, 2010). Chaudron et al. (2010) found the EPDS and BDI-II were equally accurate in identifying depression in low-income, black mothers during the first postnatal year.

The BDI II (Beck, Steer, Ball, & Ranieri, 1996) is widely used in depression screening in perinatal settings. A complication of using the BDI-II in pregnancy and the postnatal period is its heavy reliance on somatic symptoms. As pregnancy symptoms can mimic some somatic items in the BDI II, some researchers have suggested it could present false positives in detecting depression (Gaynes et al., 2005), however others have argued that higher somatic symptoms during pregnancy provides important insights to a woman's mental state (Kelly, Russo, & Katon, 2001; Nylen, Williamson, O'Hara, Watson, & Engeldinger, 2013). Indeed, women with depression present with greater somatic complaints, (Apter et al., 2013; Nylen et al., 2013) suggesting that they might be valid markers of the disorder.

As such, depressive symptoms were measured by both the BDI-II and the EPDS. Ji et al. (2011) has reported that the sensitivities and specificities of both the EPDS and BDI-II were very similar when administered antenatally and postnatally (28 weeks antenatal to 26 weeks postnatal). A validity study of 708 women using the BDI and EPDS from pre-conception to 26 weeks postnatal determined both instruments performed in the good to excellent range with the EPDS achieving

² The BDI-II is copyrighted, and questions cannot be extracted for use in study questionnaires. For the *Sleep HAPi* study, copies of the BDI-II were purchased from Pearson Australia, New Zealand and attached as a separate form to the pregnancy and postnatal questionnaires. Reproduction of the BDI-II is not permitted, therefore it is not included in the appendices.

excellent validity in the preconception, first trimester and third trimester and the BDI in the second trimester, early postpartum and late postnatal (Ji et al., 2011). This was consistent with a systematic review by Gaynes et al. (2005), who found that the specificity of the BDI and EPDS used in perinatal populations (in this instance described as during pregnancy or one year postnatal) to be high with substantial overlap. Sensitivity assessment was generally lower and while the EPDS was more sensitive than the BDI, the wide confidence intervals overlapped nearly completely. Both screening tools were used in this study to provide additional exploratory scope.

2.3.11 Statistical analyses

Statistical analyses are described in brief in Chapters 5 and 6 however they will also be described at this point for clarification. Descriptive statistics (means, standard deviations, proportions) were calculated in SPSS (version 25, IBM SPSS Statistics for Windows, Armonk, NY). As no differences were found between the first and second actigraphy weeks in each trimester these weeks were averaged. Changes to sleep or depressive symptoms over time were assessed using linear mixed models calculated in SAS (version 9.4, SAS Institute Inc., Cary, NC). The Kenward-Roger adjustment was applied to the degrees of freedom estimation (Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2007). Normality, linearity and constant variance assumptions were visually checked and the Shapiro-Wilk test used to assess the distribution of the residuals (Tabachnick & Fidell, 2012). Where outlying residual values were identified, the model was re-run without the outlier(s). If removing the outlier(s) altered the findings of the model, the reported results exclude the outlier(s), otherwise the results are reported including the outlier(s). Post-hoc tests were used to investigate comparisons of interest where main effects were statistically significant. Bonferroni's adjusted *p*-values were calculated for post-hoc tests. A *p*-value of <0.05 was considered significant.

3 SLEEP HEALTH IN PREGNANCY: A SCOPING REVIEW

Scoped reviews aim to map the existing literature in a field of interest and are commonly undertaken to examine the extent, nature, and characteristics of research activity in a topic area (Arksey and O'Malley, 2005). Scoped reviews are useful to summarize and disseminate research findings; identify research gaps in the existing literature; and determine the value, potential scope and cost of undertaking a full systematic review (Arksey and O'Malley, 2005).

Both scoped reviews and systematic reviews share the same comprehensive, rigorous and transparent methods to identify and examine the relevant literature relating to a research question, however scoped and systematic review are performed for different reasons and have some key methodological differences. Firstly, a scoped review aims to present an overview of a potentially large and diverse body of literature pertaining to a broad topic, whereas a systematic review attempts to present empirical evidence on a focused research question (Arksey and O'Malley, 2005). Secondly, scoped reviews include a greater range of study designs and methodologies, while systematic reviews generally address the effectiveness of interventions (Arksey and O'Malley, 2005). And thirdly, scoped reviews provide a descriptive overview of the reviewed literature without critically evaluating the design and methodology of individual studies, while systematic reviews aim to provide a synthesis of evidence from studies assessed for risk of bias (Arksey and O'Malley, 2005).

Based on this guidance, a scoped review was chosen for Study 1. Prior to this study, literature pertaining to sleep health throughout all trimesters of pregnancy had not been previously examined, hence the breadth and nature of previous research was unknown. Including a range of study designs was considered important to understand the extent of the current literature and identify gaps in knowledge. This chapter reports the findings of Study 1.

The following manuscript was prepared by the researcher (Appendix 28) and was published by the journal *Sleep Medicine Clinics* in September 2018. All rights reserved© Ladyman C. I., Signal T. L.

3.1 Abstract

Background: For most pregnant women, altered sleep is one of the most noticed changes and a topic that women regularly seek information on, yet there is still limited empirical information available on what constitutes healthy sleep in each trimester of pregnancy.

Methods: Using scoping review methodology, underpinned by Buysse's definition of sleep health, we investigated the literature on sleep duration, continuity/efficiency, timing, daytime sleepiness/alertness and perceived sleep quality in each trimester of pregnancy. Using key search terms, selected databases were used to identify 24 relevant studies.

Results: Information is limited to a small number of geographic areas (USA and Asia) and focuses primarily on sleep duration and sleep continuity/efficiency. Average polysomnographic and actigraphically determined total sleep time was less than seven hours, with standard deviations of approximately one hour. Sleep efficiencies ranged from $\approx 70-90\%$ and sleep onset latencies from $\approx 10-30$ mins. Based on limited information, a third of women report excessive daytime sleepiness across pregnancy and average PSQI scores were greater than five in the first and third trimester.

Conclusions: Limited literature is available on changes in sleep timing, perceived sleep quality, alertness/sleepiness across pregnancy. Data suggests significant variability in sleep between women, with less evidence to support large changes in sleep health across trimesters, but some support for an increase in sleep disturbances in the third trimester. There is a need for further

research on sleep health and sleep positioning to better inform women and their health providers. Future studies should ensure sample screening criteria are clearly specified and women are screened for complications throughout data collection not just at recruitment.

3.2 Introduction

For most women, altered sleep is one of a multitude of physiological changes occurring during pregnancy. It is also one of the most noticed changes (Kennedy et al., 2007), and a topic women regularly seek information on, yet there is still limited empirical information available on what constitutes healthy sleep in each trimester of pregnancy. This makes it difficult for maternal health providers to advise women on what changes are within the range of normal.

Previous literature suggests there are alterations to sleep duration, the architecture of sleep, and perceptions of sleep quality with clear changes occurring from one trimester to the next (Brunner et al., 1994; K. A. Lee, Zaffke, et al., 2000; Tsai, Lee, Lin, & Lee, 2016a). Many studies in this area have focused on the possible consequences of altered or disturbed sleep for the health of pregnant women and the health of their growing babies. They have revealed important findings, showing for example, that short and/or long sleep duration and/or disturbed sleep are risk factors for pre-term birth (Micheli et al., 2011; Okun, Schetter, & Glynn, 2011), gestational diabetes (Facco, Grobman, Kramer, Ho, & Zee, 2010; Qiu, Enquobahrie, Frederick, Abetew, & Williams, 2010), hypertension (Williams et al., 2010), pre-eclampsia (O'Brien et al., 2012), increased labor duration and a greater likelihood of caesarean delivery (K. A. Lee & Gay, 2004). Poorer antenatal mood and depression (Dørheim, Bjorvatn, & Eberhard-Gran, 2012; Okun, Kiewra, et al., 2011; Swanson, Pickett, Flynn, & Armitage, 2011) and poorer postpartum mood (Wolfson et al., 2003) have also been associated with disturbed sleep in pregnancy. These

health outcomes have consequences for women and children both in the short term and across the lifespan.

Like the studies that have investigated sleep during pregnancy, sleep science and sleep medicine more generally focus on what can go wrong with sleep. This approach has been important in advancing our understanding of the role of sleep in the development of ill health and disease (Cappuccio & Miller, 2017; Farrell & Richards, 2017; Jike, Itani, Watanabe, Buysse, & Kaneita, 2017). However, there is growing recognition that healthy sleep is more than just an absence of sleep problems or a sleep disorder. A sufficient amount of good quality sleep is being acknowledged as one of the fundamental components of good health, along with diet and physical activity (Canadian Society for Exercise Physiology, 2016; New Zealand Ministry of Health, 2017b).

Recently there has been an effort to frame sleep positively and look at the potential benefits of good sleep. Buysse (2014) has defined sleep health as “...a multidimensional pattern of sleep-wakefulness, adapted to individual, social, and environmental demands, that promotes physical and mental well-being”, and he proposes five dimensions of good sleep health: “subjective satisfaction, appropriate timing, adequate duration, high efficiency, and sustained alertness during waking hours.”

This shift in focus is highly relevant during pregnancy, a time when women have greater awareness of their own health and are concerned about the consequences for their child. Women also have more frequent interaction with health professionals and are receptive to information on maintaining or improving their health. Pregnancy is normally viewed as a positive time for most women and it is therefore relevant to focus on sleep health as a positive component of pregnancy. To do so, women and health professionals need practical, evidence-

based information about different aspects of sleep and what constitutes normal healthy ranges. Such information would also allow health professionals to know when women need further assessment and possibly referral for sleep problems.

To our knowledge there has been no previous attempt to define sleep health in pregnancy. The aim of the review is to summarise the available research evidence on healthy sleep in each trimester of pregnancy. To achieve this we have used a scoping review underpinned by Buysse's (2014) definition of sleep health.

3.3 Methods

The methodology outlined by Arksey and O'Malley (2005) was used as the basis for this scoping review. The following key steps were followed: (1) consultation; (2) identifying the research question; (3) identifying the relevant studies; (4) study selection; (5) charting the data; and (6) collating, summarising and reporting the results.

3.3.1 Identifying the research question

To ensure the topic addressed by the review was relevant and the findings practically useful, consultation with potential end users occurred. These were healthcare providers working with pregnant women and included an obstetrician, community-based midwife, antenatal information coordinator at a large regional hospital, and a pregnancy and childbirth education manager of a community-based service. All agreed that information on healthy sleep in pregnancy is sparse at best, and that information on this topic would be useful in their clinical environment. This consultation formed the rationale for our scoping review.

Based on Buysse's multi-dimensional definition of sleep health (2014), this review examined the extent of knowledge on sleep duration, sleep efficiency/continuity, sleep timing, daytime

alertness/sleepiness and perceived satisfaction/quality of sleep. It is proposed that healthy sleep is most likely to occur in a healthy, uncomplicated pregnancy, therefore studies included in this review needed to clearly specify criteria used to assure that participating women were healthy. Thus, the research question was “What do we know about sleep health in each trimester of pregnancy?”

3.3.2 Identifying the relevant studies

The initial literature search was conducted in the Cochrane Library, PubMed, Medline, psycINFO, Web of Science, CINAHL Complete and Scopus databases. These databases were systematically searched using key terms for sleep and pregnancy to form a Boolean string. Our final string was (pregnan* OR gestat*) AND (sleep*) AND (quality OR duration OR timing) AND (week* OR trimester* OR early OR mid OR late).

3.3.3 Inclusion/exclusion criteria

To ensure broad coverage, studies published in the English language from January 1975 to December 2017 were considered eligible. Only studies that reported sleep in a healthy sample or sub-sample of pregnant women were included. Data from control groups or sub-samples that sufficiently screened participating women were eligible for consideration. For a study to be included in the review, sleep data needed to be presented in sufficient detail, and report means and SDs or proportions above/below specified cut-offs, and trimester or gestational week.

Due to an established relationship with altered sleep, the exclusion criteria in each study had to stipulate that participating women self-reported or were screened for current mood disorders and sleep problems. At a minimum, each sample also had to be screened for pregnancy complications or pregnancy related health issues, which if not specifically stated, were assumed

to include gestational diabetes, hypertensive disorders (e.g. hypertension and/or pre-eclampsia/eclampsia) and other health concerns associated with small for gestational age infants and pre-term birth.

3.3.4 Study selection

Endnote reference management software was used to import and manage references. The initial search produced 1946 articles, of which 1218 were duplicates, leaving 728 for initial screening. The titles, abstract and keywords of the 728 identified articles were reviewed by two researchers and 503 records were excluded as not relevant to the topic. Full text records of the remaining 225 articles were read by both researchers to assess topic relevance, and a further 57 articles were excluded. Thirty-nine articles were considered central to the topic and eight articles were identified as review papers. The reference lists of these review papers and key articles were reviewed and yielded a further 88 studies (14 were additional review papers and the reference lists of these were also screened).

Careful screening of the participant inclusion/exclusion criteria was completed for 248 articles and 224 records were excluded. This resulted in 24 studies being included in the review. Figure 3.1 outlines the study selection pathway. Throughout the entire process, a conservative approach was taken and if there was uncertainty about the inclusion/exclusions criteria, both researchers discussed the study and reached consensus.

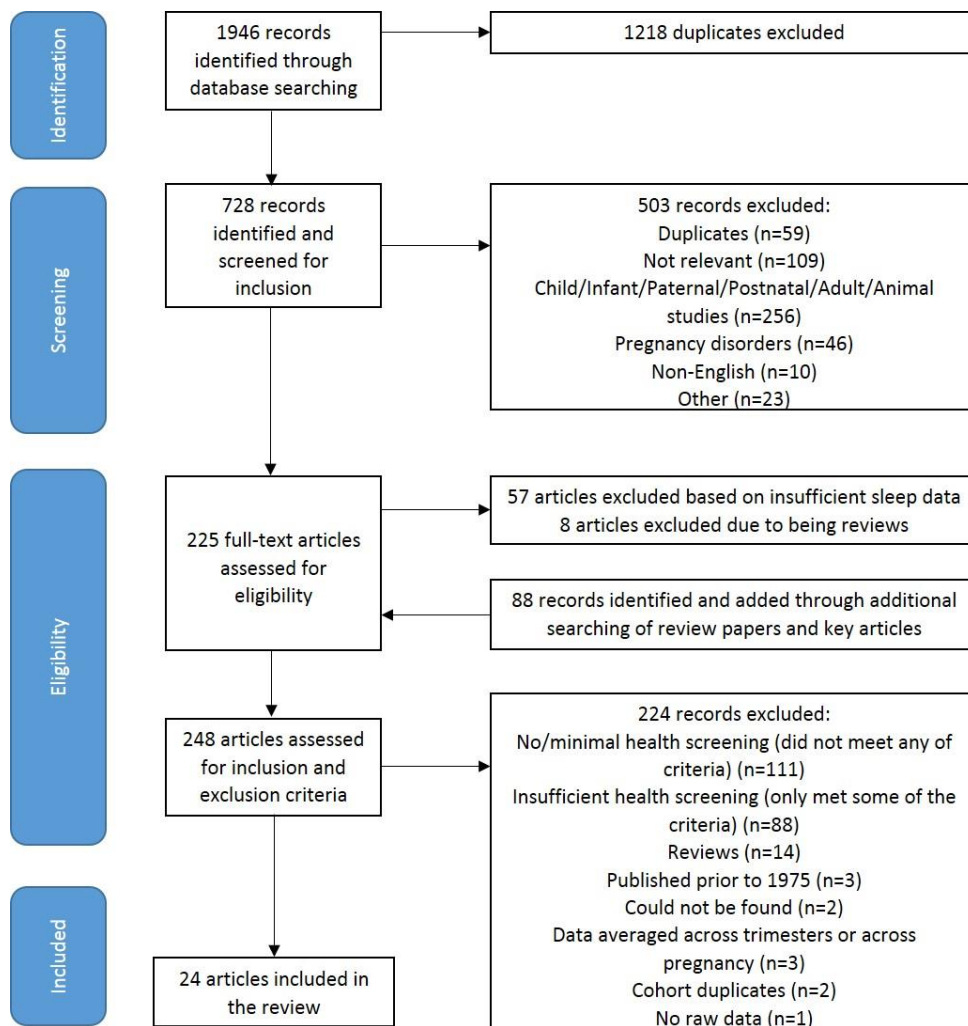


Figure 3.1 Flow diagram of the study selection process

3.3.5 Charting the data

Data was extracted from the final 24 studies and charted in Excel. The following information was recorded: Author, year of publication, journal name, geographical location, sample size and characteristics, measurement tools, dimension of sleep reported, aims and conclusions. Table 3.1 summarises descriptive characteristics of the included studies.

Table 3.1 Summary of characteristics of the included studies alphabetically by author (n=24).

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Baker et al. (2016); USA	172	1st Trimester (10-12 wks) 2nd Trimester (14-16 wks and 18-20 wks)	Parity: Does not specify Mean Age: 29.3 ± 4.9 yrs Recruitment Setting: Self-referral, physician referrals, local advertisements, or University research registries Other characteristics reported: BMI, marital status, household annual income, education, ethnicity	Objective: Actigraphy Subjective: Diary, PSQI	OBJECTIVE Duration: TST(min) _{acti} Continuity/Efficiency: WASO(min) _{acti} , SE(%) _{acti} , SOL(min) _{acti} , SUBJECTIVE Duration: TST(min) _{diary} Continuity/Efficiency: WASO(min) _{diary} , SE(%) _{diary} , SOL(min) _{diary} Satisfaction/Quality: PSQI (global)	To examine whether varying degrees of exercise were associated with better nocturnal sleep among pregnant women during early gestation.	Some level of exercise among pregnant women appears to be more advantageous than no exercise at all.
Brunner et al. (1994); Switzerland	9	1st Trimester (9-14 wks) 2nd Trimester (18-23 wks) 3rd Trimester (32-35 wks)	Parity: 5 primiparous, 4 multiparous Mean Age: 30.6 ± 2.9 yrs Recruitment Setting: University Obstetrics Clinic Other characteristics reported: Nil	Objective: In-lab PSG Subjective: Nil	OBJECTIVE Duration: TST(min) _{psg} Continuity/Efficiency: SE(%) _{psg} , SOL(min) _{psg} , WASO(min) _{psg} Other: REM Latency(min) _{psg} , N1(min) _{psg} , N2(min) _{psg} , N3(min) _{psg} , N4(min) _{psg} , REM(min) _{psg} , SWS sleep(min) _{psg} , Movement time(min) _{psg}	To investigate changes in sleep in the course of pregnancy, PSG was recorded and analysed in 9 healthy women on 2 consecutive nights during each trimester.	Documents alterations in EEG spectral power that may be associated with hormonal changes during pregnancy.
Crowley et al. (2016); USA	14	2nd Trimester (21.0 ± 1.0 wks)	Parity: All primiparous Mean Age: 29.9 ± 4.7 yrs Recruitment Setting: Community Other characteristics reported: Ethnicity, education, family income, depression history, anxiety history, EPDS, STAI	Objective: Actigraphy Subjective: Diary, PSQI	OBJECTIVE Continuity/Efficiency: WASO(min) _{acti} , Fragmentation Index _{acti} , SOL(min) _{acti} SUBJECTIVE Continuity/Efficiency: SOL(min) _{diary} Satisfaction/Quality: PSQI(global)	Pilot study to examine associations among stress-related physiological factors (including GABA-ergic neurosteroids) and stress-related behavioral indices of anxiety during pregnancy.	Data suggest that cortisol, progesterone and ALLO + pregnanolone levels in 2nd trimester are inversely related to negative emotional symptoms and the negative impact of acute stress challenge appears to exert its effects by reducing these steroids to further promote negative emotional responses.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Ebert et al. (2015); USA	161	1st Trimester (10-12 wks) 2nd Trimester (14-16 wks and 18-20 wks)	Parity: 83 primiparous, 78 multiparous Mean Age: 29.3 ± 4.9 yrs Recruitment Setting: Self-referral, physician referrals, local advertisements, or university research registries Other characteristics reported: Education, ethnicity, marital status, income, children at home, pre-weight, BMI at week 10, BP at week 10, caffeine, exercise, IDS, PSS	Objective: Actigraphy Subjective: Diary	OBJECTIVE Duration: TST(nighttime)(min) _{acti} Continuity/Efficiency: WASO(min) _{acti} , SOL(min) _{acti} , SE _{acti} , SUBJECTIVE Duration: TST(Nighttime)(min) _{diary} Continuity/Efficiency: WASO(min) _{diary} , SE(%) _{diary} , SOL(min) _{diary} Other: Naps taken	To assess whether daytime naps negatively impact nocturnal sleep.	The number of daytime naps have minimal impact on nocturnal sleep parameters; however, long nappers did exhibit modestly impaired sleep continuity and sleep quality. Overall, daytime naps were a beneficial countermeasure to sleep disruption commonly reported by pregnant women.
Elek et al. (1997); USA	24	3rd Trimester 7th month (26.0 ± 0.8 wks) 8th month (31.3 ± 1.0 wks) 9th month (36.4 ± 1.1 wks)	Parity: All primiparous Mean Age: 25.3 yrs (range 21 to 32 yrs) Recruitment Setting: Private physician offices Other characteristics reported: Ethnicity, marital status, minimum education, employment status, income (per couple)	Objective: Actigraphy Subjective: Diary, VAS-F (13-item)	OBJECTIVE Duration: TST _{diary} Continuity/Efficiency: Number of undisturbed 90-minute sleep cycles SUBJECTIVE Other: Morning and Evening Fatigue	This pilot study examined parents' levels of morning or evening fatigue, number of uninterrupted sleep periods and length of sleep during 3rd trimester; and relationship of sleep to parents' reports of fatigue.	The findings support the multidimensional nature of fatigue and indicate need for perinatal health caregivers to develop individualised interventions for mothers during the 3rd trimester. Fathers should also participate in future research on factors influencing prenatal and postpartum experience.
Haney et al. (2014); USA	161	1st Trimester (10-12 wks) 2nd Trimester (14-16 wks and 18-20 wks)	Parity: Does not describe (37% with at least 1 child <18 years old living at home) Mean Age: 29.0 ± 5.0 yrs Recruitment Setting: Community Other characteristics reported: Pre-pregnancy weight, weight at 1st trimester, BMI at 1st trimester, BP at 1st trimester, PSS (Perceived Stress Scale), IDS (Inventory of Depressive Symptoms), ethnicity, marital status, number of children	Objective: Actigraphy Subjective: Diary	OBJECTIVE Duration: TST(nighttime)(min) _{acti} Continuity/Efficiency: WASO(min) _{acti} , SOL(min) _{acti} SUBJECTIVE Duration: TST(nighttime)(min) _{diary} Continuity/Efficiency: WASO(min) _{diary} , SOL(min) _{diary}	To examine whether women with poor sleep (defined as short sleep duration, longer WASO or longer SOL at 10–12 wks, measured by sleep diary and actigraphy, would have higher BP or higher BMI across early pregnancy (10–20 wks) and whether women with sleep disturbance (i.e., poor sleep between 10 and 20 wks) would have greater increases in BP or BMI.	A subset of women report substantial difficulty initiating and maintaining sleep during early pregnancy and this may augment risk of higher BP and BMI. Assessing sleep in early pregnancy is important to allow time for appropriate intervention.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Hertz et al. (1992); USA	12	3rd Trimester (30-38 wks)	Parity: 7 primiparous, 5 multiparous Mean Age: 30.5 ± 5.1 yrs Recruitment Setting: Hospital Obstetrics Department Other characteristics reported: Nil	Objective: In-lab PSG Subjective: SSS	OBJECTIVE Duration: TIB(min) _{psg} , TST(nighttime)(min) _{psg} Continuity/Efficiency: SE(%) _{psg} , SOL(min) _{psg} , WASO(min) _{psg} , No of awakenings _{psg} Other: REM Latency(min) _{psg} , N1(min) _{psg} , N2(min) _{psg} , N3/4(min) _{psg} , REM(min) _{psg} SUBJECTIVE Alertness/Sleepiness: SSS Satisfaction/Quality: Restless Sleep Other: Snoring, Bad dreams	To present a detailed investigation of sleep patterns, respiration and leg muscle EMG of 12 women in third trimester.	In accordance with subjective reports, women in 3rd trimester demonstrated PSG patterns of sleep maintenance insomnia.
Hux et al. (2017); USA	103	1st Trimester (12.2 ± 1.1 wks)	Parity: 63 primiparous, 40 multiparous Mean Age: 29.8 ± 5.0 yrs Recruitment Setting: Self-referral, physician referrals, local advertisements, or university research registries Other characteristics reported: Ethnicity, income, education, Socioeconomic score, mean gestational age at delivery, preterm birth, pre-eclampsia, gestational diabetes	Objective: Nil Subjective: PSQI	SUBJECTIVE Satisfaction/Quality: PSQI(global)	To validate previously developed novel model of Allostatic Load (AL) in early pregnancy by evaluating associations between AL scores and subjective measures of stress and proxies of chronic stress, including race/ethnicity, sleep quality, and socioeconomic status.	Higher AL, measured by the pregnancy-specific model, was associated with poorer sleep quality and lower educational attainment, both considered chronic stressors. These relationships were consistent with previous findings in non-pregnant populations and suggest that AL may be useful for capturing the physiologic impact of chronic stress in early pregnancy.
Lee et al. (2000); USA	31	3rd Trimester (35-36 wks)	Parity: Does not specify Mean Age: 31.6 ± 4.5 yrs Recruitment Setting: Media advertisements, flyers on University campus Other characteristics reported: Annual income, employment status, marital satisfaction	Objective: In-home PSG Subjective: Diary, POMS	OBJECTIVE Duration: TST(nighttime)(min) _{psg} Continuity/Efficiency: SE(%) _{psg} , Wake(%) _{psg} Other: REM Latency(min) _{psg} , N1(%) _{psg} , N2(%) _{psg} , SWS(%) _{psg} , REM(%) _{psg} SUBJECTIVE Other: Fatigue(POMS)	To test the hypothesis that increases in endogenous progesterone levels during luteal phase of menstrual cycle will alter REM sleep and mood state, and that decrease in endogenous progesterone levels postpartum will also alter REM sleep and mood state.	REM sleep and mood state were related to low progesterone levels during menstrual cycle, but postpartum REM sleep and mood state were related to increased wake time rather than changes in progesterone levels.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Lee et al. (2000); USA	33	1st Trimester (11-12 wks) 3rd Trimester (35-36 wks)	Parity: 16 primiparous, 17 multiparous Mean Age: 30.5 ± 3.7 yrs (primiparas), 31.5 ± 3.0 yrs (multiparas) Recruitment Setting: Advertisements on University campus Other characteristics reported: Ethnicity, annual income, employment status, education, marital satisfaction	Objective: In-home PSG Subjective: Diary	OBJECTIVE Duration: TST(nighttime)(mins) _{psg} Continuity/Efficiency: SE(%) _{psg} , SOL(min) _{psg} , Wake(%) _{psg} Other: REM Latency(min) _{psg} , N1(mins) _{psg} , N2(min) _{psg} , N3/4(mins) _{psg} , REM(min) _{psg}	To describe changes in women's sleep patterns from pre-pregnancy to postpartum.	Sleep disturbance was greatest during the first postpartum month, particularly for first-time mothers.
Okun et al. (2015); USA	143	1st Trimester (10-12 weeks) 2nd Trimester (14-16 wks and 18-20 wks)	Parity: 85 primiparous, 54 multiparous Mean Age: 30.4 ± 5.8 yrs (with insomnia), 29.1 ± 4.6 yrs (no insomnia) Recruitment Setting: Self-referral, physician referrals, local advertisements, or university research registries Other characteristics reported: Education, ethnicity, marital status, employment status, income	Objective: Actigraphy Subjective: Diary, ISQ, PSQI	OBJECTIVE Duration: TST(min) _{acti} , TIB(min) _{acti} , Continuity/Efficiency: WASO(min) _{acti} , SOL(min) _{acti} , SE(%) _{acti} , Timing: Bedtime _{acti} SUBJECTIVE Duration: TST(min) _{diary} , TIB(min) _{diary} Continuity/Efficiency: WASO(min) _{diary} , SOL(min) _{diary} , SE(%) _{diary} Timing: Bedtime _{diary} Satisfaction/Quality: PSQI(global)	To provide additional psychometric evaluation and validation of ISQ and to establish prevalence rates of insomnia among a women during early gestation.	Insomnia is a health problem for many pregnant women at all stages in pregnancy. These data support validity and reliability of the ISQ to identify insomnia in pregnant women. The ISQ is a short and cost-effective tool that can be quickly employed in large observational studies or in clinical practice where perinatal women are seen.
Strange et al. (2009); USA	220	2nd Trimester (20-29 wks)	Parity: Does not specify Mean Age: Does not specify Recruitment Setting: Obstetric practices Other characteristics reported: Nil	Objective: Nil Subjective: PSQI, ESS	SUBJECTIVE Duration: TST _{psqi} Continuity/Efficiency: SE(%) _{psqi} , SE(score) _{psqi} , SOL(min) _{psqi} , SOL(score) _{psqi} , Disturbances _{psqi} Alertness/Sleepiness: ESS, Dysfunction _{psqi} , Satisfaction/Quality: PSQI(global), Quality _{psqi} Other: Use of sleep medications	This study examined subjective sleep quality and daytime sleepiness in relation to preterm birth.	Disturbed sleep in pregnancy may be associated with preterm birth. Future studies should examine specific physiological factors that underlie this increased vulnerability.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Tsai et al. (2017); Taiwan	204	1st Trimester (11.8 ± 2.30 wks) 2nd Trimester (16-28 wks) 3rd Trimester (>29 wks)	Parity: 107 primiparous, 97 multiparous Mean Age: 32.5 ± 4.0 yrs Recruitment Setting: Medical centre outpatient obstetric clinic Other characteristics reported: Marital status, education, weekly working hours, BMI, CES-D	Objective: Actigraphy Subjective: Diary, PSQI, ESS	OBJECTIVE Duration: TST(nighttime)(min) _{acti} , TST(daytime)(min) _{acti} Continuity/Efficiency: WASO(%) _{acti} Other: Daytime sleep _{acti} SUBJECTIVE Alertness/Sleepiness: ESS (global), ESS (global>=10) Satisfaction/Quality: PSQI (global), PSQI (global>5) Other: Snoring(n,%)	To examine 1st trimester maternal characteristics associated with persistent and new onset daytime sleepiness in pregnancy.	Snoring in the 1st trimester is involved in both persistent and new-onset daytime sleepiness with elevated depressive symptoms related to new-onset daytime sleepiness. Intervention strategies for alleviating daytime sleepiness in pregnant women should focus on managing snoring and symptoms of depression in early pregnancy with special attention to primiparous and employed women.
Tsai et al. (2012); Taiwan	38	3rd Trimester (32.6 ± 2.8 wks)	Parity: 38 primiparous Mean Age: 32.1 ± 5.1 yrs Recruitment Setting: University-affiliated hospital Other characteristics reported: BMI, education, working hours per week, CES-D	Objective: Actigraphy Subjective: Diary, PSQI, VAS-F	OBJECTIVE Duration: TST(nighttime)(min) _{acti} Continuity/Efficiency: WASO(mins) _{acti} SUBJECTIVE Duration: TST(min) _{psqi} Continuity/Efficiency: SOL(min) _{psqi} Timing: Bedtime _{acti} , Risetime _{acti} , Alertness/Sleepiness: Morning fatigue, Midday fatigue, Afternoon fatigue, Evening fatigue Satisfaction/Quality: PSQI(global), PSQI(global>5) Other: Number days napped _{psqi} , Number naps on a given day _{psqi}	To examine association among nighttime sleep and daytime napping behaviours, depressive symptoms, and perception of fatigue in pregnant women.	Interventions designed to increase sleep duration and decrease depressive symptoms have the potential to prevent, ameliorate, or reduce fatigue in pregnant women. Depressive symptoms during pregnancy likely share some psychological and behavioral tendencies with fatigue or sleep disturbance which may complicate evaluation of intervention effect.
Tsai et al. (2016); Taiwan	164	1st Trimester (11.7 ± 2.4 wks) 2nd Trimester (22.3 ± 2.3 wks) 3rd Trimester (33.7 ± 2.3 wks)	Parity: 85 primiparous, 79 multiparous Mean Age: 32.7 ± 4.0 yrs Recruitment Setting: University affiliated hospital Other characteristics reported: Education, employment status, pre-pregnancy BMI	Objective: Actigraphy Subjective: Diary, PSQI	OBJECTIVE Duration: TST(nighttime)(hr) _{acti} , TST(daytime)(min) _{acti} Continuity/Efficiency: WASO(mins) _{acti} , SE(%) _{acti} SUBJECTIVE Satisfaction/Quality: PSQI(global), PSQI(global>5)	To examine cross-sectional and longitudinal association between sleep and health-related quality of life in pregnant women.	Sleep disturbances are highly prevalent and a persistent problem in pregnant women. Adequate sleep is essential at all pregnancy stages and improving nocturnal sleep quantity and quality in early gestation is important for health-related quality of life later in pregnancy.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Tsai et al. (2013); Taiwan	80	3rd Trimester (32.8 ± 2.7 wks)	Parity: 80 primiparous Mean Age: 31.7 ± 4.6 yrs Recruitment Setting: University Hospital obstetric clinics Other characteristics reported: Education years, employment status, weekly working hours, BMI, CES-D	Objective: Actigraphy Subjective: Diary, PSQI, VAS-F (7-item)	OBJECTIVE Duration: TST(nighttime)(min) _{acti} , TST(daytime)(min) _{acti} , TST(in 24hr)(min) _{acti} , Continuity/Efficiency: WASO(min) _{acti} , SE(%) _{acti} , FragIndex _{acti} , SUBJECTIVE Duration: TST(nighttime)(min) _{diary} Continuity/Efficiency: Awakenings _{diary} Satisfaction/Quality: PSQI(global), PSQI(global>5) Other: Total naps over 7 day _{diary} , Number women taking > 1 nap on a given day _{diary}	To examine temporal association of nighttime sleep quality and quantity with subsequent daytime naps and temporal association of daytime naps with sleep quality and quantity the following night in 3rd trimester.	Naps during pregnancy might indicate insufficient nighttime sleep, and longer daytime naps could compromise subsequent nighttime sleep. Further research is needed to determine if short sleep duration and longer daytime naps are associated with negative pregnancy outcomes.
Tsai et al. (2011); Taiwan	30	3rd Trimester (32.9 ± 2.7 wks)	Parity: 30 primiparous Mean Age: 30.8 ± 4.8 yrs Recruitment Setting: University associated hospital prenatal clinics Other characteristics reported: BMI, education, daily work hours, CES-D	Objective: Actigraphy Subjective: Diary, PSQI	OBJECTIVE Duration: TST(min) _{acti} , TST(wkend)(min) _{acti} , TST(wkday)(min) _{acti} , Continuity/Efficiency: WASO(min) _{acti} , WASO(wkend)(min) _{acti} , WASO(wkday)(min) _{acti} , SE(%) _{acti} , SE(wkend)(%) _{acti} , SE(wkday)(%) _{acti} , SOL(min) _{acti} , SOL(wkend)(%) _{acti} , SOL(wkday)(%) _{acti} , Timing: Bedtime _{acti} , Bedtime(wkend) _{acti} , Bedtime(wkday) _{acti} , Risetime _{acti} , Risetime(wkend) _{acti} , Risetime(wkday) _{acti} SUBJECTIVE Duration: Bedtime _{psqi} , Risetime _{psqi} , TIB(hr) _{psqi} , TST(hr) _{psqi} Continuity/Efficiency: SE(%) _{psqi} , SOL(min) _{psqi} Satisfaction/Quality: PSQI(global), PSQI(global>5) Other: Number naps/day, Number naps/week, Number naps on weekdays, Number naps on weekends, Use of sleep enhancement strategies	To identify sociodemographic, lifestyle, and health-related factors associated with poor sleep quality in women during 3rd trimester.	Primiparous women experience both objective and subjective sleep disturbances, and their sleep patterns differ between weekdays and weekends during 3rd trimester. Maternal sleep patterns may be improved by maintaining a regular and earlier bedtime, so women have more opportunity to obtain sufficient nocturnal sleep and improve sleep quality.
Tsai et al. (2011); Taiwan	274	3rd Trimester (33.2 ± 2.6 wks)	Parity: All primiparous Mean Age: 31.9 ± 4.1 yrs Recruitment Setting: University affiliated obstetrics and gynecology clinics Other characteristics reported: Marital status, employment status, BMI, caffeine intake, smoking and alcohol consumption, education, CES-D scores	Objective: Actigraphy Subjective: Diary, PSQI, ESS	OBJECTIVE Duration: TST(nighttime)(min) _{acti} , TST(nighttime<6hrs) _{acti} , TST (daytime)(min) _{acti} , TST(24hrs)(min) _{acti} , TST(24hrs<7hr) _{acti} Continuity/Efficiency: SOL(min) _{acti} , SE(%) _{acti} , SE(<85%)(%) _{acti} SUBJECTIVE Alertness/Sleepiness: ESS(global), ESS(global>10), Satisfaction/Quality: PSQI(global), PSQI(global>5), Other: Napping	To examine objective and self-reported sleep disturbances and symptoms of depression and daytime sleepiness in a group of healthy pregnant women.	Both objective nighttime sleep < 6 hrs and self-reported poor sleep quality in healthy 3rd trimester pregnant women is associated with significant risks for clinical depression. Improving sleep may reduce depression symptom severity and attenuate prevalence of depression in pregnant women.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Tsai et al. (2016); Taiwan	197	3rd Trimester (33.2 ± 2.7 wks)	Parity: All primiparous Mean Age: 32.0 ± 4.2 yrs Recruitment Setting: Medical center Other characteristics reported: Education, employment hours, BMI, CES-D	Objective: Actigraphy Subjective: Diary, PSQI, SHPS	OBJECTIVE Duration: TST(nighttime)(min) _{acti} , TST variability(nighttime)(min) _{acti} , TST(daytime)(min) _{acti} , TST variability(daytime)(min) _{acti} Continuity/Efficiency: SOL(min) _{acti} , SOL variability(min) _{acti} , WASO(min) _{acti} , WASO variability(min) _{acti} SUBJECTIVE Other: SHPS score	A descriptive study examining associations of sleep hygiene and actigraph measures of sleep with self-reported sleep quality in pregnant women.	Findings support avoiding physically, physiologically, emotionally, or cognitively arousing activities before bedtime as a target for sleep-hygiene intervention in pregnant women.
Tsai et al. (2013); Taiwan	120	3rd Trimester (33.7 ± 2.7 wks)	Parity: 120 primiparous Mean Age: 31.3 ± 4.2 yrs Recruitment Setting: University affiliated hospital Other characteristics reported: Gestational age at delivery, pre-pregnancy BMI, CES-D, infant birth weight, marital status, education, working hours per week, gender of infant, labour duration	Objective: Actigraphy Subjective: Diary, PSQI	OBJECTIVE Duration: TST(nighttime)(hr) _{acti} , TST(nighttime<6)(%) _{acti} , TST(daytime)(min) _{acti} , TST(in 24hr) _{acti} Continuity/Efficiency: SE(%) _{acti} , SE(<85)(%) _{acti} Other: Prevalence daytime napping(%) SUBJECTIVE Duration: TST(nighttime)(hr) _{psqi} Continuity/Efficiency: SE(%) _{psqi} Satisfaction/Quality: PSQI(global), PSQI(global>5)	To examine associations of nighttime and daytime sleep during 3rd trimester with labor duration and risk of cesarean deliveries.	There was a beneficial effect of sleep on labor duration, suggesting that studies of sleep duration effects on labor and pregnancy outcomes should consider amount of both daytime and nighttime sleep.
Tzeng et al. (2015); Taiwan	139	3rd Trimester (36 wks)	Parity: 53 primiparous, 86 multiparous Mean Age: 33.6 ± 3.8 yrs Recruitment Setting: Antenatal clinics Other characteristics reported: Education, employment status, prenatal exercise, planned pregnancy, anaemia, use of PCA (patient-controlled analgesia), use of pain medication, pre-pregnancy BMI, EPDS	Objective: Nil Subjective: PSQI, FCF	SUBJECTIVE Duration: TST _{psqi} , Duration(subscale) _{psqi} , Continuity/Efficiency: SOL(subscale) _{psqi} , SOL(mins) _{psqi} , SE(subscale) _{psqi} , SE(%) _{psqi} , Disturbances(subscale) _{psqi} Alertness/Sleepiness: Daytime Function(subscale) _{psqi} Satisfaction/Quality: PSQI (global), Quality(subscale) _{psqi} Other: Fatigue(FCF), Sleep medication _{psqi} , Insomnia(%) _{psqi}	Two aims: 1) identify distinct classes of sleep-disturbance trajectories in women considering elective cesarean from 3rd trimester pregnancy to 6 months postpartum and 2) examine associations of sleep trajectories with BMI, depressive symptoms, and fatigue scores.	Women had 3 distinct sleep-disturbance trajectories before and after elective cesarean. These poor-sleep courses were associated with BMI and psychological well-being. Findings suggest need to continuously assess sleep quality in women considering elective cesarean and up to 6 months post-cesarean.

Authors	n=	Trimester (gestational week)	Participant Characteristics	Measure	Sleep Parameters Reported	Aim/Overview	Conclusions
Waters et al. (1996); USA	31	3rd Trimester (35-36 wks)	Parity: 12 primigravida, 19 multigravida Mean Age: 31.3 ± 3.3 yrs (primiparas), 32.4 ± 5.1 yrs (multiparas) Recruitment Setting: Advertisements in Obstetric offices and newspapers Other characteristics reported: Ethnicity, marital status, number of months married, education, employment status	Objective: PSG, location not specified Subjective: VAS-F (18-item)	OBJECTIVE Continuity/Efficiency: SE(%) _{psg} SUBJECTIVE Other: Fatigue(VAS-F), vitality(VAS-F)	To describe differences between primigravidae and multigravidae in their experience of sleep efficiency, fatigue and vitality, and level of functioning in 3rd trimester of pregnancy and 1st month postpartum.	Maternal role 'acquisition' experienced by primigravidae results in more fatigue and sleep disruption than maternal role 'expansion'. The significant decrease in sleep efficiency and increase in fatigue in primigravidae after delivery indicates that health care professionals need to provide anticipatory guidance to primigravidae to help smooth the transition from pregnancy to motherhood.
Wilson et al. (2011); Australia	48	1st Trimester (9-14 wks) 3rd Trimester (30-38 wks)	Parity: 9 primiparous and 12 multiparous (1st Trimester), 15 primiparous and 12 multiparous (3rd Trimester) Mean Age: 29.6 ± 3.4 yrs (1st Trimester), 32.3 ± 3.5 yrs (3rd trimester) Recruitment Setting: Hospital Outpatient Obstetrics Clinic Other characteristics reported: Pre-pregnancy BMI, marital status, education, employment status	Objective: In-lab PSG Subjective: Study specific questionnaire	OBJECTIVE Continuity/Efficiency: SOL(min) _{psg} , WASO(min) _{psg} , Arousals/hr _{psg} , Awakenings _{psg} , SE(%) _{psg} Other: REM latency(min) _{psg} , Resp arousals _{psg} , limb arousals _{psg} , Spont arousals _{psg} , N1(min) _{psg} , N2(min) _{psg} , N3(min) _{psg} , N4(min) _{psg} , REM(min) _{psg} , %TST supine _{psg} SUBJECTIVE Duration: TST(<8hrs/night)(%) Continuity/Efficiency: SOL(>20mins)(%), Difficulty falling asleep(%), Number of awakenings Satisfaction/Quality: Quality & Tiredness (study specific questionnaire) Other: Reasons for overnight awakenings	To objectively measure sleep architecture and investigate subjective sleep quality in 1st and 3rd trimester, when compared to non-pregnant state.	Sleep during pregnancy is compromised by higher amounts of wake and cortical arousals leading to sleep fragmentation, with greater amounts of light sleep and less deep sleep. Mood state did not have an effect on sleep. Findings may help healthcare providers recognise when severe sleep disruption may warrant referral to specialist for appropriate diagnosis and treatment.
Wolfson et al. (2003); USA	38	3rd Trimester (34.5 ± 2.3 wks)	Parity: All primiparous Mean Age: 30.0 ± 3.8 yrs Recruitment Setting: Antenatal classes Other characteristics reported: ethnicity, marital status, education	Objective: Nil Subjective: Diary (Mother's Sleep-Wake Diary)	SUBJECTIVE Duration: TST(nighttime)(min) _{diary} , TST(daytime)(min) _{diary} Continuity/Efficiency: SOL(min) _{diary} , Disruptions(min) _{diary} Timing: Bedtime _{diary} , Risetime _{diary}	To describe and compare diary reported sleep-wake variables and depressive symptoms during last wks of pregnancy, at 2-4 wks postpartum, 12-16 wks postpartum, and at 12-15 mths postpartum; and compare sleep-wake variables between depressed and non-depressed mothers at 2-4 wks postpartum.	Mothers who developed clinically elevated depressive symptoms (CES-D ≥ 16) at 2-4 wks postpartum reported more total sleep time, later rise times, and more time napping at end of pregnancy compared to mothers who reported fewer symptoms (CES-D < 16) at 2-4 wks postpartum.

3.4 Results

Studies identified in the scoping review are predominantly from Taiwan (38%) and the USA (54%), with only one study from Australia (Brunner et al., 1994) and one from Switzerland (Wilson et al., 2011). In reviewing studies from the same authors or groups of authors, it became evident that different studies potentially used the same sample of participating women, although this was not always explicitly stated in any publication. To ensure data from the same cohort of participants was not included in the review multiple times, sample sizes and data collection time frames (when given) were carefully considered. In the first instance, data are presented from studies with the largest number of participants and the widest timeframe. Data from additional studies, thought to using the same sample of women, are included if different sleep variables are provided or if data are presented by sub-groups of women (e.g. those with and without insomnia symptoms).

The majority of studies used well-validated and widely accepted sleep measurement tools. PSG was used in six studies, actigraphy in 14 studies and sleep diary in 17 studies. Subjective sleep scales were used in a majority of the studies, with the Pittsburgh Sleep Quality Index (PSQI) being the most common (n=14). The Epworth Sleepiness Scale (ESS) and various forms of the Visual Analogue Scale for Fatigue (VAS-F) were used in a limited number of studies (18-item, 13-item and 7-item). The Fatigue Continuum Form (FCF), the Profile of Mood States (POMS) fatigue subscale, Insomnia Symptom Questionnaire (ISQ), Stanford Sleepiness Scale (SSS) and the Sleep Hygiene Practice Scale (SHPS) were each reported once. It is important to note that although studies may have indicated they used the above tools, authors may have chosen not to present data on all measures.

Figure 3.2 shows an overview of publication dates of the included studies. Recent publications dominate the review with 71% of the studies published after 2009. However current literature using PSG measures of sleep is limited, with five of the six studies published prior to 2000 and the sixth study was published in 2011. The six actigraphy studies are more current (range 2011-2016), however, all are published by Tsai and colleagues.

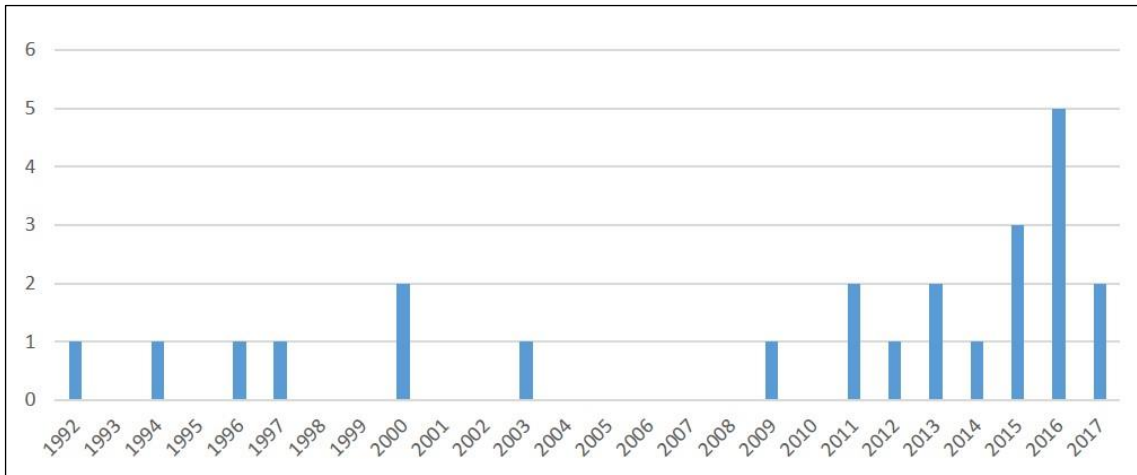


Figure 3.2 Number of publications over the past 25 years.

Sleep data are centred around the third trimester with 17 articles providing data from this gestational period. Ten articles report on first trimester, while only eight articles report on the second trimester. Six studies span two trimesters, while only three studies provide data from all three trimesters (Brunner et al., 1994; Tsai, Lee, Lin, et al., 2016a, 2016b).

As seen in Figure 3.3, most articles report on sleep efficiency/continuity (42%) and sleep duration (24%). Data are limited for other dimensions of sleep including quality, timing and alertness/sleepiness. Over 50% of the data comes from five measures of sleep; nighttime TST, sleep efficiency, sleep onset latency, wake after sleep onset and PSQI scores.



Figure 3.3 Hierarchical representation of reported sleep parameters from included studies.

3.4.1 Duration

There are PSG, actigraphy and self-report data available on the duration of nighttime sleep in each trimester of pregnancy (see Table 3.2). Mean polysomnographic and actigraphic nighttime TST values are on average less than seven hours, with standard deviations of approximately one hour. At each trimester, self-reported TST is longer than PSG and actigraphic TST, with women

reporting sleep durations over seven hours on average, particularly in the first and second trimester. In the third trimester, self-reported TST is similar to PSG and actigraphic measured sleep duration. There is limited actigraphic and subjective data on the amount of time pregnant women spend in bed at night, which on average is over eight hours.

Table 3.2 Sleep duration in each trimester as reported for night-time and day-time periods, in studies using PSG, actigraphy and self-reported measures (Brunner et al., 1994; Ebert, Wood, & Okun, 2015; Elek, Hudson, & Fleck, 1997; Haney et al., 2014; Hertz et al., 1992; K. A. Lee, McEnany, & Zaffke, 2000; K. A. Lee, Zaffke, et al., 2000; Okun, Buysse, & Hall, 2015; Tsai et al., 2011; Tsai, Kuo, Lee, Lee, & Landis, 2013; Tsai, Lee, Wu, et al., 2016; Tsai, Lee, Lin, et al., 2016a, 2016b; Tsai, Lin, Kuo, Lee, & Landis, 2013; Tsai, Lin, Kuo, & Thomas, 2012; Tsai, Lin, et al., 2016; Tzeng, Chen, Chen, Wang, & Kuo, 2015; Wilson et al., 2011; Wolfson et al., 2003).

	1 st trimester	2 nd trimester	3 rd trimester
Measure	Mean ± SD	Mean ± SD	Mean ± SD
PSG TIB (mins)	(no data)	(no data)	462 ± 52
Actigraphy TIB (mins)	478 ± 43 (with insomnia) 483 ± 49 (no insomnia)	(no data)	(no data)
Self-report TIB (mins)	509 ± 39 (with insomnia) 508 ± 53 (no insomnia)	(no data)	493 ± 70
PSG TST (mins)	389 ± 10* 446 ± 66	401 ± 15	370-415 ± 59-65 430 ± 33 (negative postpartum affect) 412 ± 69 (positive postpartum affect)
Actigraphy TST (mins)	390-412 ± 54-64 380 ± 64 (frequent nappers) 439 ± 45 (non-nappers) 400 ± 60 (short nappers) 372 ± 66 (long nappers) 394 ± 65 (with insomnia) 365 ± 69 (no insomnia)	396-398 ± 50-51 383 ± 53 (frequent nappers) 422 ± 51 (non-nappers) 405 ± 47 (short nappers) 381 ± 56 (long nappers)	386-394 ± 52-61 441 ± 61 (frequent nappers) 476 ± 55 (non-nappers) 388 ± 52 (good sleeper) 390 ± 47 (poor sleeper) 388 ± 45 (vaginal delivery) 406 ± 58 (cesarean delivery) 376 ± 54 (frequent nappers) 411 ± 54 (infrequent nappers)

Self-report TST (mins)	461 ± 52 450 ± 49 (frequent nappers) 474 ± 46 (non-nappers) 464 ± 49 (short nappers) 455 ± 57 (long nappers) 444 ± 55 (with insomnia) 466 ± 52 (no insomnia)	454 ± 54 441 ± 61 (frequent nappers) 476 ± 55 (non-nappers) 462 ± 48 (short nappers) 439 ± 65 (long nappers)	408-454 ± 56-92 375 ± 63 (weekdays) 414 ± 72 (weekends) 417 ± 74 (vaginal delivery) 398 ± 80 (cesarean delivery)
Actigraphy Daytime TST (mins)	42 ± 33 97 ± 60 (moderate nappers) 82 ± 29 (frequent nappers)	34 ± 26 83 ± 36 (moderate nappers) 91 ± 37 (frequent nappers)	49-84 ± 51-52 46 ± 46 (good sleeper) 38 ± 34 (poor sleeper) 42 ± 36 (vaginal delivery) 41 ± 57 (cesarean delivery) 75 ± 60 (frequent nappers) 22 ± 15 (infrequent nappers)
Self-report Daytime TST (mins)	83 ± 46 (moderate nappers) 93 ± 48 (frequent nappers)	78 ± 41 (moderate nappers) 104 ± 59 (frequent nappers)	18 ± 5*
Actigraphy 24-hr TST (mins)	(no data)	(no data)	435-442 ± 57-58 430 ± 51 (vaginal delivery) 448 ± 64 (cesarean delivery) 451 ± 58 (frequent nappers) 433 ± 58 (infrequent nappers)
TST <8hrs	71% (PSG, nighttime TST)	(no data)	74% (PSG, nighttime TST)
TST <7hrs	38% (Actigraphy, nighttime TST) 24% (Diary, nighttime TST)	25% (Actigraphy, nighttime TST) 26% (Diary, nighttime TST)	42% (actigraphy, 24hr TST)
TST <6hrs	(no data)	(no data)	26% (actigraphy, nighttime TST)
PSG %TST in supine	41 ± 24	(no data)	19 ± 15

*SEM rather than SD

Detail on the percentage of time and number of minutes spent in the different stages of sleep and wake, REM latency and movement time can be found in Table 3.3. With the exception of N1 light sleep, the amount of time spent in the different stages of sleep is markedly different from one study to the next.

Table 3.3 Sleep stages, REM latency and movement time in each trimester, measured by PSG (Brunner et al., 1994; Hertz et al., 1992; K. A. Lee, Zaffke, et al., 2000; Wilson et al., 2011).

	1 st trimester		2 nd trimester		3 rd trimester	
	Mean ± SD	(% sleep)	Mean ± SD	(% sleep)	Mean ± SD	(% sleep)
N1 (mins)	34 ± 4*		31 ± 4*	(no data)	36 ± 5*	
	30 ± 16	(3 ± 1%)			35 ± 15	(4 ± 1%) (19 ± 13%)
N2 (mins)	215 ± 14*		234 ± 17*	(no data)	221 ± 14*	
	166 ± 44	(54 ± 6%)			162 ± 41	(56 ± 6%) (55 ± 14%)
N3 (mins)	40 ± 4*		39 ± 3*	(no data)	36 ± 3*	
	85 ± 38	(9 ± 3%) [#]			67 ± 28	(8 ± 4%) [#] (12 ± 3%) [#]
N4 (mins)	20 ± 4*	(no data)	24 ± 5*	(no data)	18 ± 6*	(no data)
	62 ± 27				55 ± 24	
REM (mins)	80 ± 2*		73 ± 43*	(no data)	71 ± 6*	
	64 ± 16	(24 ± 5%)			60 ± 23	(21 ± 5%) (14 ± 4%)
REM Latency (mins)	79 ± 8*	(no data)	70 ± 43*	(no data)	65 ± 3*	(no data)
	118 ± 61				125 ± 51	
	74 ± 26				126 ± 55	
Wake (mins)	(no data)	(9 ± 6%)	(no data)	(no data)	(no data)	(11 ± 6%)
Movement Time (mins)	10 ± 1*	(no data)	11 ± 41*	(no data)	11 ± 1*	(no data)

*SEM rather than SD; # Combined N3 & N4

Daytime nap duration is reported in Table 3.2, with average durations ranging widely from approximately 20 minutes to over 100 minutes, depending on the study. Three studies describe the frequency of napping in the third trimester (Tsai et al., 2011; Tsai, Lin, et al., 2013; Tsai et

al., 2012). The first study reports the prevalence of daytime napping as 97.5% (Tsai, Lin, et al., 2013), while a second describes 50% of their cohort napping on 4 days or more (21% on four to five days and 29% napping on six to seven days) (Tsai et al., 2012) and the third study reported that the average number of naps per week was 4 ± 3 , with 0.64 ± 0.45 naps on weekdays and 0.53 ± 0.45 naps on weekends (Tsai et al., 2011). There is a small amount of data on TST in 24 hours, but only in the third trimester, and values average seven hours (see Table 3.2). Some studies also reported the proportion of women obtaining <8 , <7 and <6 hours sleep per night (see Table 3.2) and a single study reported on the percentage of time women spent in the supine position, dropping from nearly half the night in the first trimester to 20% of the night in the third trimester (Wilson et al., 2011). Together this information demonstrates that during a healthy pregnancy both nighttime and daytime sleep duration is highly variable from one woman to the next.

3.4.2 Continuity/sleep efficiency (SE)

Compared to other dimensions of sleep, there is a large amount of data available on continuity/sleep efficiency (SE) (see Table 3.4). Objective SE measured using both PSG and actigraphy range from 71-91% while subjective values of SE have a narrower range (83-91%). PSG WASO values (in mins) are highest in the third trimester, but one study that reports WASO (% of sleep) showed little difference between the first and third trimesters (K. A. Lee, Zaffke, et al., 2000). WASO (in mins) is generally lowest in the third trimester when measured by actigraphy. When measured by self-report, WASO values (in mins) are lower than either PSG or actigraphically determined WASO. Objective and subjective reports of SOL were similar, ranging from 10-27 mins with a SD of up to 23 min. As with sleep duration, the data indicates how variable sleep is between studies and between women.

Table 3.4 Continuity/Sleep Efficiency in each trimester reported by SE, WASO and SOL, in studies using PSG, actigraphy and self-reported measures (Baker, Okun, Rothenberger, & Kline, 2016; Brunner et al., 1994; Crowley et al., 2016; Ebert et al., 2015; Haney et al., 2014; Hertz et al., 1992; K. A. Lee, McEnany, et al., 2000; K. A. Lee, Zaffke, et al., 2000; Okun et al., 2015; Strange, Parker, Moore, Strickland, & Bliwise, 2009; Tsai et al., 2011; Tsai, Kuo, et al., 2013; Tsai, Lee, Wu, et al., 2016; Tsai, Lee, Lin, et al., 2016a; Tsai, Lin, et al., 2013; Tsai et al., 2012; Tsai, Lin, et al., 2016; Tzeng et al., 2015; Waters & Lee, 1996; Wilson et al., 2011; Wolfson et al., 2003).

	1 st trimester	2 nd trimester	3 rd trimester
Measure	Mean ± SD	Mean ± SD	Mean ± SD
PSG SE (%)	85-91 ± 6-8 87 ± 2* 84 ± 7 (primiparous) 86 ± 9 (multiparous)	88 ± 3*	78-89 ± 6-14 75 ± 15 (primiparous) 86 ± 8 (multiparous) 90 ± 4 (primigravidae) 87 ± 7 (multigravidae) 90 ± 6 (negative postpartum affect) 89 ± 6 (positive postpartum affect)
Actigraphy SE (%)	82 ± 7 74 ± 13 (inactive) 76 ± 12 (insufficiently active) 76 ± 12 (sufficiently active) 76 ± 12 (frequent nappers) 82 ± 7 (non-nappers) 78 ± 10 (short nappers) 74 ± 11 (long nappers) 71 ± 13 (with insomnia) 77 ± 11 (no insomnia)	83 ± 6 78 ± 9 (inactive) 81 ± 8 (insufficiently active) 79 ± 8 (sufficiently active) 80 ± 9 (frequent nappers) 80 ± 6 (non-nappers) 80 ± 7 (short nappers) 78 ± 9 (long nappers)	80-81 ± 6-7 81 ± 6 (vaginal delivery) 82 ± 5 (cesarean delivery) 80 ± 6 (frequent nappers) 82 ± 6 (infrequent nappers) 80 ± 7 (weekdays) 80 ± 8 (weekends)
Self-report SE (%)	87 ± 7 (frequent nappers) 89 ± 4 (non-nappers) 89 ± 6 (short nappers) 85 ± 6 (long nappers) 87 ± 8 (with insomnia) 91 ± 5 (no insomnia)	86 ± 13 88 ± 6 (frequent nappers) 89 ± 5 (non-nappers) 90 ± 5 (short nappers) 89 ± 8 (long nappers)	83-87 ± 13-19 87 ± 13 (vaginal delivery) 82 ± 13 (cesarean delivery)
SE <85%	(no data)	(no data)	67% (actigraphy)
PSG WASO (mins)	49 ± 36 33 ± 10* 55 ± 36 (primiparous) 45 ± 36 (multiparous)	23 ± 5*	62-80 ± 37-44 58 ± 6* 77 ± 38 (primiparous) 44 ± 27 (multiparous)

Actigraphy WASO (mins)	91 ± 57 86 ± 54 (frequent nappers) 73 ± 33 (non-nappers) 88 ± 59 (short nappers) 97 ± 54 (long nappers) 113 ± 58 (with insomnia) 91 ± 59 (no insomnia)	28-72 ± 10-38 70 ± 40 (frequent nappers) 69 ± 25 (non-nappers) 70 ± 31 (short nappers) 76 ± 45 (long nappers)	54 ± 27 57 ± 21 (good sleeper) 54 ± 23 (poor sleeper) 53 ± 19 (frequent nappers) 56 ± 21 (infrequent nappers) 53 ± 21 (weekdays) 56 ± 28 (weekends)
Self-report WASO (mins)	24 ± 18 24 ± 18 (frequent nappers) 16 ± 12 (non-nappers) 24 ± 19 (short nappers) 25 ± 17 (long nappers) 38 ± 22 (with insomnia) 23 ± 17 (no insomnia)	20 ± 14 20 ± 14 (frequent nappers) 19 ± 12 (non-nappers) 20 ± 14 (short nappers) 20 ± 18 (long nappers)	(no data)
WASO >=30min	98% (actigraphy)	(no data)	(no data)
PSG SOL (mins)	11 ± 8 (to stage 2) 20 ± 4*(to stage 2) 20 ± 17 (3 consecutive stages of sleep)	22 ± 8*(to stage 2)	14 ± 12*(to stage 1) 13 ± 11 (to stage 2) 25 ± 4*(to stage 2) 18 ± 13 (no criteria)
Actigraphy SOL (mins)	15 ± 11 15 ± 13 (frequent nappers) 11 ± 6 (non-nappers) 12 ± 9 (short nappers) 19 ± 14 (long nappers) 15 ± 9 (with insomnia) 15 ± 12 (no insomnia)	10-13 ± 6-10	22 ± 16-21 23 ± 20 (weekdays) 21 ± 17 (weekends)
Self-report SOL (mins)	20 ± 15 20 ± 17 (frequent nappers) 17 ± 8 (non-nappers) 17 ± 12 (short nappers) 25 ± 18 (long nappers) 27 ± 21 (with insomnia) 20 ± 14 (no insomnia)	16-27 ± 13-17	23-27 ± 3-23
SOL >20min	37% (actigraphy)	(no data)	44% (self-report) (37% difficulty getting to sleep & 63% difficulty falling asleep after waking)
SOL >30min	(no data)	(no data)	23% (actigraphy)

*SEM rather than SD

3.4.3 Sleep disturbances

In trimester one, a single study provided information on arousals (Mdn=11, range=8-16) and number of awakenings (mean=16, ± 5) as measured by PSG (Wilson et al., 2011). This study also reported that 24% of women had an Apnea-Hypopnea Index (AHI) of >5 and 10% a Periodic Limb Movement Index (PLMI) of >5 . The same study reported that 57% self-reported awakening one to two times per night, 48% had difficulty falling asleep after waking up at night. The main causes of nighttime awakenings were the need to urinate (76%) and care for children/partner (45%). Another study reported the prevalence of snoring to be 29% in the first trimester when measured using the "Do you snore?" item of the Berlin Questionnaire (Tsai, Lee, Lin, et al., 2016b).

For the second trimester, there is minimal data published on sleep disturbances. One study reported an actigraphy sleep fragmentation index of 28 ± 10 (Crowley et al., 2016) and another study measured sleep disturbance with the PSQI disturbance subscale (1.6 ± 0.6) (Strange et al., 2009).

In the third trimester, two PSG studies report on the number of awakenings per hour (19 ± 7 and 37 ± 11) (Hertz et al., 1992; Wilson et al., 2011). Objectively, there is limited data on arousals, with only one PSG study presenting data on total arousals per hour (Mdn=15, range=11-19), respiratory arousals per hour (Mdn=2, range=1-5), and spontaneous arousals per hour (8 ± 5) (Wilson et al., 2011). This study also found that 31% of women had an AHI >5 , and 30% of women had a PLMI of >5 . One study that utilised actigraphy reported a fragmentation index of 22 ± 5 (Tsai, Kuo, et al., 2013). Two subjective studies found that women report between $2-3 \pm 1$ awakenings per night (Hertz et al., 1992; Tsai, Kuo, et al., 2013). Another study indicated self-reported awakenings with the following frequencies; 4% of women with no awakenings, 30% with one to two awakenings, 44% with three to four awakenings and 22% with five or more

awakenings per nights (Wilson et al., 2011). This same study also provides information on the primary causes of the awakenings, with the need to urinate and feeling uncomfortable as the most prevalent. Women have also reported almost an hour of sleep disruptions per night (59 mins \pm 6 SEM) (Wolfson et al., 2003).

Only one study has reported on snoring in the third trimester, with 42% of women reporting that they never snored, 58% reporting they sometimes snored and 0% reporting they always snored (Hertz et al., 1992). This same study reported on the percentage of women reporting restless sleep (17% never, 50% sometimes, 33% always) and bad dreams (25% never, 75% sometimes, 0% always).

3.4.4 Timing

This review yielded three studies on sleep timing in pregnancy, measured with actigraphy and diary self-reports in the first and third trimester (see Table 3.5). In the first trimester, actigraphy and self-report bedtime were after 23:00. There is no information on rise times. On average in the third trimester, bedtime and sleep onset was after midnight on both weekdays and weekends and average wake times ranged between 6:50am and nearly 8:00am on weekdays and later on the weekend. For all timing values SDs were greater than 60 mins.

Table 3.5 Sleep timing in each trimester as measured by actigraphy (bedtime, onset and offset) and self-report (bedtime and wake time) (Okun et al., 2015; Tsai et al., 2011; Wolfson et al., 2003).

	1 st trimester	2 nd trimester	3 rd trimester
Measure	Mean Time \pm SD (min)	Mean Time \pm SD (min)	Mean Time \pm SD (min)
Actigraphy Bedtime	23:24 \pm 72 (with insomnia) 23:15 \pm 65 (no insomnia)	(no data)	(no data)
Self-Report Bedtime	23:12 \pm 60 (with insomnia) 23:19 \pm 61 (no insomnia)	(no data)	00:24 \pm 150 22:43 \pm 7*
Self-Report Wake time	(no data)	(no data)	7:46 \pm 78 6:50 \pm 9*
Actigraphy Onset	(no data)	(no data)	00:30 \pm 60 (week) 00:28 \pm 60 (weekdays) 00:39 \pm 72 (weekends)
Actigraphy Offset	(no data)	(no data)	7:55 \pm 72 (week) 7:37 \pm 72 (weekdays) 8:30 \pm 84 (weekends)

*SEM rather than SD

3.4.5 Alertness/sleepiness

Data on alertness/sleepiness is limited (see Table 3.6). In the first and second trimester, daytime sleepiness and alertness was primarily measured using the ESS, with approximately a third of pregnant women reporting excessive daytime sleepiness. Similar proportions of women reported excessive daytime sleepiness in the third trimester. Measures of fatigue (using a visual analogue scale) were also utilised in studies focused on the third trimester, however, due to differences in the construction of each scale it is difficult to compare or summarise findings from these studies.

Table 3.6 Alertness/Sleepiness in each trimester, measured by the ESS, FCF, POMS and VAS-F (Elek et al., 1997; Hertz et al., 1992; K. A. Lee, McEnany, et al., 2000; Strange et al., 2009; Tsai, Lee, Lin, et al., 2016b; Tsai et al., 2012; Tsai, Lin, et al., 2016; Tzeng et al., 2015; Waters & Lee, 1996; Wilson et al., 2011).

	1 st trimester	2 nd trimester	3 rd trimester
Measure	Mean \pm SD or %	Mean \pm SD or %	Mean \pm SD or %
ESS (global)	8.4 \pm 3.9	9.0 \pm 4.1	8.0 \pm 3.8
ESS \geq 10 (%)	37%	32% (>10)	37%
FCF (global)			51.3 \pm 12.0
SSS (global)			4.1 \pm 1.4
POMS (fatigue subscale)			10.5 \pm 7.4 (negative postpartum affect) 11.8 \pm 7.0 (positive postpartum affect)
Fatigue (VAS-F 18 item)			64.2 \pm 17.9 (primigravidae) 64.8 \pm 19.3 (multigravidae)
Vitality (VAS-F 18 item)			30.5 \pm 13.4 (primigravidae) 26.2 \pm 16.9 (multigravidae)
Morning Fatigue (VAS-F 13 item)			36.2 \pm 17.1 (7th month) 41.6 \pm 21.0 (8th month) 47.9 \pm 23.3 (9th month)
Afternoon Fatigue (VAS-F 13 item)			74.8 \pm 16.3 (7th month) 74.5 \pm 16.2 (8th month) 77.6 \pm 13.2 (9th month)
Fatigue (VAS-F 7 item)			4.2 \pm 1.3 (overall fatigue) 3.4 \pm 1.6 (morning fatigue) 3.6 \pm 1.6 (midday fatigue) 4.4 \pm 1.2 (afternoon fatigue) 5.8 \pm 1.8 (evening fatigue)
Study Specific Questionnaire	95% (experiencing daytime tiredness)		93% (experiencing daytime tiredness)

3.4.6 Satisfaction/quality

Perceived sleep satisfaction and quality were all measured using the PSQI, with average scores >5 in first and third trimester across all studies, and slightly lower averages in the second trimester. The proportion of women with PSQI scores >5 was approximately 40% in the first and second trimesters. In the third trimester, proportions with scores >5 were higher and ranged from 45-76% depending on how groups of women were defined. Table 3.7 details the measures and findings relating to perceived satisfaction and quality of sleep.

Table 3.7 Sleep quality in each trimester, using the PSQI, ISQ and the SHPS (Baker et al., 2016; Crowley et al., 2016; Hux, Roberts, & Okun, 2017; Okun et al., 2015; Strange et al., 2009; Tsai, Kuo, et al., 2013; Tsai, Lee, Wu, et al., 2016; Tsai, Lee, Lin, et al., 2016a, 2016b; Tsai, Lin, et al., 2013; Tsai et al., 2012; Tsai, Lin, et al., 2016; Tzeng et al., 2015).

	1 st trimester	2 nd trimester	3 rd trimester
Measure	Mean ± SD or %	Mean ± SD or %	Mean ± SD or %
PSQI (global)	5.4-5.6 ± 2.4-2.5	5.2-6.7 ± 2.7-3.1 4.9 ± 2.6 (inactive) 4.2 ± 2.3 (insufficiently active) 4.0 ± 2.4 (sufficiently active)	5.7-8.4 ± 2.8-3.7 5.8 ± 3.2 (vaginal delivery) 6.7 ± 3.3 (cesarean delivery) 7.9 ± 3.4 (frequent nappers) 5.2 ± 3.3 (infrequent nappers)
PSQI global >5 (%)	45%	37%	45-66% 48% (vaginal delivery) 66% (cesarean delivery) 76% (frequent nappers) 36% (infrequent nappers)
ISQ (met criteria) (%)	13%		
SHPS (global)			63.3 ± 11.7

3.5 Discussion

A scoping review was used to collect and summarise the available research evidence on healthy sleep in each trimester of pregnancy. Consultation with maternal health providers confirmed the need for empirical information on this issue and although findings show that some data are available for most dimensions of healthy sleep in each trimester, information is relatively limited. The growth in the number of studies published on this topic since 2011 points to an increased awareness of the importance of healthy sleep in pregnancy and to an increased need for information on the topic from pregnant women and their health providers.

Most of the available data on healthy sleep in pregnancy focuses on sleep duration, the architecture of sleep, and sleep continuity/efficiency. There is limited information on daytime sleepiness and alertness, and on subjective perceptions of sleep satisfaction and quality. Very little information is available on sleep timing. Recent literature points to the importance of stable sleep timing in health (Landhuis, Poulton, Welch, & Hancox, 2008), but we know little about how sleep timing might change across pregnancy and what the consequences may be for maternal and child health. This is certainly an area deserving of further research attention.

Another aspect of sleep, potentially relevant to sleep health during pregnancy, is the position in which women slept. Position was only reported in one of the studies included in this review. Given the possible relationship between sleep position and stillbirth (Cronin et al., 2017; Gordon et al., 2015; Stacey et al., 2011) position is an important aspect of sleep that should be described for pregnant women, and one which women and health care providers are seeking information.

This study did not aim to compare dimensions of healthy sleep across trimesters. However, several longitudinal studies were identified. PSG recorded TST in a laboratory setting was similar across all three trimesters (Brunner et al., 1994), whereas PSG recording in the home indicated

that women obtained more sleep in the first trimester than the third trimester (K. A. Lee, Zaffke, et al., 2000). Two studies showed that sleep continuity and efficiency were reduced in the third trimester (Brunner et al., 1994; Wilson et al., 2011). Brunner et al. (1994) found that WASO was higher in the third trimester compared to the second trimester, despite comparable TST. Wilson et al. (2011) examined changes between the first and third trimesters using PSG and found that SOL was similar, but that arousals, awakenings, AHI >5, and PLMI >5 were all higher in the third trimester, while time spent in the supine position was halved. Self-report data from this study showed that SOL >20 min was greater in the third trimester and reports of >5 awakenings per night doubled from the first to the third trimester. No other studies we reviewed used statistical comparisons to examine changes in sleep across trimesters.

A strength of this study is the use of the framework proposed by Arksey and Malloy (2005) for conducting a scoping review and the incorporation of Buysse's (2014) definition of sleep health, which places a positive focus on sleep and considers sleep health as a multi-faceted concept. None of the studies in this review were specifically designed with Buysse's (2014) recent definition in mind, therefore no single paper provided data for all dimensions of sleep in each trimester of pregnancy.

Studies provided different amounts of detail on exclusion and inclusion criteria, which in some instances, produced uncertainty on how women were screened. Given that mood disorders have a strong and consistent relationship with alterations in sleep in pregnancy (Dørheim et al., 2012; Okun, Kiewra, et al., 2011; Swanson et al., 2011) we decided that for a publication to be included, these aspects of health needed to be clearly described in the screening process. Many other aspects of maternal health and infant health have also been associated with changes in sleep (e.g. gestational diabetes, hypertension, small for gestational age infants, preterm infants) (Facco, Grobman, et al., 2010; Micheli et al., 2011; O'Brien et al., 2012; Okun, Schetter, et al.,

2011; Qiu et al., 2010; Williams et al., 2010), but the majority of studies did not specifically state all the conditions for which women were excluded (refer to Figure 1). Instead, they referred to women being “healthy”, or having an “uncomplicated” pregnancy or, being free of “chronic illnesses.” Our approach may have resulted in studies being included that did not sufficiently screen women for all health conditions currently shown to have a relationship with altered sleep, but to have required this criteria would have resulted in only three studies in our scoping review. We may have also excluded studies from this review that did screen for sleep and mood disorders but did not state this explicitly in the methods. We recommend that in the future, for studies that focus on a healthy sample of pregnant women, the authors clearly specify the health issues considered in the screening process.

Related to screening and enrolling pregnant participants for research, is the issue of on-going health for women participating in longitudinal studies. No studies included in this review discussed screening women throughout the course of the study to ensure they remained free of health complications. As a consequence, it is possible that women developed health issues later in pregnancy (i.e. hypertension or pre-eclampsia) that could affect sleep or could be associated with changes in sleep.

Another limitation of this scoping review is that 38% (n=9) of the publications were conducted in Taiwan and 54% were conducted in the USA, biasing results towards cultural practices in those areas of the world. There may be cultural differences in sleep practices (i.e. napping) during pregnancy that would influence the findings presented in this review. Furthermore, half of the studies had small sample sizes (< 40) which may limit the generalisability of the results.

We have provided information on the range (and variability) of values presented for each dimension of sleep but have not made judgements on when maternal healthcare professionals should refer women to other healthcare providers for further assessment or treatment. It is

argued that recommendation should be made only after using a consensus approach, similar to the process for developing other guidelines (Hirshkowitz et al., 2015; Ohayon et al., 2017). A consensus group would also consider if there was sufficient data presently available on which to base such guidelines. Unfortunately, even if guidelines were in place, many countries may not have clearly defined treatment pathways for pregnant women with sleep problems or disorders. In New Zealand, for example, there are clinical sleep services, but the public health system often experiences long waiting times. It would be important for pregnant women to be given priority in such circumstances.

3.6 Conclusion

While data on each of the five dimensions of sleep detailed in Buysse's (2014) definition of sleep health are presented in this scoping review, diverse and extensive evidence of healthy sleep in pregnancy is limited. The majority of studies are relatively recent, with 92% of studies originating from only two countries and from a limited group of authors and cohorts. Comparable data on sleep duration and measures of continuity/efficiency are available, but reports of sleep timing, perceived sleep quality and alertness/sleepiness measures are lacking. The data presented in this scoping review indicate that sleep in each trimester of pregnancy is highly variable from one woman to the next but does not support the idea of large changes in sleep across pregnancy in healthy pregnant women. There is some evidence of more disturbed sleep in the third trimester, but at this stage there is limited information on which to draw firm conclusions. Further research is needed to clearly differentiate between healthy sleep and insufficient or disturbed sleep where intervention might be necessary. Knowing when to intervene if women need help with their sleep is vital in ensuring the short-term and long-term health and wellbeing of mothers and their children.

4 MULTIPLE DIMENSIONS OF SLEEP ARE CONSISTENTLY ASSOCIATED WITH CHRONICALLY ELEVATED DEPRESSIVE SYMPTOMS FROM LATE PREGNANCY TO THREE YEARS POSTNATAL IN INDIGENOUS AND NON-INDIGENOUS NEW ZEALAND WOMEN

A key finding from the scoped review in the previous chapter was an absence of large changes in sleep throughout a physically and mentally healthy pregnancy. Due to the recognised bi-directional relationship between sleep and mental health, it was hypothesised that sufficient good quality sleep that remained stable over time (i.e. fewer or smaller changes from one trimester to the next) would support good mental health throughout pregnancy. This prompted the intervention study detailed in Chapters 5 and 6. The scoped review also highlighted the limited longitudinal data available across pregnancy and influenced the design of the intervention study.

Findings of the scoped review noted that prior research focused on measuring and reporting sleep duration, quality and continuity, during pregnancy, while there was a lack of information on daytime sleepiness and sleep timing. All five dimensions of sleep health, as described by Buysse (2014), have a demonstrated impact on health outcomes, including pregnancy outcomes. This finding prompted the inclusion of Buysse's five sleep health dimensions into the subsequent studies in this thesis.

While the review in the previous chapter focused on sleep during a healthy pregnancy, the broader goals of this thesis were to understand the relationship between sleep and depression. The next chapter begins by investigating patterns of depression of 856 New Zealand women throughout the perinatal period to three years post birth. Because of the existence of ethnic

inequities in maternal mental health, and the Kaupapa Māori research framework that underpinned this study, the trajectories of Māori and non-Māori women were explored, in addition to examining trajectories of the total cohort. The relationship between the patterns of depression and dimensions of sleep health were also considered.

The following manuscript was prepared by the researcher (Appendix 29) and has been prepared for publication in the journal *Australian and New Zealand Journal of Psychiatry*. All rights reserved© Ladyman, C. I., Signal, T. L., Sweeney, B. S., Jefferies, M., Gander, P. H., Paine, S-J & Huthwaite, M.

4.1 Abstract

Introduction: Poor sleep and depressive symptoms are common throughout the perinatal period, but little is known about the extended time course of depression and the sleep dimensions associated with these trajectories.

Purpose: This study investigated different depression trajectories in New Zealand Māori and non-Māori women from late pregnancy through to three years postnatal. Relationships between multiple dimensions of sleep and depression trajectories was also investigated.

Methods: Data from 856 women (30.6% Māori and 69.4% non-Māori) from the longitudinal *Moe Kura* cohort study were used. Depressive symptoms and multiple dimensions of sleep (quality, duration, latency, continuity and daytime sleepiness) were collected at 36 weeks gestation, 12 weeks postnatal and three years postnatal. Trajectory analysis was completed using latent class analysis (LCA).

Results: LCA revealed two distinct groups of depressive symptom trajectories; 'chronic high' and 'stable mild' for both Māori and non-Māori women. Māori women in both trajectories were

more likely than non-Māori women to have clinically significant depressive symptoms at every time point. Poorer sleep quality, latency, continuity and greater daytime sleepiness were consistently associated with the chronic high depressive symptom trajectory at all three time points, after controlling for sociodemographic factors.

Conclusions: A significant proportion of Māori and non-Māori women experience chronically high depressive symptoms during the perinatal period and following years. Across this extended timeframe Māori women have a higher probability of experiencing clinically significant depressive symptoms compared to non-Māori women. These persistent patterns of depressive symptoms occur concurrently with multiple dimensions of poor sleep. Given the well described impact of maternal depression on the mother, child, family and community, this highlights the importance of healthcare professionals asking about mothers' sleep quality, continuity, latency and daytime sleepiness as potential indicators of long-term mood outcomes.

Keywords: Pregnancy, Postnatal, Indigenous, Depression, Sleep

4.2 Introduction

There is clear evidence that maternal depression can have severe and enduring adverse consequences for both mother and child, as well as the extended family (Letourneau et al., 2012). Depression in pregnancy can lead to inadequate uptake of antenatal care; adverse obstetric outcomes; poor family functioning; poor infant bonding, feeding and sleeping (Chuang et al., 2011) and deficits in children's social, behavioural, learning and cognition development (Burke, 2003). Mothers experiencing perinatal depression are more likely to experience future episodes (McMahon et al., 2008), while their children, partners and grandchildren are also at greater risk of experiencing depression (Weissman et al., 2005). In

New Zealand, suicide is the leading single cause of maternal death, with rates higher than those seen in the United Kingdom and Australia (Perinatal and Maternal Mortality Review Committee, 2015).

Ethnic inequities in maternal mental health exist (Watson et al., 2019). In New Zealand, Māori women are at higher risk of experiencing symptoms of perinatal depression (22%) compared to non-Māori (15%) (Signal et al., 2016). These reported rates may be conservative, due to inequities in access to care and the quality of care received, resulting in Māori women being less likely to be detected or treated for depression by maternal care providers (Oakley Browne et al., 2006). Māori women also have higher overall maternal mortality and suicide rates (Perinatal and Maternal Mortality Review Committee, 2018), often experience earlier onset of mental health conditions, depressive symptoms of greater severity and are more likely to have simultaneous risk factors, such as younger age, lower socioeconomic status, poorer access to services and less partner support (New Zealand Ministry of Health, 2008).

Prolonged or recurrent episodes of maternal depression are likely to have long term physical and psychological effects on the mother and child (Slomian, Honvo, Reginster, Bruyère, & Emonts, 2019; Weissman et al., 2006). Importantly, recent studies have shown that depression is not uniform and trajectories differ between individual women (Nandi, Beard, & Galea, 2009). In a systematic review of longitudinal depression studies, Vliegen et al. (2014) identified two community-based studies that included women with depression at three to four months postnatally, of whom 17%-62% experienced depressive symptoms three years later. Furthermore, this review showed that in two clinical samples, 39%-58% of mothers with early postnatal depression continued to experience it three to three and a half years later. Since this review, an increasing number of studies have utilised trajectory analysis to examine the time course of perinatal depression. Analyses of this type are valuable because they could reveal

variability and patterns in the development and/or persistence of depression (Tomfohr, Buliga, Campbell, Giesbrecht, & Letourneau, 2015).

Poor or insufficient sleep are linked to depression (Peterson & Benca, 2008) and it appears that a proportion of women are unable to consistently achieve healthy sleep throughout pregnancy (Ross et al., 2005; Yang et al., 2017). Early pregnancy sleep disturbances have been associated with later pregnancy depressive symptoms (Skouteris, Wertheim, Germano, et al., 2009) and late pregnancy poor sleep is independently linked to postnatal depression (Tomfohr et al., 2015). The few studies that have examined trajectories of sleep and depression across the perinatal period, show that poor sleep patterns are associated with depressive symptoms (Tzeng et al., 2015; G. Wang et al., 2018) or conversely, trajectories of depressive symptoms are associated with poor sleep (S.-Y. Kuo, Yang, Kuo, Tseng, & Tzeng, 2012). These studies have typically only examined one dimension of sleep, such as sleep duration or sleep quality. To our knowledge, no study to date has investigated whether multiple dimensions of sleep are associated with depressive symptom trajectories. Sleep is a series of complex physiological processes that are not easily portrayed by a single measure and it may be that various sleep dimensions, or more importantly combinations of dimensions, are more predictive of mood changes at particular time points throughout the perinatal period (J. L. Paulson & Miller-Graff, 2019).

Investigating how sleep and depressive symptoms are related could provide the basis for early detection and interventions. Sleep is a critical health behaviour, and necessary to maintain and improve mental and physical health outcomes. It is also one of the few potentially modifiable risk factors for depression. In New Zealand, the prevalence of sleep problems and disorders are higher amongst Māori compared with non-Māori (Paine & Gander, 2013). Recognising and treating poor sleep health as a vital aspect of a mother's overall health and could be a novel intervention to reduce inequities in maternal mental health.

This study investigates the trajectories of depressive symptoms from late pregnancy to three years post birth in a large community-based sample of Māori and non-Māori women and the different dimensions of sleep associated with those trajectories. Buysse's 'Sleep Health' conceptual model (Buysse, 2014) underpinned the selection of measures used to assess sleep. This approach considers sleep as a multidimensional model that "promotes physical and mental well-being". We investigated four of Buysse's five sleep health dimensions: quality, quantity, continuity, and daytime sleepiness. The fifth sleep dimension, sleep timing, was not available for the comparison group, and instead data on sleep latency (onset insomnia) was included in analyses.

4.3 Methods

4.3.1 Participants

Data for this analysis were drawn from the *Moe Kura* prospective observational cohort study, collected between October 2009 and April 2015. Details of the recruitment process for Moe Kura are described elsewhere (Signal et al., 2016). Questionnaires were completed by women at 35- to 37-weeks gestation (T1), 12-weeks postnatal (T2) and at three years postnatal (T3). Women provided demographic and lifestyle information as well as responding to items on their sleep, and prior and current health and mood. Inclusion criteria for participation in the study included carrying a single foetus, 16 years of age or older, and being between 35- and 37-weeks gestation. The *Moe Kura* study was designed to investigate ethnic inequities in maternal sleep and health between Māori and non-Māori in New Zealand, with Kaupapa Māori epidemiological research principles informing the study design, analysis and reporting (Paine & Gander, 2013; Simmonds, Robson, Cram, & Purdie, 2008). The Kaupapa Māori principles employed in the Moe

Kura study are aligned with the CONSIDER criteria and broadly meet the same expectations (Huria et al., 2019).

Ethical approval for the study was obtained from the Central Region Health and Disability Ethics Committee (protocol CEN 09/09/070). Prior to statistical analysis, any outliers in the database (data not possible within the scale limits) were checked and either removed/ or corrected by referring back to the original questionnaire.

4.3.2 Measures

4.3.2.1 Demographic, health and lifestyle

The following measures were collected: maternal age; ethnicity (categorised as Māori [anyone who identified as Māori either alone or in combination with another ethnic group/s] or non-Māori [all others] (Statistics New Zealand, 2017); currently pregnant; having an additional child younger than their *Moe Kura* child; relationship satisfaction using an 8-point Likert scale (range 0-7; where <3 signifies greater satisfaction, ≥3 signifies less satisfaction or not applicable); history of diagnosed depression; stressful life events (using the 13-item Pregnancy Risk Monitoring System (PRAMS) where low stress was considered <2 stressors, and high stress ≥2 stressors) (Mukherjee et al., 2017); and an area-level measure of socioeconomic deprivation. Women were assigned to a socioeconomic deprivation decile based on their residential address using the 2006 NZDep Index at T1 and T2 and the 2013 NZDep Index at T3, which are based on the respective 2006 and 2013 population census (decile 1 = 10% of small areas with lowest levels of deprivation to decile 10 = 10% of small areas with highest levels of deprivation). In analyses these were utilised as quintiles (i.e. five levels, each representing 20% of small areas) (Atkinson et al., 2014).

4.3.2.2 Sleep Measures

Sleep duration was measured at each time point by the question “How many hours sleep do you usually get in 24 hours, including naps?” Sleep quality, latency and continuity were assessed using the relevant General Sleep Disturbance Scale (GSDS) subscales (K. A. Lee & Gay, 2004). Each item in the GSDS was rated from 0 (never) to 7 (every day) and if a subscale is comprised of two or more items, the mean was calculated. Sleep quality was assessed using the GSDS Quality Subscale items; “How often in the last week did you feel rested upon awakening at the end of a sleep period?”, “How often in the last week did you sleep poorly?” and “How often in the last week did you feel satisfied with the quality of your sleep?” The first and last items are reversed scored. Sleep latency was assessed using the GSDS Onset Insomnia Subscale item; “How often in the last week did you have difficulty getting to sleep?” Sleep continuity was measured by the GSDS Maintenance Insomnia Subscale items; “How often in the last week did you wake up during your sleep period?” and “How often in the last week did you wake up too early at the end of your sleep period?” Validity and reliability of the GSDS have been demonstrated in childbearing women (K. A. Lee & Gay, 2004). Daytime Sleepiness was measured by the Epworth Sleepiness Scale (ESS). The ESS assesses daytime sleepiness in eight everyday situations using the question “How likely are you to doze off in the following situations, in contrast to feeling just tired...?” The ESS has been demonstrated to be reliable and valid for use in pregnant populations (Baumgartel et al., 2013) and excessive daytime sleepiness is typically defined as a total score ≥ 10 (Johns, 1991).

4.3.2.3 Mental Health Measures

Depressive symptoms were measured by the 10-item Edinburgh Postnatal Depression Scale (EPDS) at T1 and T2, with scores at or above 13 considered clinically significant (Cox et al., 1987; National Collaborating Centre for Mental Health, 2014). The EPDS is a screening tool used internationally to detect depressive symptomatology in women during pregnancy and postnatal periods. While validated for use in pregnancy and postnatally (Kozinszky & Dudas, 2015), the EPDS has not been used extensively beyond one year post birth. For this reason, the 10-item Kessler (K-10, using a 0-4 Likert scale) was used to identify psychological distress at T3. The K-10 was developed for use in the US National Health Interview Survey and has been used in the annual New Zealand Health Survey since 2006-07 (New Zealand Ministry of Health, 2006) and the New Zealand Mental Health Survey since 2003/04, with scores of 12 or more strongly associated with having a depressive disorder in the previous month and in the previous year (Oakley Browne, Wells, Scott, & McGee, 2010).

Even though depressive symptoms were assessed using different scales, both the EDPS and K-10 cut-offs are recognised as indicating clinically significant depressive symptoms. In the trajectory analysis described below, a binary variable (having clinically significant depressive symptoms or not) was used.

4.3.3 Statistical analysis

Latent Class Analysis (LCA) is an advanced statistical approach for identifying discrete subgroups of participants within a study cohort. Classes (or groups) are not directly observable, they are dormant, hence the term latent (Roeder, Lynch, & Nagin, 1999). LCA is similar to factor or cluster analysis, in that it classifies participants into mutually exclusive and exhaustive subgroups based on observed patterns in the data. Furthermore, LCA is person-orientated rather than variable-

orientated. While variable-orientated approaches focus on identifying relationships between variables with the assumption that the relationships are stable across the sample, person-orientated approaches identify groups of people that exhibit similar trajectories or characteristics with the number and type of classes not known *a priori*. Although group and individual trajectories cannot be exactly identical, individuals follow approximately the same course as other individuals in their group (Nagin & Tremblay, 2005). In line with the Kaupapa Māori epidemiological research principles applied in the *Moe Kura* cohort (Paine & Gander, 2013), LCA were conducted for Māori and non-Māori women separately to determine if the number of classes and shape of trajectories differed between these populations.

A two-step statistical approach was taken. Firstly, patterns of clinically significant depressive symptoms were modelled at three time points using LCA (T1, T2 and T3) and subgroups of women with specific trajectories were identified. Two and three group LCA models were fit and compared and included both linear and quadratic terms (given there were only three time points, no further orders beyond quadratic were included in models). Where the model could not be fit, due to a paucity of data, the models were condensed either to two groups, and/or to include only linear terms. The optimal model was chosen using the Bayesian Information Criteria (BIC), with greater (less negative) absolute BIC values indicating a better model fit. Parsimony and clinical interpretability were also taken into account (M. Zhou, Thayer, & Bridges, 2017). Class (trajectory group) prevalences and posterior probabilities were used to interpret the model, with prevalences providing the proportion of people belonging to a class and posterior probabilities reflecting the chance that an individual is correctly classified. Individuals were assigned to each latent class with the highest posterior probability, with a figure above 0.80 suggesting a good fit (Nagin & Tremblay, 2005). Kruskal Wallis rank sum test (for proportions) and ANOVA (for means) were used to test for differences between the depressive symptom variables in each of the latent classes at each time point.

Complete case logistic regression was used to investigate the association between each sleep variable and the likelihood of membership in the trajectory groups at each time point. We conducted univariate analysis between potential covariates and the outcome variable. Being currently pregnant and having a younger child had no significant relationship with the outcome and were not included in the final models, which were adjusted for maternal ethnicity, maternal age, stressful life events, prior history of depression, NZDep and relationship with partner. Further adjusting for parity made no material difference to the results. Data are reported as odds ratios (OR) and 95% confidence intervals (CI). Analyses were performed in STATA (version 15).

4.4 Results

4.4.1 Sample characteristics

The study included 856 women (n=262 Māori women and n=594 non-Māori) who completed questionnaires at each of the three time points, representing 75% of the baseline cohort. Women who did not complete all data collection time points and were not included in the analysis were more likely to be younger ($p=0.000$), identify as Māori ($p=0.000$), live in a more deprived area ($p=0.000$), have more life stress ($p=0.000$), be unhappy with their partner relationship ($p=0.004$), and have higher depressive symptom scores ($p=0.030$) than women with complete data sets at T1. No difference was seen for parity, a prior history of depression, or scoring at or above a cut-off of 13 on the EPDS.

Sample characteristics are summarised in Table 4.1. There was a significant difference ($p=0.020$) between Māori and non-Māori for parity, with 45.5% of Māori and 53.8% of non-Māori women being nulliparous (51.3% of the total cohort). At T3, 35.1% of Māori and 38.7% of non-Māori had a child younger than their *Moe Kura* child and 10.7% of Māori and 9.7% of non-Māori were

currently pregnant (there were no statistical differences between these proportions). As illustrated in Table 4.1, Māori women were younger, lived in more deprived areas, experienced more stressful life events and had a less happy relationship with their partner.

Table 4.1 Sample characteristics

	T1				T2				T3			
	Mean & SD (range) or n (%)			p value (M-nM)	Mean & SD (range) or n (%)			p value (M-nM)	Mean & SD (range) or n (%)			p value (M-nM)
Māori n = 262	non-Māori n = 594	Total n = 856	Māori n = 262		non-Māori n = 594	Total n = 856	Māori n = 262		non-Māori n = 594	Total n = 856		
Maternal age	28.92 ± 6.23	32.41 ± 5.06	30.85 ± 5.68	0.000					31.53 ± 6.23	35.21 ± 5.07	34.07 ± 5.71	0.000
Gestational or child age[‡]	35.91 ± 0.97 (32-40)	35.82 ± 0.85 (34-40)	35.85 ± 0.89 (32-40)	0.177	12.05 ± 1.28 (8-20)	12.05 ± 1.18 (6-20)	12.05 ± 1.21 (6-20)	0.964	3.14 ± 0.30 (2.78-5.00)	3.15 ± 0.27 (2.55-4.94)	3.15 ± 0.28 (2.55-5.00)	0.315
PRAMS Highscorer (≥2)	127 (48.5)	162 (27.3)	289 (33.8)	0.000	150 (57.5)	174 (29.2)	324 (37.9)	0.000	150 (56.4)	205 (34.7)	355 (41.5)	0.000
Relationship with partner[#]												
Happy	184 (76.0)	487 (82.5)	671 (80.6)	0.001	163 (66.5)	501 (85.9)	664 (80.2)	0.000	135 (51.7)	428 (73.8)	563 (66.9)	0.000
Unhappy	46 (19.9)	97 (16.4)	143 (17.2)		56 (22.90)	76 (130)	132 (15.9)		84 (32.2)	125 (21.6)	209 (24.9)	
Not applicable	12 (5.0)	6 (1.0)	18 (2.2)		26 (10.6)	6 (1.0)	32 (3.9)		42 (16.1)	27 (4.7)	69 (8.2)	
NZDep quintiles[^]												
1 (least deprived)	30 (11.5)	170 (28.7)	200 (23.4)	0.000	34 (13.0)	167 (28.2)	201 (23.5)	0.000	32 (12.6)	196 (34.4)	228 (27.7)	0.000
2	31 (11.8)	143 (24.1)	174 (20.4)		26 (9.9)	148 (25.0)	174 (20.4)		34 (13.4)	149 (26.2)	183 (22.3)	
3	56 (21.4)	134 (22.6)	190 (22.2)		58 (22.1)	131 (22.1)	189 (22.1)		43 (17.0)	111 (19.5)	154 (18.7)	
4	66 (25.2)	87 (14.7)	153 (17.9)		68 (26.0)	87 (14.7)	155 (18.1)		49 (19.4)	66 (11.6)	115 (14.0)	
5 (most deprived)	79 (30.2)	59 (9.9)	138 (16.1)		76 (29.0)	60 (10.1)	136 (15.9)		95 (37.5)	47 (8.3)	142 (17.3)	

[‡]Gestational age at T1 & T2 measured in weeks and child age at T3 measured in years; [#]15, 28, 24 missing for Relationship with partner (T1, T2 & T3 respectively);

[^]1, 1, 34 missing for NZDep Quintiles (T1, T2 & T3 respectively)

4.4.2 Sleep and depression results

Sleep and depressive symptom scores for Māori and non-Māori women are shown in Table 4.2. Twenty two percent of Māori women had clinically significant EPDS scores at T1 compared with 14.5% of non-Māori women, a statistically significant difference. This difference continued at T2 (11.9% Māori vs 6.8% non-Māori) and with K-10 scores at T3 (21.8% Māori vs 13.0% non-Māori). Mean scores on the EPDS was significantly different (T1 and T2) and the K-10 (T3) ($p=0.001$, $p=0.047$, and $p=0.000$) as was the proportion of women with a clinically significant EPDS (T1 and T2) and K-10 score (T3) ($p=0.007$, $p=0.015$, and $p=0.002$).

Table 4.2 Sleep and depressive symptom scores for Māori and non- Māori at each timepoint

	T1 Mean & SD or n (%)				T2 Mean & SD or n (%)				T3 Mean & SD or n (%)			
	Māori n = 262	Non-Māori n = 594	Total n = 856	p value (M-nM)	Māori n = 262	Non-Māori n = 594	Total n = 856	p value (M-nM)	Māori n = 262	Non-Māori n = 594	Total n = 856	p value (M-nM)
Duration[#]												
Mean (hrs)	7.51 ± 1.94	7.26 ± 1.60	7.34 ± 1.71	0.050	7.79 ± 1.83	7.36 ± 1.20	7.49 ± 1.43	0.001	7.75 ± 1.44	7.33 ± 0.94	7.46 ± 1.14	0.000
Quality[§]												
GSDS Quality Subscale	4.65 ± 1.59	4.73 ± 1.83	4.70 ± 1.75	0.518	3.75 ± 1.79	3.73 ± 1.85	3.74 ± 1.83	0.905	4.17 ± 1.75	4.29 ± 1.75	4.25 ± 1.75	0.387
Daytime Sleepiness^{&}												
ESS Mean	7.63 ± 4.10	6.76 ± 3.78	7.03 ± 3.90	0.003	6.33 ± 4.02	5.80 ± 3.88	5.96 ± 3.93	0.069	5.25 ± 3.48	5.18 ± 3.45	5.20 ± 3.45	0.773
Continuity[^]												
GSDS Maint. Insom. Subscale	5.25 ± 1.57	5.25 ± 1.62	5.25 ± 1.60	0.995	3.45 ± 2.45	3.74 ± 2.29	3.65 ± 2.28	0.094	3.93 ± 1.90	4.19 ± 2.01	4.11 ± 1.98	0.075
Onset Insomnia[@]												
GSDS Onset Insom. Subscale	3.32 ± 2.49	2.39 ± 2.23	2.67 ± 2.35	0.000	1.56 ± 1.89	1.33 ± 1.60	1.40 ± 1.70	0.092	1.97 ± 1.85	1.52 ± 1.68	1.66 ± 1.74	0.001
EPDS / K-10 Score^{''}												
Mean	8.80 ± 5.02	7.61 ± 4.71	7.97 ± 4.83	0.001	6.01 ± 4.70	5.49 ± 4.06	5.65 ± 4.27	0.047	7.65 ± 6.22	6.07 ± 4.91	6.56 ± 5.40	0.000
High (≥13)	57 (22.0)	86 (14.5)	143 (16.8)	0.007	31 (11.9)	40 (6.8)	71 (8.3)	0.015	57 (21.8)	77 (13.0)	134 (15.7)	0.002

Missing data at T1, T2 & T3 respectively: [#]6 (T1), 12 (T2), 16 (T3); [§]8 (T1), 5 (T2), 7 (T3); [&]19 (T1), 16 (T2), 19 (T3); [^]5 (T1), 3 (T2), 15 (T3); [@]2 (T1), 2 (T2), 9 (T3); ^{''}3 (T1), 3 (T2), 0 (T3)

GSDS=General Sleep Disturbance Scale, ESS=Epworth Sleepiness Scale, EPDS=Edinburgh Postnatal Depression Scale, K-10 Kessler Psychological Distress Scale (10-item)

EDPS reported at T1 & T2, K-10 reported at T3

4.4.3 Identification of depressive symptom trajectories

Across the entire sample two distinct depressive symptom groups, stable mild (SM) and chronic high (CH), were identified using LCA (Figure 4.1, Panel C). The two-class model was selected for use due to statistical instability in fitting the three-class model, which is likely due to sparse data. A quadratic term model had better fit and better mean posterior membership compared to a model with one linear and one quadratic group. In the chosen model, average posterior probabilities (the chance of being correctly assigned to the trajectory group) for the CH group was 0.98 and SM group was 0.81. In the model including the entire sample, 91.5% of women belonged to the SM group and 8.5% of women followed the CH trajectory. Plots describe time across the horizontal axis while the probability of experiencing clinically significant depressive symptoms is presented on the vertical axis. Results for the total sample showed that the probability of experiencing clinically significant depressive symptoms in the CH group was 80.4% at T1, 51.9% at T2 and 84.2% at T3 and the SM group was 10.8% at T1, 4.2% at T2 and 9.3% at T3.

Table 4.3 details the median and inter-quartile range for the EPDS and K-10 scores for the total sample at the three time points, which shows significant between group differences at all-time points. There were also within group differences found between T1-T2 (SM $p < 0.001$; CH $p < 0.001$) and T2-T3 (SM $p < 0.001$; CH $p < 0.001$) but not between T1-T3 (SM $p = 0.360$; CH $p = 0.810$).

Table 4.3 Median and inter-quartile range for the EPDS (T1 & T2) and K-10 (T3) for the total sample, and separately for Māori and non-Māori

	Māori			non-Māori			Total		
	SM Trajectory	CH Trajectory	<i>p</i> value	SM Trajectory	CH Trajectory	<i>p</i> value	SM Trajectory	CH Trajectory	<i>p</i> value
T1	8 (5-11)	16 (14-18)	<0.0001	6 (4-9)	15 (14-16)	<0.0001	7 (4-10)	15 (14-18)	<0.0001
T2	5 (2-8)	14 (10-16)	<0.0001	4 (2-7)	8 (5-12)	<0.0001	4 (2-7)	13 (10-16)	<0.0001
T3	6 (3-9)	16 (15-24)	<0.0001	5 (2-7)	9 (5-14)	<0.0001	5 (2-8)	15 (13-20)	<0.0001

4.4.4 Depressive symptom trajectories for Māori and non-Māori

LCA was applied to Māori and non-Māori women's data separately. Similar to the model for the total sample, two depressive symptom groups were revealed for each population, stable mild (SM) and chronic high (CH), as illustrated in figure 4.1 (Panel A & B). Linear terms for the SM group and quadratic for the CH group proved a better fit than quadratic terms for both trajectories for Māori. Quadratic terms for both groups were only slightly better for non-Māori (-614.5 vs -616.1), so for consistency, models with a quadratic term for the CH group and a linear term for the SM group were selected for use. For Māori women, 90.3% of women belonged to the SM group and 9.7% of women followed the CH trajectory. The probability of Māori women experiencing clinically significant depressive symptoms in the CH group was 99.6% at T1, 64.0% at T2 and 95.9% at T3 and the SM group was 13.6% at T1, 6.3% at T2 and 13.8% at T3. For non-Māori women, 80.1% of women belonged to the SM group and 19.9% of women followed the CH trajectory. The probability of non-Māori women experiencing clinically significant depressive symptoms in the CH group was 59.5% at T1, 22.4% at T2 and 42.5% at T3 and the SM group was 3.3% at T1, 2.9% at T2 and 5.6% at T3.

Table 4.3 provides the median and inter-quartile ranges of EPDS and K-10 scores for both Māori and non-Māori at the three time points. These also show significant between group differences at all time points. Māori within group differences were seen between T1-T2 (SM $p=0.019$; CH $p=0.001$) and T2-T3 (SM $p=0.016$; CH $p=0.001$) but not between T1-T3 (SM $p=0.900$; CH $p=0.990$). Non-Māori intra-group differences were seen between T1-T2 (SM $p<0.001$; CH $p<0.001$), T2-T3 (SM $p=0.003$; CH $p=0.006$) and T1-T3 for the SM group (SM $p<0.001$) but not between T1-T3 for the CH group (CH $p=0.900$).

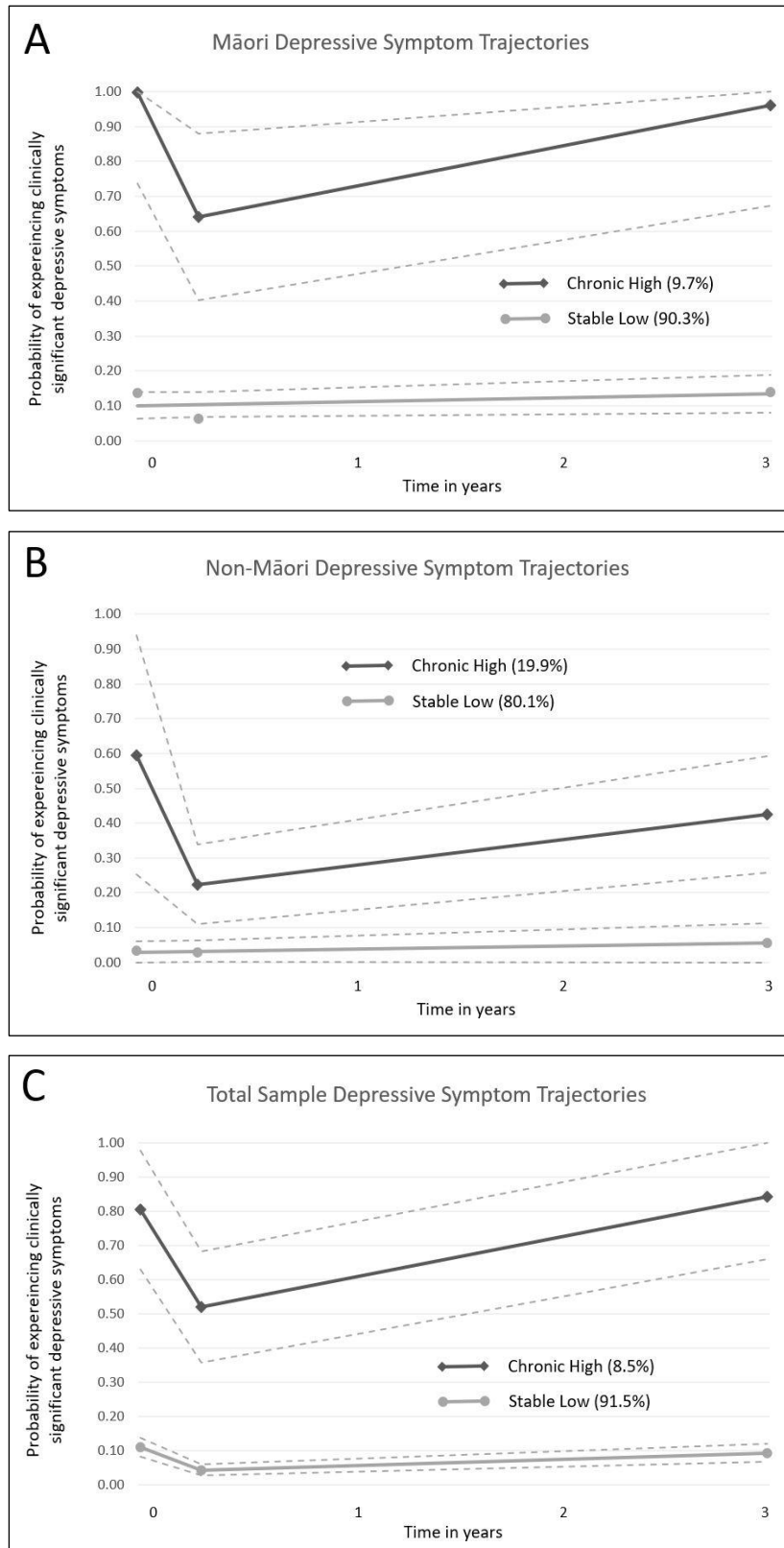


Figure 4.1 Trajectories of depressive symptoms for the Māori and non-Māori and the total sample. Data points measured at mean 36 weeks gestation, 12 weeks postnatal and 3 years post birth.

4.4.5 Sleep variables associated with chronic high trajectory group

The association between sleep dimensions and trajectory group membership was also investigated. In these models, the sleep dimensions were modelled as continuous variables, so the odds ratios are interpreted as the likelihood of being in the CH group, per unit change in the sleep subscale (for example, at T1 every additional night per week a women reported difficulty getting to sleep, increased the odds of being in the CH group by 21%). As can be seen in Table 4.4, at all three time points, poorer sleep quality, reduced sleep continuity and latency and greater day time sleepiness increased the odds of being in the CH group. After adjusting for age, ethnicity, partner relationship, history of depression and stressful life events, all associations remained significant, with the exception of daytime sleepiness at T3. No association was found between sleep duration and depression trajectory group in either the crude or adjusted models.

Table 4.4 Sleep variables associated with the CH trajectory group. Adjusted for socio-demographic variables (age, ethnicity, relationship with partner, history of depression, NZDep and PRAMS SLEs)

	n	Crude OR	95% CI	Adjusted OR	95% CI
T1 (36 weeks gestation)					
Duration (24 hr TST)	822	0.96	0.83 to 1.12	0.92	0.78 to 1.07
Quality (GSDS Quality Subscale)	820	1.30	1.11 to 1.53	1.27	1.06 to 1.52
Continuity (GSDS Maint. Insom. Subscale)	823	1.35	1.12 to 1.62	1.35	1.12 to 1.63
Daytime Sleepiness (Epworth Sleepiness Scale)	810	1.12	1.06 to 1.19	1.11	1.04 to 1.18
Latency (GSDS Onset Insom. Subscale)	826	1.30	1.17 to 1.44	1.21	1.08 to 1.35
T2 (12 weeks postnatal)					
Duration (24 hr TST)	813	0.99	0.82 to 1.18	0.93	0.77 to 1.13
Quality (GSDS Quality Subscale)	821	1.35	1.17 to 1.57	1.32	1.12 to 1.55
Continuity (GSDS Maint. Insom. Subscale)	823	1.13	1.01 to 1.26	1.12	0.99 to 1.26
Daytime Sleepiness (Epworth Sleepiness Scale)	809	1.08	1.02 to 1.14	1.05	0.99 to 1.12
Latency per unit (GSDS Onset Insom. Subscale)	823	1.35	1.20 to 1.52	1.28	1.12 to 1.46
T3 (three years post birth)					
Duration (24 hr TST)	788	0.92	0.73 to 1.16	0.79	0.65 to 1.07
Quality (GSDS Quality Subscale)	798	1.40	1.19 to 1.65	1.35	1.15 to 1.63
Continuity (GSDS Maint. Insom. Subscale)	791	1.23	1.07 to 1.40	1.22	1.08 to 1.44
Daytime Sleepiness (Epworth Sleepiness Scale)	787	1.06	0.99 to 1.14	1.05	0.97 to 1.13
Latency per unit (GSDS Onset Insom. Subscale)	796	1.31	1.16 to 1.48	1.18	1.04 to 1.37

4.5 Discussion

In this population sample, two distinct depressive symptom classes, 'stable mild' (SM) and 'chronic high' (CH), were identified from late pregnancy to three years post birth for both Māori and non-Māori women. The CH trajectory demonstrates that for a subsample of women, persistent depressive symptoms are experienced well beyond pregnancy and the early postnatal period. In the full sample, 8.5% of women were identified as belonging to the CH class, with median scores on the EDPS and K-10 consistently at or above clinical cut-offs for depressive symptomology. Specifically, a mother in the CH group, who has elevated depressive symptoms in late pregnancy will also have a very high probability of experiencing depressive symptoms three years post birth.

Our previous work has shown that Māori women are more likely than non-Māori women to experience depression in pregnancy (Signal et al., 2016) and the present study adds to this by demonstrating that there is a group of Māori women who have a very high probability of experiencing clinically significant depressive symptoms from pregnancy through until their child is three years of age. This is in contrast to non-Māori women, who show a similar pattern of change but a lower probability of clinically significant depressive symptoms from pregnancy through to three years of age and lower median scores on the measures of depressive symptoms at T2 and T3, although the proportion of women in the non-Māori group is greater than the Māori women group.

These results highlight the enduring nature of depression in perinatal women and suggest that mental health support and management in pregnancy and the years post birth are suboptimal for New Zealand women, particularly for Māori women given the severity and likelihood of persistent depressive symptoms found in the present study. Fahey & Shenassa (2013)

emphasise the need to lengthen maternity care after childbirth as women are vulnerable to compromised health, due to the immense physical and psychosocial transition and decreased opportunities for self-care related to the demands of new motherhood. Verbiest et al. (2018) attributes poor maternal health to an infant-centric (and not mother-centred) approach, with focus placed on the birth, delivery and immediate postnatal period but not the years post birth. These authors appeal for an expanded continuum of care, before conception, throughout pregnancy, childbirth, adaption and recovery, and beyond. Previous studies have revealed that mothers experiencing depressive symptoms in late pregnancy may be identified in early pregnancy (Skouteris, Wertheim, Germano, et al., 2009), providing an opportunity for novel interventions throughout pregnancy to help minimise persistent perinatal depressive symptoms. Moreover, there is an urgent need for health care providers and policy advisors to raise awareness of the persistent nature and severity of depression past traditional perinatal timeframes and to advocate for quality primary care (including identification, referral and timely treatment) during pregnancy and the years beyond.

In both Māori and non-Māori populations, depressive symptoms significantly improved at 12 weeks postnatal. It is not clear why this occurred, but it may be that the social and professional support available for mother and baby in the early perinatal period was of benefit, and/or that women place fewer expectations on themselves at this time and have fewer external obligations. An alternative explanation is that based on their involvement in this study, they were receiving the necessary mental health support after being referred to their Lead Maternity Carer (LMC) or doctor if there was evidence of self-harm or elevated depressive symptoms in late pregnancy. It should be noted however, that Māori women and their families have greater exposure to factors associated with depression and experience significant barriers to accessing high quality pregnancy and postnatal health care services (Makowharemahihi et al., 2014) and health care services in general (New Zealand Ministry of Health, 2008). This could also be

reflected in the lack of difference found between Maori and non-Maori women in the reporting of depression history. That Māori women remained in a chronic depressive symptom group at the three-year time point is of serious concern. Further research is required to document the pathways to and through mental health care for Māori women.

This is the first study to examine the association between depression trajectory classes and different dimensions of sleep. The results extend findings from previous studies, supporting the association between sleep quality and depressive symptoms (S.-Y. Kuo et al., 2012; Tomfohr et al., 2015; Tzeng et al., 2015; G. Wang et al., 2018). The current study also demonstrated that depressive symptoms were consistently associated with poor sleep quality, continuity, latency and daytime sleepiness at each time point and remained significant when adjusting for other factors related to depression. Given that the ORs represent an increased risk of being in the CH group per unit change of sleep, these results demonstrate a strong association between sleep and mental health outcomes. The analyses cannot address the causal or directional relationships between aspects of sleep and depressive symptoms. However, this pattern of co-occurrence supports evidence of the bi-directional nature of sleep and depression. Thus, early pregnancy sleep health interventions may be beneficial for women and further studies are needed to investigate whether improving sleep (or indeed, keeping sleep stable over time) can minimise depressive symptoms, especially in the early stages of pregnancy.

Strengths of our study are the large community sample with approximately one third of women identifying as Māori, the examination of multiple dimensions of sleep, and controlling for known predictors of depression. The demographic characteristics of the participants in this study enhance the generalisability of our findings to a wider perinatal population. The inclusion of measures of depressive symptoms in pregnancy expands the research on the course of maternal depression, given that the majority of other population-based samples have examined

trajectories across shorter time spans or the postnatal period only. We also used a sophisticated statistical approach to focus on data driven and person-centred outcomes which allows a greater emphasis on individual and longitudinal patterns of depressive symptoms. This is particularly important when investigating Indigenous populations, as total population analysis can potentially mask inequities concealed in the data. Posterior probability for each trajectory group was high as was the clear separation of classes further supporting the analytical approach we have taken.

Despite the large sample and the longitudinal data, there are several limitations to this study. Due to the large sample size, depressive symptoms were assessed using well validated self-report measures and not clinical interview, so it is unclear how many of these women were experiencing clinically diagnosable depression or were receiving antidepressant medication. However, this study used cut-off scores on the EPDS and K-10 which are considered to indicate major or probable clinical depression, rather than just mild, transient or possible depression (Cox et al., 1987; Fellmeth et al., 2019; Khanlari, Barnett Am, Ogbo, & Eastwood, 2019). The EPDS includes an item regarding changes in sleep and this item was included in the analysis of this scale to enable standard cut-off scores to be utilised and may have slightly increased the scores of some women. Furthermore, some studies investigating optimal cut-off scores on the EPDS have suggested a higher cut-off score in pregnancy (Matthey et al., 2006) although this is not universally supported. The sub-group used in the analyses presented here differed in some respects to those who did not have complete data. However, the proportion of women experiencing clinically significant depressive symptoms did not differ between the groups and this was the variable used to determine trajectories. The study only used three time points, so we are not able to comment on the course of depressive symptoms between time points, specifically during the long period of time between three months and three years postnatal, which may be why our analyses support a two-class model. Follow-up periods are a critical

dimension in determining the number of trajectory groups, thus if we had more data time points, the classes may have split into sub-groups following divergent trajectories (Nagin & Tremblay, 2005). Furthermore, we do not currently have data past three years post birth, so cannot comment on depressive symptoms trajectories past this time. However, three depression trajectory studies have identified groups of mothers with increasing depressive symptoms in the child's preschool years (Hammerton et al., 2015; Matijasevich et al., 2015; Van Der Waerden et al., 2015). Thus, more studies with additional timeframes within and beyond three years and that include Indigenous women would be valuable. We did not control for women receiving behavioral or pharmacological treatment for depression, which could have altered the natural course of symptoms, or led to misclassification.

To our knowledge, this is the first study investigating depressive symptoms throughout the extended perinatal period and the association with multiple dimensions of sleep. Notably, persistent patterns of depressive symptoms occurred concurrently with poor sleep at distinct time points from late pregnancy to three years post birth. Given the well described impact of maternal depression on the mother, child and community, this highlights the importance for healthcare professionals to ask about and assess mothers sleep quality, continuity, latency and daytime sleepiness as potential indicators for depressed mood beyond the perinatal period. These results are congruent with much of the literature on maternal depression trajectories and add to the mounting evidence on the relationships between sleep and depression. In addition, the study includes important findings on the specific aspects of sleep involved. Mothers with poor sleep are at risk of experiencing chronic depressive symptoms. Given the higher incidence and more pervasive nature of depressive symptoms in Indigenous Māori women, priority should be focused on the development of preventative interventions for these women.

Acknowledgements

We gratefully acknowledge the contribution of the women who participated in the *Moe Kura* study. We would also like to thank the localities for supporting promotion of the study and assisting with participant recruitment, Ms Monique Priston, Dr Kathryn Lee, Ms Alexander Smith, the research assistants and the study advisory group.

Declaration of Conflicting Interests

The author(s) declare there are no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

This work was supported by the New Zealand Health Research Council (HRC grant number 09/255 and 08/547); and a Massey University Doctoral Scholarship.

5 SLEEP HAPI: A FEASIBILITY AND DESCRIPTIVE ANALYSIS OF AN EARLY AND LONGITUDINAL SLEEP EDUCATION INTERVENTION FOR PREGNANT WOMEN

Study 2 (discussed in Chapter 4) examined trajectories of depressive symptoms from late pregnancy until three years post birth, and whether these trajectories were associated with different dimensions of sleep health. This provides new information on longitudinal patterns of depressive symptoms for Indigenous Māori and non-Māori women.

Results from the longitudinal analysis revealed two distinct trajectories:

- ‘Chronic high’ - A group of women with elevated depressive symptoms from late pregnancy through until three years post birth.
- ‘Stable low’ - A group of women with minimal or no depressive symptoms from late pregnancy through until three years post birth.

Māori women in the chronically depressed group, also had a much greater probability of experiencing depressive symptoms at each timepoint compared to non-Maori women.

Poorer sleep quality, reduced sleep continuity, increased sleep latency and greater day time sleepiness) were consistently associated with clinically elevated and persistent depressive symptoms for women throughout the perinatal period and into their child’s preschool years.

Two key findings from Studies 1 and 2 contributed to the design, development and application of Study 3, a pilot sleep intervention for pregnant women. Firstly, that multiple dimensions of poor sleep are associated with depressive symptom trajectories (Study 2); and secondly, that women who have good physical and mental health in pregnancy are also likely to have sufficient, good quality sleep that remains stable throughout pregnancy (Study 1). This pilot sleep

education intervention aimed to determine whether providing women who had a prior history of depression information on the expected changes to sleep dimensions across pregnancy and strategies and advice to assist them optimise and/or stabilise their sleep throughout pregnancy, could alter their likelihood of being in the 'chronic high' depressive trajectory group.

Chapter 5 and 6 both report the findings from Study 3; Chapter 5 presents and discusses the feasibility and acceptability of the pilot study, while the efficacy is detailed in Chapter 6. Study results from these two chapters were also disseminated to participants as a summary brochure that the researcher prepared (Appendix 27).

The following manuscript was prepared by the researcher (Appendix 30) and was published in the journal *Behavioural Sleep Medicine* in June 2020. All rights reserved © Ladyman, C. I., Gander, P. H., Huthwaite, M., Sweeney, B. S. & Signal, T. L.

5.1 Abstract

Background: Poor sleep and prior depression are key predictors of perinatal depression, with research suggesting depressive symptoms may emerge in early pregnancy. Sleep is a potentially modifiable risk factor for depression. This pilot study examined the feasibility and acceptability of a six-month sleep education intervention designed to optimise sleep and minimise depressive symptoms throughout pregnancy. Sleep measures and depressive symptoms are described from 12 weeks gestation to 12 weeks postpartum.

Participants: A community sample of nulliparous pregnant women with a history of depression were recruited prior to 14 weeks gestation.

Methods: An individualised sleep education program was developed, and participants engaged in three trimester specific sleep education sessions. Feasibility and acceptability were determined via recruitment and retention rates and participant feedback. Depressive symptoms and sleep were measured at five time points throughout the study.

Results: 22 women enrolled in the study and 15 completed the intervention. Participants reported the intervention as highly acceptable. There was minimal change in all dimensions of sleep across pregnancy, but sleep measures were significantly worse at six weeks postpartum and improved by 12 weeks postpartum. Depressive symptoms were significantly lower at the conclusion of the intervention and 12 weeks postpartum compared to trimester 1.

Conclusions: This sleep education program appears feasible, acceptable and may be effective in minimising depressive symptoms in pregnant women with a history of depression. Trials with larger and more diverse samples are warranted and further studies to ascertain efficacy should be undertaken with a control group.

Keywords: Sleep, depression, pregnancy, trimester, intervention

5.2 Introduction

Having a baby is often perceived as a positive and celebrated life event for most women, but not for all. One in five women will experience significant depressive symptoms during pregnancy (Marcus et al., 2003; Yonkers, Wisner, et al., 2009) and the negative individual and societal impacts of perinatal depression are extensive, both in the short and long term (Stein et al., 2014). These include maternal suicide (Oates, 2003), adverse pregnancy, birth and infant outcomes (Accortt, Cheadle, & Dunkel Schetter, 2014; Stein et al., 2014), and difficulties in establishing the mother-infant relationship (Campbell et al., 2004; Hairston et al., 2016). Long

term impacts include poorer cognitive development and behavioural problems in the child (Bernard-Bonnin, 2004) as well as greater risk of future depressive episodes for both the mother and child (Luoma, Korhonen, Salmelin, Helminen, & Tamminena, 2015; Pearson et al., 2013).

A history of depression is the most consistent predictor of perinatal depression (Faisal-Cury & Menezes, 2012; Jeong et al., 2013). Poor sleep is also a consistent predictor of perinatal depression and with profound physiological, psychological and hormonal changes occurring in pregnancy, sleep disruption is experienced by a majority of pregnant women (Howe et al., 2015; Mellor et al., 2014). There is considerable evidence that sleep and depression are linked in pregnancy (Peterson & Benca, 2008) and likely share a reciprocal causal relationship (Fang, Tu, Sheng, & Shao, 2019). This relationship has been established across all perinatal time points, with cross-sectional and longitudinal studies demonstrating that insufficient and poor sleep quality is associated with elevated depressive symptoms at the same time point (Jomeen & Martin, 2007; Sattler et al., 2017). Additionally, poor sleep in early pregnancy predicts worsening depressive symptoms in later pregnancy (Eichler et al., 2019; Skouteris, Wertheim, Germano, et al., 2009) and poor sleep in late pregnancy presents an increased risk of postpartum depression (Tomfohr et al., 2015; Wolfson et al., 2003). Only a few studies have investigated depression in early pregnancy and these show an increased vulnerability in the first trimester compared to later in pregnancy (Fan et al., 2009; Teixeira, Figueiredo, Conde, Pacheco, & Costa, 2009; Truijens et al., 2017) and for women who become depressed early in pregnancy, an increased risk of postpartum depression (Skouteris, Wertheim, Rallis, Milgrom, & Paxton, 2009; Truijens et al., 2017).

The first trimester is a window of opportunity to predict and prevent many pregnancy complications (Poon et al., 2018) including the early detection of both poor sleep and depressive symptoms. Early detection is important but even more so are effective interventions to improve

sleep, being one of only a few modifiable risk factors for depression (Franzen & Buysse, 2008). This is highly pertinent for women seeking non-pharmacological, inexpensive and non-invasive health interventions in pregnancy.

This research uses a novel sleep education intervention for pregnant women, called *Sleep HAPi* (**Sleep Health and Pregnancy Information**) which gives women the opportunity to understand and improve their sleep health. This intervention was developed by the researchers and aimed to: 1) establish the feasibility of recruiting women in the first trimester of pregnancy and maintaining their involvement through to late pregnancy; 2) ascertain the use and acceptability of this sleep education program during pregnancy; and 3) describe the changes in the participants' sleep health and depressive symptoms throughout pregnancy and early postpartum period. The intervention incorporates the 'Sleep Health' principles identified by Buysse (2014), which considers sleep as a multidimensional model that "promotes physical and mental well-being", described through measures of quality, duration, continuity, timing and daytime sleepiness.

5.3 Methodology

5.3.1 Study design

The *Sleep HAPi* pilot study covered six time points: Pre-pregnancy (PP), pregnancy (T1=trimester 1; T2=trimester 2; T3=trimester 3) and postpartum (P1=six weeks postpartum; P2=12 weeks postpartum) (see figure 5.1). Collection of pre-pregnancy data was retrospective, and these data are not reported here. Questionnaires, completed in the participants own time, collected sleep (all time points) and mental health data (T1, T2, T3, P1 and P2) at a defined gestational or postpartum week. Actigraphy was used to obtain sleep data at T1, T2 and T3. Three sleep education sessions were completed in between the actigraphy weeks in each trimester.

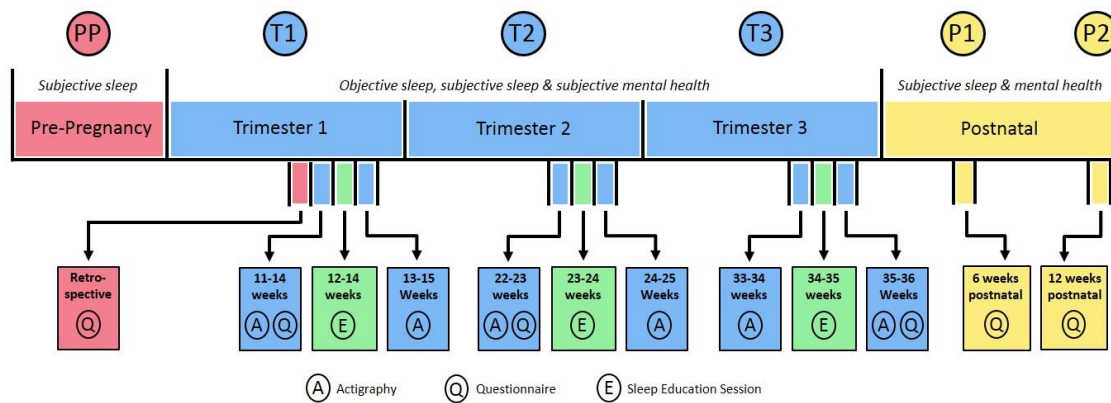


Figure 5.1 Study design for *Sleep HAPi*

5.3.2 Sample

Women were recruited from the Greater Wellington area or Palmerston North, New Zealand through advertisements in medical centres, midwifery clinics, mental health clinics, hospitals, parent and community centres, libraries, schools, crèches/kindergartens, supermarkets, community fairs, and various social and traditional media channels. Presentations were also given to hospital staff, midwifery groups, continuing medical education (CME) workshops and fertility clinics to encourage medical professionals to refer patients/clients.

Eligible participants had a history of previously diagnosed depression but were currently non-symptomatic and had been medication-free for at least three months prior to study enrolment. They were at or less than 14 weeks pregnant, nulliparous, had a singleton pregnancy and were at least 16 years of age and proficient in English. They were also required to have a primary health care provider and no children under three years of age living in the home. Participants were excluded if they had a diagnosed sleep disorder, medical condition or mental health disorder (other than depression) known to be associated with sleep abnormalities.

5.3.3 Procedure

Written consent was obtained prior to study commencement and ongoing consent and screening for symptoms of depression was completed at each time point. As required for ethical approval, a protocol was in place for participants reporting elevated depressive symptoms or thoughts of self-harm, which included women providing consent for the researchers to notify their doctor or lead maternity carer (LMC). Women received a \$50 gift card at the end of the pregnancy component and a further \$20 gift card at the conclusion of the study.

At study commencement the participants filled out a retrospective pre-pregnancy sleep questionnaire and received instructions on using the actigraph and sleep diary. At T1, T2 and T3 participants completed further questionnaires and their sleep was recorded and assessed using actigraphy and sleep diaries over seven nights. Actigraphs, diaries and questionnaires were either delivered by the researcher (to home or work addresses) or provided at education sessions. Analysed actigraphy and questionnaire data were presented to the participant at the education sessions (see below for details). Immediately after the education sessions, a further seven days of actigraphy data and sleep diary recordings were collected. At P1 and P2, only sleep and mental health questionnaires were completed (using post and reply-paid envelopes). The first education session (T1) was 60-90 minutes in duration and sessions at T2 and T3 lasted 45-60 minutes.

At the completion of the pregnancy component of the study, participants filled out a feedback questionnaire, requesting information on their sleep knowledge, the structure, content and helpfulness of the intervention and views on their participation.

5.3.4 Sleep education sessions

Sleep HAPi is a sleep education package developed by the study researchers that incorporated three main sleep topics: 1) general sleep and circadian information; 2) how and why sleep changes in each trimester of pregnancy; and 3) trimester specific strategies to improve sleep. Printed information was presented in a folder that allowed subsequent trimester information and actigraphy printouts to be progressively added, creating a comprehensive and personalised ‘Sleep in Pregnancy’ booklet (52 pages in total). After each education session, women were encouraged to refer back to the booklet and share with their family/social supports. To ensure consistency, one researcher performed all communication using standardised checklists and letters/emails. The same researcher also presented education sessions in a standardised format, guided by the education booklet.

The aim of the educational information was to increase women’s understanding of the benefits of good sleep and consequences of poor sleep, practices and factors that promote or hinder sleep, ‘normalise’ the sleep changes experienced in pregnancy and to improve overall sleep health. There was no expectation that all of the information and advice would be used by all women, rather that they would have a ‘tool kit’ of knowledge they could use when necessary. All meetings and education sessions were scheduled at times and places convenient to the women (homes, cafés, community libraries, university meeting spaces), and were one-on-one and face-to-face.

5.3.5 Measures

The participants completed paper-based questionnaires, previously used in the “*E Moe, Māmā: Maternal Sleep and Health in Aotearoa/ New Zealand*” pregnancy and postpartum studies, (Signal et al., 2016) which asked participants about their sleep, mood and general health.

5.3.5.1 Sleep measures

Actigraphy and sleep diary - Objective sleep was recorded using a wrist-worn Micro-Motionlogger actigraph (Ambulatory Monitoring, Inc., Ardsley, NY, USA). Actigraphy provides a long-life, light-weight, non-invasive, objective measure of sleep that has been validated against polysomnography (PSG) (Kosmadopoulos et al., 2014; Marino et al., 2013). The actigraph was worn continuously for seven nights on the non-dominant wrist, recording movement in one-minute epochs. Participants were instructed to press the event marker at the start and end of attempted sleep periods. Data were analysed using Action-W (Version 2.7; Ambulatory Monitoring, Inc) software using the Cole Kripke algorithm. Each woman was also asked to record sleep, wake and removal of the watch in a sleep diary, based on previous studies used in this research group (Signal et al., 2007) and The Core Consensus Sleep Diary (CSD) (Carney et al., 2012).

Sleep quality - Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a 19-item measure of sleep quality over the past month, yielding a total score ranging from 0 to 21 with higher scores indicating poorer sleep quality (Buysse et al., 1989). In differentiating good and poor sleepers, a global PSQI score >5 has a sensitivity of 89.6% and a specificity of 86.5% (Buysse et al., 1989). This cutoff has been validated in a pregnant population investigating associations between sleep and mood (Qiu et al., 2016). In addition, the question “In the last week, how often did you get a good night’s sleep?” was dichotomised into good (>3 nights a week) or poor (≤ 3 nights a week) (Howe et al., 2015).

Sleep duration - Sleep duration was measured by self-reported nighttime sleep duration (TST) and actigraphic TST in each sleep period, calculated as the number of minutes of sleep from the first 10 consecutive minutes scored as sleep by the software algorithm, until final wake-up (Tsai et al., 2011).

Sleep timing - The midpoint of sleep was calculated from actigraphically determined weekday and weekend bedtimes and wake times, and from self-reported items in the Munich Chronotype Questionnaire (Roenneberg, Wirz-Justice, & Mellow, 2003). Weekday midsleep was subtracted from weekend midsleep to calculate the 'Midsleep Difference' and used as both a continuous and a categorical variable (0-60mins, 61-120mins, and 120+ mins) (Levandovski et al., 2011; Wittmann et al., 2006).

Sleep continuity - Sleep continuity was measured by the General Sleep Disturbance Scale (GSDS) Maintenance Insomnia Subscale which includes the items; "How often in the last week did you wake up during your sleep period?" and "How often in the last week did you wake up too early at the end of your sleep period?" Items were rated from 0 (never) to 7 (every day) and the mean calculated (K. A. Lee & Gay, 2004).

Daytime sleepiness - Daytime sleepiness was measured using the Epworth Sleepiness Scale (ESS). The ESS assesses daytime sleepiness in eight everyday situations using the question "How likely are you to doze off in the following situations, in contrast to feeling just tired...?" The ESS has been deemed reliable and valid for use in pregnant populations (Baumgartel et al., 2013) and excessive daytime sleepiness is typically defined as a total score ≥ 10 (Johns, 1991).

Additional sleep measures - Additional sleep measures including the Insomnia Severity Index (ISI), total GSDS score, reasons for awakenings; getting a comfortable sleep position, frequency of napping, frequent snoring, frequent breathing pauses, frequent leg twitching and Restless Legs Syndrome (RLS) are detailed in Appendix 1.

5.3.5.2 Depression symptom measures

Depressive symptoms were measured using the Beck Depression Inventory (BDI-II) (Beck et al., 1996) and the Edinburgh Postpartum Depression Scale (EPDS) (Cox et al., 1987). The EPDS is a ten-item screening tool used internationally to detect depressive symptomatology and has been validated for use in pregnancy and the postpartum (Kozinszky & Dudas, 2015), although it is not widely utilised in early pregnancy. Women selected a response that described how they felt over the past seven days on ten items.

The BDI II (Beck et al., 1996) is also widely used to screen for depression in the perinatal period, however, there is some concern about false positives due to pregnancy symptoms mimicking somatic symptoms associated with depression (Čuržik & Begić, 2012). Others argue that the occurrence of such somatic symptoms during pregnancy is important for mental state and question the EPDS's inability to detect these symptoms (Yonkers, Smith, Gotman, & Belanger, 2009), as women with a higher EPDS scores have been shown to present with greater somatic complaints (Apter et al., 2013).

5.3.5.3 Demographic measures

Participants provided information on age, gestational age, parity, ethnicity, health status, education, height and weight to compute body mass index (BMI), current work commitments, status of partner relationship, alcohol and drug intake, and time since last depressive episode. Stressful life events were drawn from the 13-item Pregnancy Risk Monitoring System (PRAMS) survey questions (Shulman, D'Angelo, Harrison, Smith, & Warner, 2018), used to assess women's experience of traumatic, emotional, financial and partner related stressors in the past year. Women with higher levels of stressors (two or more) have been shown to have higher adjusted odds of postpartum depression symptoms (Mukherjee et al., 2017).

5.3.5.4 Acceptability measures

Questions used to measure usability and acceptability of the intervention included; knowledge of sleep prior to commencing the study, helpfulness of the information received and ease or difficulty of the study components. There were additional questions that covered the readability and understandability of the information as well as session format and timing. Women were also able to answer open ended questions about key learnings and their overall experience.

5.3.6 Statistical analysis

Descriptive statistics (means, standard deviations, proportions) were calculated in SPSS (version 25, IBM SPSS Statistics for Windows, Armonk, NY). As no differences were found between the first and second actigraphy weeks in each trimester these weeks were averaged. Changes to sleep or depressive symptoms over time were assessed using linear mixed models in SAS (version 9.4, SAS Institute Inc., Cary, NC). The Kenward-Roger adjustment was applied to the degrees of freedom estimation (Littell et al., 2007). Normality, linearity and constant variance assumptions were visually checked and the Shapiro-Wilk test used to assess the distribution of the residuals (Tabachnick & Fidell, 2012). Where outlying residual values were identified, the model was re-run without the outlier(s). If removing the outlier(s) altered the findings of the model, the reported results exclude the outlier(s), otherwise the results are reported including the outlier(s). Post-hoc tests were used to investigate comparisons of interest where main effects were statistically significant. Bonferroni's adjusted p -values were calculated for post-hoc tests. A p -value of <0.05 was considered significant.

5.3.7 Ethical approval

The study was approved by the Massey University Human Ethics Committee: Human Ethics Southern A Committee (SOA 16/29). It was reviewed and registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12617000055303).

5.4 Results

5.4.1 Participants

Over a 12-month period from February 2017 to February 2018, 53 women responded to the recruitment advertisements. Twenty-two were screened and accepted into the study. Six withdrew and one was excluded, resulting in 15 participants completing the study (see figure 5.2).

Participants ranged from 28 to 34 years of age. All were of New Zealand European ethnicity, had a history of depression, did not report smoking nor recreational drugs consumption throughout the study and were not employed in shift work. Five women had required assisted reproductive technology (ART) to become pregnant, four had previously miscarried and for 13 of the women this was a planned pregnancy.

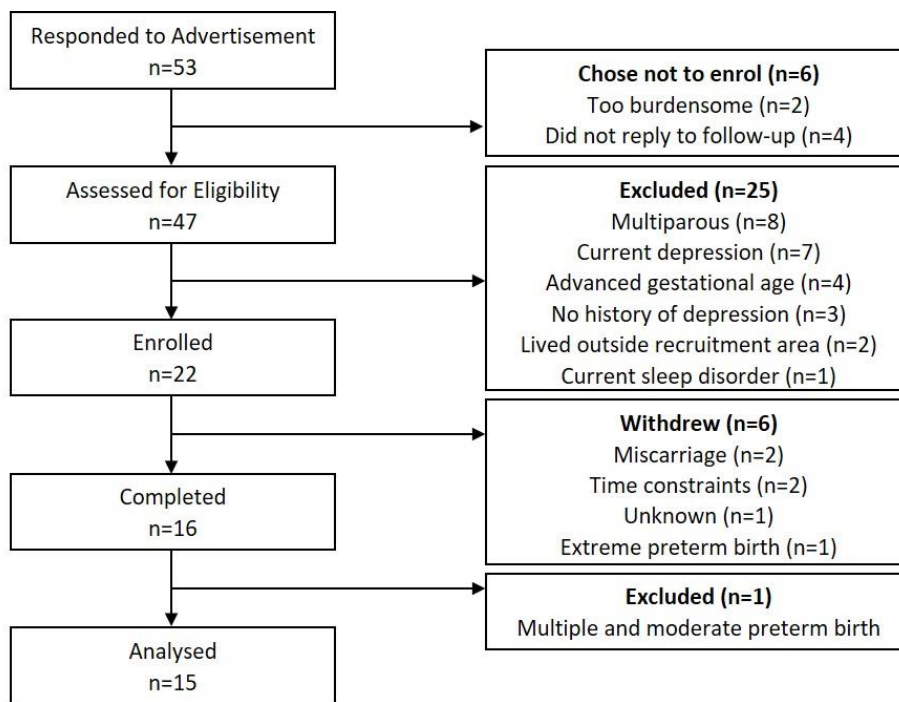


Figure 5.2 Recruitment and retention flow diagram.

One had finished secondary schooling while 14 were tertiary qualified. Two thirds had a household income of \$100,000 or more and the other third ranged from \$50,000 to \$100,000, indicating that the majority of women in this study were financially advantaged. Pre-pregnancy BMI calculations categorised 11 in the healthy, two in the overweight and two in the obese weight ranges. Mean age was 31.47 years ($SD \pm 5.19$) at study commencement. Four women had experienced some depressive symptoms three to 12 months prior to becoming pregnant, four had experienced symptoms between one and three years ago and seven women had not experienced any symptoms for over three years (mean 6.18 ± 6.12 years). A family history of mental illness was reported by 13 women, of which seven had multiple family members, spanning at least two consecutive generations. Five women also reported that female family members experienced either antepartum or postpartum depression. Additional characteristics that altered over the study period are summarised in Table 5.1.

Table 5.1 Sample characteristics

	Trimester 1 (n=15)	Trimester 2 (n=15)	Trimester 3 (n=15)	6 Weeks Postnatal (n=14)	12 Weeks Postnatal (n=14)
Age					
Gestational Age (wks)	11.50 ± 1.55	23.07 ± 1.05	36.13 ± 0.51		
Baby's Age (weeks)				7.01 ± 0.78	12.29 ± 0.46
Health Status					
Fair/Poor	0 (0)	2 (13)	2 (13)	1 (7)	1 (7)
Good or better	15 (100)	13 (87)	13 (87)	13 (93)	13 (93)
Work Commitments					
Currently Working	15 (100)	15 (100)	7 (47)	0 (0)	1 (7)
Currently on Paid Maternity Leave	0 (0)	0 (0)	8 (53)	14 (100)	13 (93)
Hours of Work [#]	36.67 ± 10.49	38.63 ± 11.32	39.07 ± 1.64	0 (0)	10 ± 0.00
Relationship with partner					
Happy	12 (80)	12 (80)	13 (87)	10 (71)	10 (71)
Unhappy	2 (13)	2 (13)	1 (7)	3 (21)	3 (21)
Not Applicable	1 (7)	1 (7)	1 (7)	1 (7)	1 (7)
PRAMS					
Highscorer (≥2)	5 (33)	6 (40)	6 (40)	4 (29)	2 (14)
Alcohol Frequency					
Never	15 (100)	15 (100)	15 (100)	8 (57)	6 (43)
Less than once a week	0 (0)	0 (0)	0 (0)	5 (36)	6 (43)
Once every 3-7 days	0 (0)	0 (0)	0 (0)	1 (7)	2 (14)
Once every 2 days	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Daily	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Alcohol Volume					
None	15 (100)	15 (100)	15 (100)	8 (57)	5 (36)
Less than 2 drinks	0 (0)	0 (0)	0 (0)	6 (43)	8 (57)
More than two drinks	0 (0)	0 (0)	0 (0)	0 (0)	1 (7)

Results reported as mean & SD or n (%)

[#] of those working

5.4.2 Recruitment and retention

Complete data sets were analysed for 15 women during pregnancy (68% retention rate) and 14 in the postpartum period (64% retention rate). All questionnaires, education sessions and actigraphy were completed except for one woman who did not complete her second trimester sleep education session due to work travel (99.7% completion rate).

5.4.3 Intervention acceptability

While many women claimed a reasonable knowledge of sleep in general, few considered they had knowledge of their own sleep, trimester changes to sleep or sleep strategies prior to the intervention (figure 5.3a). Most found the information covered in the education sessions either ‘really’ or ‘quite’ helpful (figure 5.3b). And that various components of the study were easy to manage, with the exception of remembering to ‘press the event maker’ on the actigraph (figure 5.3c).

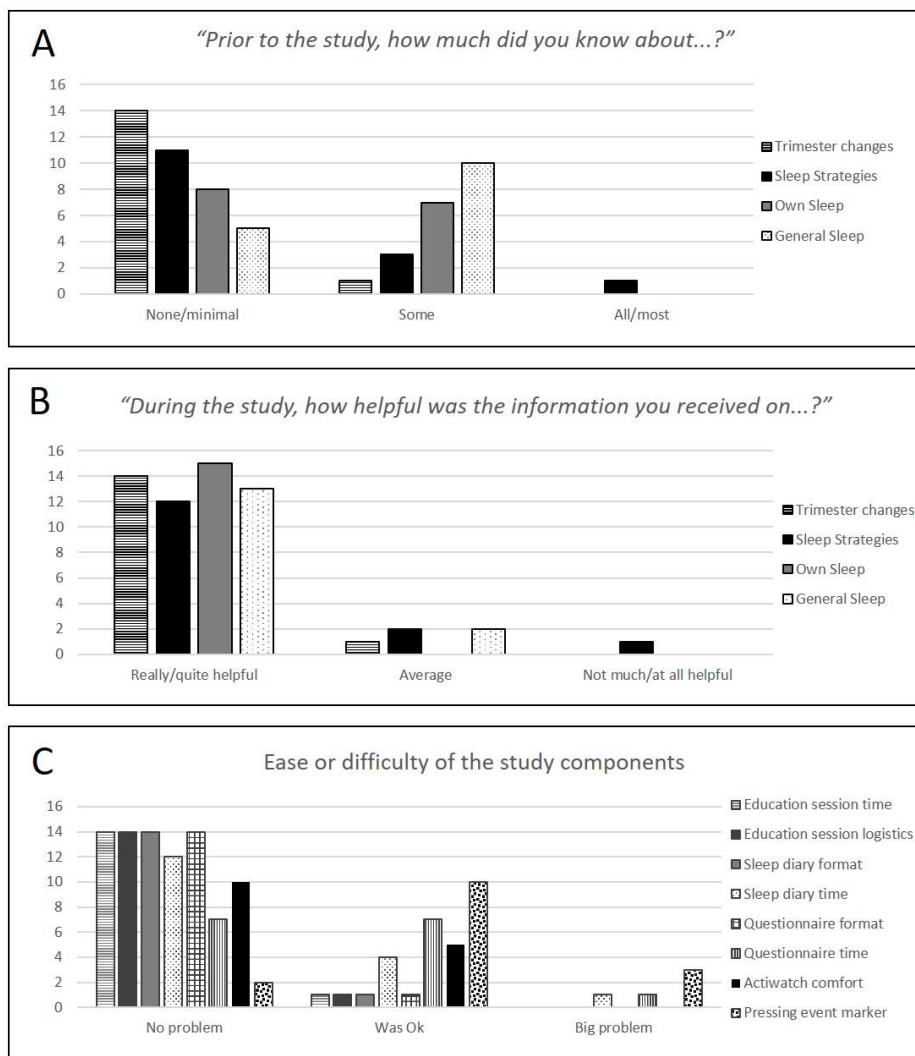


Figure 5.3 Panel A: Participants sleep knowledge prior to starting the intervention; Panel B: Level of helpfulness of information received in the intervention; Panel C: Ease or difficulty of the study components

All participants endorsed that contact once per trimester was ideal and while the overall time commitment was also found to be ideal, one third said they could have dedicated more time to the study. Over two thirds of women preferred having the researcher guide them through the material and although the remaining third said they could have understood the material on their own, they noted similar comments to *“you get more out of it when someone else explains it to you”*. Over one third of the women stated they were not expecting their sleep to change throughout pregnancy, but all confirmed their sleep had changed, with six women saying their sleep changed a lot and nine saying it had changed a little.

A majority of women reported benefits from participation in the intervention, stating that they ‘definitely’ understood their sleep better (93%), ‘definitely’ had a positive experience (86%) and would ‘definitely’ recommend the study to others (86%). Three quarters of the women said that what they learnt about sleep would ‘definitely’ be useful in the future and that the benefits of the study ‘definitely’ outweighed the burden.

When asked about the most helpful thing they had learned, over a third of women said consistency in sleep timing between weekends and weekdays. Other key learnings were understanding sleep changes during pregnancy, safe sleeping positions, napping advice, understanding sleep architecture, keeping the bedroom dark, cool and quiet, and managing sleep stress. Comments such as *“My sleep is better than I thought”*, or *“My sleep is quite normal”* were also common. Notably an email received from a participant’s midwife who stated, *“*** had a great birth a week ago and was listing taking part in your study as one of several contributing factors that kept her positive and able to cope”*, indicating the benefits of participating in the study.

5.4.4 Sleep characteristics

Descriptive statistics for measures of sleep quality, duration, continuity, timing and daytime sleepiness, across all time points, are presented in Table 5.2.

Table 5.2 Descriptive results of sleep and depressive symptom measures

	Trimester 1 (n=15)	Trimester 2 (n=15)	Trimester 3 (n=15)	6 Weeks Postpartum (n=14)	12 Weeks Postpartum (n=14)
Sleep Duration					
Self-report (hrs)	7.47 ± 1.48	8.07 ± 1.19	7.37 ± 0.93	5.75 ± 1.85	6.86 ± 1.49
Actigraphy (hrs)	7.87 ± 1.19	7.90 ± 0.88	7.59 ± 1.08		
Sleep Quality					
PSQI Total	7.27 ± 3.34	5.87 ± 2.20	6.93 ± 2.15	9.50 ± 3.84	7.43 ± 3.48
PSQI ≥5	11 (73)	9 (60)	14 (93)	12 (86)	11 (79)
Good night's sleep (per week)	3.67 ± 2.32	4.27 ± 1.53	3.33 ± 1.18	1.71 ± 2.27	2.71 ± 2.13
Good night's sleep (Good >3 nights/wk)	8 (53)	10 (67)	5 (33)	4 (29)	5 (36)
Daytime Sleepiness					
ESS Total	7.20 ± 4.23	6.80 ± 3.80	6.07 ± 3.90	8.71 ± 5.25	4.93 ± 4.39
ESS High scorer (≥10)	5 (33)	4 (27)	3 (20)	8 (57)	3 (20)
Sleep Continuity					
GSDS Maintenance Insomnia Subscale	4.86 ± 1.56	4.23 ± 1.53	4.80 ± 1.42	6.29 ± 1.12	5.07 ± 2.40
Sleep Timing					
Self-report (hrs)	57.00 ± 36.66	39.40 ± 26.26	34.46 ± 32.97	54.91 ± 44.06	40.23 ± 34.74
Actigraphy (hrs)	41.57 ± 29.15	41.83 ± 26.81	30.00 ± 22.35		
BDI II Score					
Total	10.80 ± 3.84	10.00 ± 6.48	7.33 ± 2.66	11.00 ± 3.53	7.64 ± 4.94
Highscorer (≥13)	4 (27)	4 (27)	0 (0)	4 (29)	2 (14)
EPDS Score					
Total	7.47 ± 4.10	7.47 ± 5.00	5.67 ± 3.37	7.14 ± 4.04	5.21 ± 3.38
Highscorer (≥13)	1 (7)	2 (14)	0 (0)	2 (14)	1 (7)

Results reported as mean & SD or n (%)

5.4.4.1 Sleep duration

Sleep duration measured either by actigraphy ($F_{(4,54)}=19.44$; $p<0.0001$) or self-report ($F_{(4,24)}=4.26$; $p=0.0259$) varied significantly over time, though post hoc analyses of self-reported duration showed no differences in pregnancy. Self-reported TST at P1 was significantly shorter than at all other time points and sleep was significantly shorter at P2 compared to T2 (Figure 5.1, panel C). Post hoc analysis of actigraphic TST data showed sleep duration at T3 was significantly shorter than at T2 ($p=0.0086$), but not compared to T1 ($p=0.1255$). Sleep durations measured using actigraphy were not significantly different to subjective sleep durations at any time point in pregnancy.

5.4.4.2 Sleep quality

Sleep quality variables also varied significantly across the study; for PSQI ($F_{(4,53)}=6.13$; $p=0.0004$) and GNS ($F_{(4,54)}=6.03$; $p=0.0004$). Post hoc analyses for both measures showed that differences occurred in the postpartum, and not throughout pregnancy, with sleep quality at P1 significantly worse compared to all trimesters of pregnancy (Figure 5.1, panel A & B). The proportion of women reporting >3 good nights sleep in the last week also decreased between T2 and P2.

5.4.4.3 Sleep continuity

Sleep continuity, as measured by the GSDS Maintenance Insomnia Scale ($F_{(4,54)}=4.15$; $p=0.0053$) varied significantly across the study, with post hoc analyses showing a significant decrease between T2 and P2 ($p=0.0022$) (Figure 5.1, panel D).

5.4.4.4 Daytime sleepiness

Sleepiness, as measured by the ESS, ($F_{(4,54)}=4.08$; $p=0.0058$), varied across time points, but post hoc analyses only found an improvement in daytime sleepiness between P1 and P2 ($p=0.0033$) (Figure 5.1, panel F).

5.4.4.5 Sleep timing

Self-reported midsleep difference ($F_{(4,47)}=1.98$; $p=0.0389$), varied significantly across the study, but none of the post hoc analyses reached significance. No significant effect of time was seen for actigraphically measured midsleep difference (Figure 5.1, panel E).

5.4.5 Depressive symptoms

Descriptive statistics across all time points are presented in Table 5.2. At T1, BDI II scores ranged from 4-19, while at T3 scores ranged from 3-12. Four women who experienced clinically relevant depressive symptoms at T1 had non-clinical scores by T3. Nine of the remaining ten women also saw reductions in BDI II scores over this time period. BDI II scores (but not EPDS scores) changed across the study ($F_{(4,52)}=2.40$; $p=0.0013$). As illustrated in Figure 5.1, panel G, post hoc pairwise comparisons revealed multiple significant differences among BDI II scores, notably a decrease between T1 and T2, an increase between T3 and P1, and a significant decrease between P1 and P2.

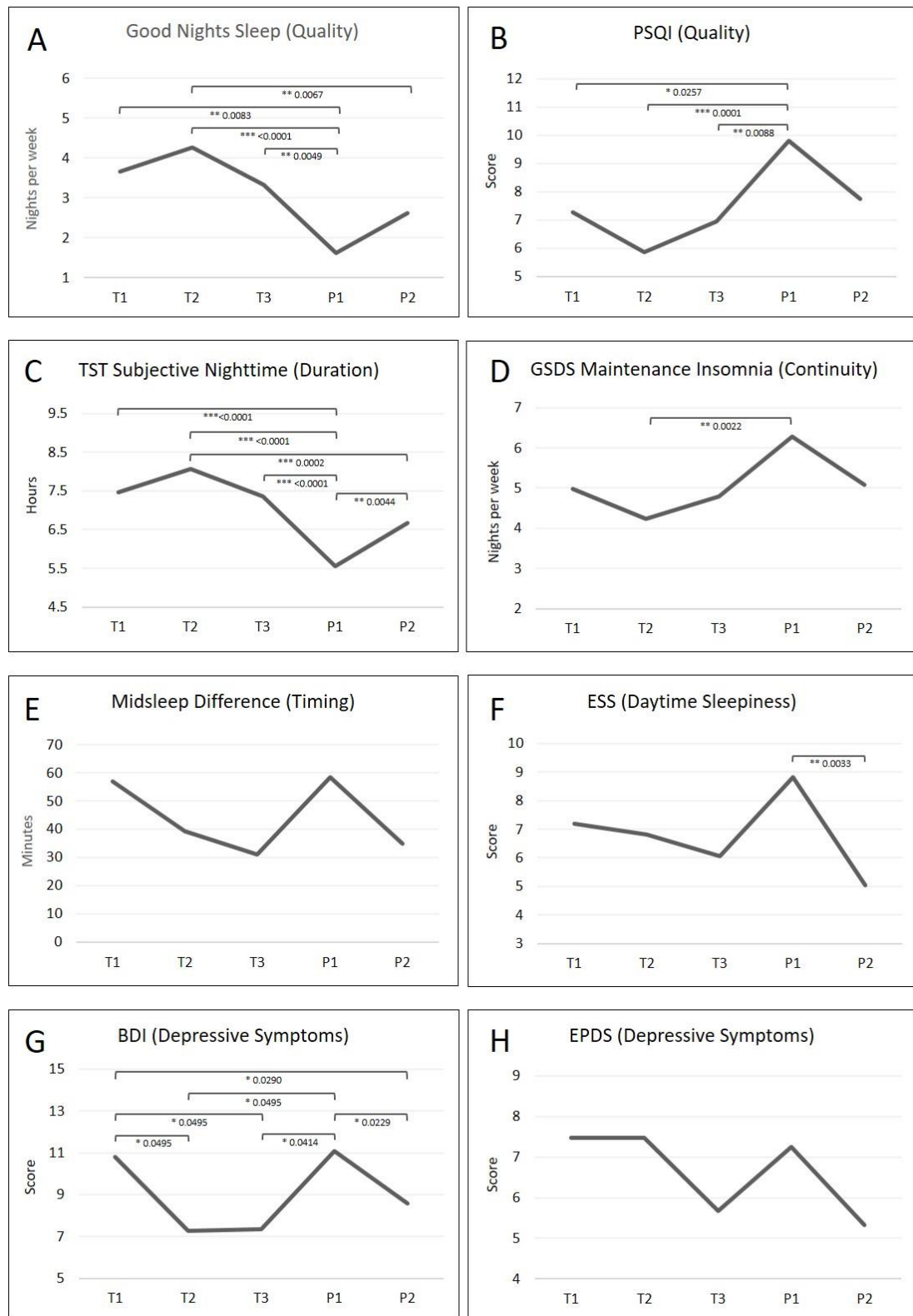


Figure 5.4 Linear mixed model sleep and depressive symptom results throughout pregnancy (T1 (trimester 1), T2 (trimester 2), T3 (trimester 3)) (n=15) and early postpartum (P1 (postpartum 12 weeks), P2 (postpartum 12 weeks)) (n=14).

5.5 Discussion

To our knowledge, this is the first prospective study to determine the feasibility of a longitudinal sleep education program throughout pregnancy, following nulliparous pregnant women with a history of depression and using both multi-dimensional objective and subjective sleep and mental health measures. The 22 women who were eligible to enrol all participated in the study and retention rates were 68% and 64% for pregnancy and the postpartum period respectively. Notably, four of the seven women that withdrew or were excluded from the study did so for reasons outside their control (i.e. miscarriage, pre-term birth, multiple birth), highlighting the unpredictable nature of pregnancy. Questionnaires, education sessions, actigraphy and diaries were all fully completed except one, equating to a 99.7% completion rate, which is an endorsement of the study given it occurred at a complex and demanding time in women's lives. These findings are not dissimilar to the range seen in previous pregnancy intervention studies with retention rates ranging from 63-85% and completion rates ranging from 34-93% (Bosaeus et al., 2015; Knight & Wyatt, 2010; McNulty et al., 2013). The sleep education intervention also proved highly acceptable, with most women enthusiastic about participating and noting they could have dedicated more time. Women stated they felt positive about participating, would definitely recommend the study to others, and felt they received valuable information about their sleep that would be helpful throughout their pregnancy and in the future.

Developing close relationships with community and hospital midwives was pivotal to recruitment, with eight of the women being referred by these clinicians. Health professionals are recognised as a key gateway in pregnancy research as their support provides women with a level of trust and validation of study procedures and intent (Frew et al., 2014). In New Zealand, women generally engage with their desired LMC (usually a midwife) immediately after confirmation of pregnancy, which makes midwives a key strategic partner in early pregnancy

recruiting. However, a critical shortage of midwives and immense time demands rendered midwives in our recruitment area hesitant to provide assistance. Forming strong reciprocal arrangements with LMCs, particularly midwives, would need to be a key focus area in a larger recruitment drive.

Sleep results in this small sample indicate that self-reported sleep duration, quality, timing, continuity and daytime sleepiness remained stable throughout pregnancy. Actigraphically measured sleep also remained stable except for a decrease in sleep duration from the second to the third trimesters suggesting that changes in sleep across pregnancy for most healthy women may not be as great as previous evidence suggests. There is a widely held belief that sleep progressively worsens with gestation, however longitudinal studies that follow women across all three trimesters are limited. With most longitudinal studies focusing only on trimester two and three, it is understandable studies conclude that sleep worsens as pregnancy progresses. However, statements such as “the prevalence of poor sleep was highest in trimester three”, may be misleading when only two out of three trimesters are being examined. Future longitudinal studies, including data on first trimester sleep, may reveal a different story. A recent review by Okun (2019), states that limited longitudinal actigraphic findings show that “*sleep is quite disturbed in the first trimester, modestly improves in the second trimester and progressively worsens by the end of pregnancy*”, and that limited longitudinal studies show that sleep architecture (measured by polysomnography) is not significantly modified throughout pregnancy. Our findings of sleep stability across pregnancy support those of Suzuki et al. (1994), Mindell et al. (2000), Mindell (2015), Skouteris et al. (2008) and Ladyman & Signal (2018).

An alternative explanation of the findings in the present study, is that increased knowledge and better sleep habits over a long period of time could have helped stabilise sleep in our sample at a time when sleep may worsen. In describing successful interventions with parents, Cowan et

al. (1995) notes that ongoing, meaningful relationships for over three months make parents more receptive and the program more successful, as it takes time for parents to experiment and implement new ideas. Similarly, Heinicke et al. (1988) found more successful outcomes for family-focused interventions when they are started early and extended over a minimum of three months. Because we were able to intervene early and throughout pregnancy, women in our study had time to employ specific strategies to guide, reinforce and support positive sleep behaviours at relevant times.

Women are eager for health information when finding out they are pregnant, with over 90% of pregnant women using the internet to source pregnancy-related information (Huberty et al., 2013). Additionally, a systematic review on internet use by pregnant women found they search for pregnancy information most often during the early stages of pregnancy and not unexpectedly, that nulliparous women search more than multiparous (Sayakhot & Carolan-Olah, 2016). A recent review on 27 Australian Government and leading industry websites reported that only two websites included information on sleep during pregnancy but neither communicated evidenced based guidelines (Cannon et al., In press). Alarming, the majority of women perceive the health information they read on the internet to be trustworthy, reliable and useful (Sayakhot & Carolan-Olah, 2016). Pregnant women, who can often find themselves confused and worried about how their actions might affect their baby, are in a no-win situation of either not finding accurate, regulated information or not knowing if the information can be trusted. Hence, evidenced-based sleep health information, such as the education material in *Sleep HAPi*, would prove useful to both mothers and those in maternal healthcare services.

In this study, women with elevated depressive symptoms in early pregnancy had improved by the end of pregnancy and those with minimal depressive symptoms in early pregnancy remained that way throughout pregnancy. This suggests the intervention assisted in averting or

minimising depressive symptoms. Previous research indicates that half of our sample could be expected to have experienced low mood either in pregnancy or postpartum (Jeong et al., 2013), yet none of the intervention group were experiencing low mood at the end of pregnancy and only one woman had persistent low mood in the postpartum. Women in the study may have benefited from an increase in sleep knowledge and consequently had improved ability to deal with the impact of poor sleep, which provided a protective effect. Stability in sleep health over time may also have minimised depressive symptoms. Women's mood may also have benefited from the extra support provided by the research team and the clinical support provided to the four women who were referred for elevated depressive symptoms in their first trimester.

Baiardi et al. (2016) has suggested that "sleep is a black box" for early perinatal depression detection and that early recognition of poor sleep in pregnancy is valuable for developing and implementing interventions in affected women. Okun et al. (2009) postulates that the effects of ongoing poor sleep are cumulative and that this interacts with women's individual vulnerability to depression, concluding that behavioural sleep interventions to improve sleep quality could decrease depression risk. The results from this study support these previous findings, suggesting that if poor sleep can be avoided in early pregnancy, the risk of experiencing depression in later pregnancy may be minimised. It may also be that the women's perception of poor sleep can be altered by moderating their expectations and normalising sleep changes. Either way, the impact of a sleep health intervention would be beneficial.

While these findings suggest a larger study is warranted, the number of measures used could be reduced to minimise both researcher and participant burden. Given that actigraphically measured sleep did not differ between weeks within a trimester, a single 7-day period of recording could be employed. No formal comparisons were made between the various measures used for sleep thus firm recommendation about the use of one measure over another

cannot be made. However, it is important to balance participant burden with information on multiple aspects of sleep which can be obtained from well validated scales such as the PSQI and GSDS. Given the small and homogeneous sample, it is also not appropriate to make decisions about the usefulness of one measure of depression over the other. Further research in the area is warranted.

This study was not without limitations. First, this is a small community-recruited sample which included nulliparous, predominantly socially and financially advantaged women of a similar age, which limits generalisability. While this has methodological benefits for restricting confounders, we cannot determine whether the intervention would be successful for other groups of women. Enrolment was voluntary and women were aware of the intervention's purpose, so positive outcomes may be amplified by their motivation for change or from being a "good participant" (Nichols & Maner, 2008). Data was collected over 18 months and thus seasonality cannot be excluded as a reason for changes in sleep or mental health. A validity study of the BDI and EPDS by Ji et al. (2011) raised concerns about learning effects for both tools in longitudinal studies.

This study also had significant strengths, including the use of both objective and subjective measures of sleep. This is important in sleep research during this life stage as subjective sleep assessments, but not objective measures, have been associated with depressive symptoms (Park et al., 2013; Volkovich et al., 2016). The study also examined multiple sleep dimensions, as described by Buysse (2014) for a comprehensive representation of sleep health. While quality, continuity and duration are well described in the literature, there is mounting evidence for daytime sleepiness and timing (Bei et al., 2010) being important in the sleep-depression relationship. It is therefore necessary that future research considers these multi-faceted associations.

5.6 Conclusion

The findings from the *Sleep HAPi* intervention demonstrate the feasibility of this approach and indicate that a sleep education program shows promise in optimising sleep health and minimising depressive symptoms during pregnancy. However, findings would need to be replicated in a larger study to prove efficacy.

Acknowledgements

We gratefully acknowledge the contribution of the women who participated in the *Sleep HAPi* study, and Dr Margo van den Berg for her statistical support.

Funding

Clare Ladyman is the recipient of a Massey University Doctoral Scholarship.

Declaration of interest statement

The author(s) declare there are no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Data availability statement

The data that support the findings of this study are held at the Sleep/Wake Research Centre, Massey University as required by study's ethical approval. The study has processes in place for collaborating with external parties for the analysis of this data. The data are not publicly available due to ethical constraints.

5.7 Appendix A

5.7.1 Additional sleep measures

Insomnia symptoms were measured by the Insomnia Severity Index (ISI), a 7-item questionnaire validated against sleep diaries and polysomnography, with excellent internal consistency in both population-based and clinical samples (Morin et al., 2011). A cut off score of 10 has been identified to classify insomnia cases in a population-based sample (Morin et al., 2011). An additional measure of sleep disturbance was assessed by the total GSDS score. The GSDS asks about frequency of various poor sleep experiences on a numerical scale of 0 (never) to 7 (every day). It has shown good internal consistency in pregnant women (Cronbach = .81) (K. A. Lee & Gay, 2004).

Other sleep items questioned: reasons for awakenings; getting a comfortable sleep position (nights/wk); frequency of napping (days/wk); frequent snoring (≥ 3 days/wk); frequent breathing pauses (≥ 3 days/wk); frequent leg twitching (≥ 3 days/wk). Restless Legs Syndrome (RLS) was also identified if all four of the following criteria were met: 1) the urge to move the extremities usually accompanied by unpleasant sensations; 2) worse symptoms at night; 3) more noticeable at rest; and 4) relieved by movement.

5.7.1.1 Additional Sleep Measure Results

Scores on the GSDS differed significantly across the study ($F_{(4,55)}=5.27$; $p=0.0012$), with post-hoc tests indicating a change between both T2 and T3 to P2. No significant change in ISI scores were seen. Twenty percent of women reported experiencing RLS at T3, one woman reported frequent snoring at T2 and P2 and two women reported frequent leg twitching at T1 which persisted at T2 and T3 for one woman. Common reasons for waking at different times across the study are shown in table 5.3. Going to the bathroom and feeling too hot or cold remained common at all

pregnancy and postpartum time points. Waking due to discomfort, pain, heartburn, dreams/nightmares and fetal movements were common throughout pregnancy, but not in the postpartum. As expected, common reasons for waking in the postpartum were to feed and care for their baby and baby noise/movement.

Table 5.3 Additional sleep measure results.

	Trimester 1 (n=15)	Trimester 2 (n=15)	Trimester 3 (n=15)	6 Weeks Postpartum (n=14)	12 Weeks Postpartum (n=14)
Other Sleep Measures					
GSDS Total	46.47 ± 10.69	37.47 ± 8.77	42.80 ± 11.23	52.71 ± 8.62	43.43 ± 10.83
ISI Total	9.20 ± 5.71	8.67 ± 4.70	7.67 ± 2.85	8.93 ± 5.92	7.50 ± 5.14
ISI High scorer (≥10)	8 (53)	6 (40)	2 (13)	5 (36)	4 (29)
Comfortable Sleep Position (nights/wk)	5.31 ± 2.21	5.27 ± 1.67	4.53 ± 1.98	5.57 ± 2.03	6.43 ± 1.16
Frequency of Napping (days/wk)	2.07 ± 1.62	1.00 ± 1.00	1.20 ± 1.15	1.93 ± 1.81	1.07 ± 1.00
Restless Legs Syndrome	2 (13)	1 (7)	3 (20)	1 (7)	1 (7)
Frequent Snoring (≥3 days/wk)	0 (0)	1 (7)	0 (0)	0 (0)	1 (7)
Frequent Breathing Pauses (≥3 days/wk)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Frequent Leg Twitching (≥3 days/wk)	2 (13)	1 (7)	1 (7)	0 (0)	0 (0)
Common Reasons for Waking					
Going to the Bathroom	12 (80)	13 (87)	13 (87)	6 (43)	7 (50)
Too Hot/Too Cold	9 (60)	8 (53)	13 (87)	8 (57)	8 (57)
Hungry/Thirsty	9 (60)	6 (40)	9 (60)	4 (29)	4 (29)
Stress/Worry	7 (47)	7 (47)	5 (33)	5 (36)	5 (36)
No Reason	7 (47)	7 (47)	10 (67)	4 (29)	4 (29)
Dreams/Nightmares	7 (47)	7 (47)	4 (27)	1 (7)	1 (7)
Partner	6 (40)	8 (53)	8 (53)	3 (21)	3 (21)
Noise	6 (40)	5 (33)	5 (33)	8 (57)	7 (50)
Uncomfortable	5 (33)	8 (53)	12 (80)	3 (21)	2 (14)
Nasal Congestion	5 (33)	2 (13)	6 (40)	0 (0)	0 (0)
Pets	5 (33)	4 (27)	3 (20)	1 (7)	3 (20)
Pain	3 (20)	4 (27)	10 (67)	1 (7)	2 (14)
Light	3 (20)	5 (33)	1 (7)	1 (7)	3 (20)
Heartburn	0 (0)	1 (7)	6 (40)	0 (0)	0 (0)
Fetal movements	0 (0)	5 (33)	9 (60)		
Baby moving or making noises				14 (100)	12 (86)
Feeding/caring for baby				13 (93)	12 (86)

Results reported as mean & SD or n (%)

6 A PILOT LONGITUDINAL SLEEP EDUCATION INTERVENTION FROM EARLY PREGNANCY AND ITS EFFECT ON OPTIMISING SLEEP AND MINIMISING DEPRESSIVE SYMPTOMS

The following manuscript was prepared by the researcher (Appendix 31) and was published with the journal *Sleep Health* in June 2020. All rights reserved© Ladyman C. I., Signal T. L., Sweeney B. S., Gander P. H., Paine S-J., Huthwaite M.

6.1 Abstract

Objectives: To investigate the efficacy of a pilot longitudinal sleep education program for optimising sleep and minimising depressive symptoms in a sample of nulliparous pregnant women.

Design: Early and longitudinal sleep education intervention pilot study.

Setting: Community-based convenience sample of New Zealand women.

Participants: 15 nulliparous women who were involved in a pilot of a longitudinal sleep education intervention during pregnancy (N=15) were compared to a comparison group (n=76) from another observational study with the same time points. Groups were matched on depression history and parity.

Intervention: A longitudinal sleep education program (*Sleep HAPi*) was developed. Women in the intervention group participated in three individualised and trimester specific education sessions designed to increase sleep knowledge and improve sleep practices. The comparison group received no sleep education.

Measurements: Self-reports of depressive symptoms and five dimensions of sleep (duration, quality, continuity, latency, daytime sleepiness) were compared between groups using linear mixed model analysis of variance.

Results: At the conclusion of the intervention, the intervention group had fewer depressive symptoms with none experiencing clinically significant depressive symptoms, while 21% of the comparison group were considered to have clinically significant depressive symptoms. The intervention group also had better sleep quality, sleep initiation and sleep continuity than the comparison group at late pregnancy.

Conclusions: Findings suggest that a longitudinal sleep education intervention commencing early in pregnancy may be effective in optimising sleep and minimising depressive symptoms for nulliparous women with a history of depression. Further investigation of sleep education interventions to improve maternal mental health in pregnancy and postnatally is warranted.

Keywords: pregnancy, postnatal, depression, sleep, intervention, trimester

6.2 Introduction

Pregnancy is a common time for the manifestation of both depression and poor sleep (Okun, Kiewra, et al., 2011), and their co-occurrence is due to their strong bidirectional relationship (Fang et al., 2019). The adverse obstetric, neonatal (Accortt et al., 2014; Szegda, Markenson, Bertone-Johnson, & Chasan-Taber, 2014), child and adolescent development outcomes (Brunton, 2013; Stein et al., 2014) as well as the economic cost of depression (Bauer, Knapp, & Parsonage, 2016), support the urgent need for longitudinal perinatal research commencing early in pregnancy, and timely interventions to limit or, if possible, prevent the severe and enduring consequences of depression and sleep disturbance in pregnancy (G. Wang et al., 2018). Sleep,

especially in early pregnancy, is increasingly being considered the 'black box' of perinatal depression, holding essential information for the early detection of depressive disorders (Baiardi et al., 2016). Further, sleep is one of the modifiable risk factors for depression, so provides a unique opportunity for behavioural change interventions.

With up to one in five women experiencing clinically significant perinatal depressive symptoms (Marcus et al., 2003), treatments are being increasingly researched, but the availability of safe, cost-effective, readily accessible, non-intrusive and non-pharmacological methods is limited. Mothers may be concerned about the risks to their unborn baby, and clinicians can be confronted with conflicting evidence about the safety of antidepressant use. (Scime, 2016). While it is clear that treating depression results in more favourable outcomes than untreated depression, less than 10% of women consider pharmaceuticals their first choice of treatment (Goodman, 2009) and report anxious and regretful feelings (Bonari et al., 2005) or poor adherence when continuing antidepressant medication during the perinatal period (Boath et al., 2004). Furthermore, in an international review guidelines produced by 13 countries on the use of antidepressant medications in pregnancy, all but one country recommended behavioural interventions before antidepressant use as an initial therapy for mild to moderate depression (Molenaar, Kamperman, Boyce, & Bergink, 2018).

A perinatal review assessing non-pharmacological interventions that aimed to improve sleep to reduce depressive symptoms, showed that behavioural treatments, such as bright light therapy, exercise, yoga, acupuncture and herbal remedies, show trends for improving sleep (Hollenbach et al., 2013). A study by Tomfohr-Madsen et al. (2016) examined aspects of sleep education as an component of their modified Cognitive Behavioural Therapy for Insomnia (CBTi) to treat 15 third trimester women suffering insomnia. Post-intervention measures showed that women in the intervention group had improvement in depressive symptoms and sleep measures, while

also reporting participation in the intervention to be positive. These results support a recommendation from a recent review on perinatal depression interventions by Johansen et al. (2019), who advocates, “*intervention for poor sleep in perinatal women is simply education on good sleep hygiene*”. While women are keen to find information on pregnancy sleep and over 90% of pregnant women using the internet as an information source (Huberty et al., 2013), resources are limited, unregulated, and not always based on empirical information (Cannon et al., In press).

Longitudinal and interventional studies need to be a priority in maternal mood and sleep research. To our knowledge, the current study is the first to explore if a sleep education intervention throughout pregnancy has an impact on the occurrence of depressive symptoms. Such interventions are particularly important for women with a history of depression, as research has consistently shown a depressive history to be the strongest predictor of both antenatal and postnatal depression (Raisanen et al., 2014; Rich-Edwards et al., 2006). While increased efforts have been made to screen, identify and treat women for antenatal or postnatal depression, little intervention research has targeted this sub-group of women, even though the literature indicates that interventions targeting parents who are disproportionately exposed to known risk factor for depression deliver better mental health outcomes (Mihelic et al., 2018).

This paper describes a trial of the *Sleep HAPi* (**Sleep Health and Pregnancy Information**) education intervention, which aimed to minimise women’s depressive symptoms by improving sleep knowledge and managing sleep expectations. The effectiveness of the intervention was evaluated by comparing *Sleep HAPi* (SH) participants with a matched sample of pregnant women from the *E Moe, Māmā: Maternal Sleep in Aotearoa/New Zealand* (EMM) study (Signal et al., 2016) who served as a comparison group. Both groups completed the same measures of sleep and mental health status in the third trimester and at 12 weeks postnatally.

6.3 Participants and methods

Participants for the *Sleep HAPi* pilot study were recruited from the Greater Wellington area or Palmerston North, New Zealand through advertisements in medical centres, midwifery clinics, mental health clinics, hospitals, parent and community centres, libraries, schools, crèches/kindergartens, supermarkets, community fairs, and various social and traditional media channels. Presentations were also given to hospital staff, midwifery groups, Continuing Medical Education (CME) workshops and fertility clinics to encourage medical professionals to refer patients/clients.

Eligible participants completed a screening questionnaire to ensure they met the study criteria, which included having a history of previously diagnosed depression but currently non-symptomatic and medication-free for at least three months prior to study enrolment. Women were at or less than 14 weeks pregnant, nulliparous, had a singleton pregnancy and were at least 16 years of age and proficient in English. They were also required to have a primary health care provider and no children under three years of age living in the home. Participants were excluded if they had a diagnosed sleep disorder, medical condition or mental health disorder (other than depression) known to be associated with sleep abnormalities.

Data were collected from February 2017 to December 2018. All women who agreed to participate reported being of sole New Zealand European ethnicity. By 36 weeks gestation, participants in the *Sleep HAPi* intervention group had completed three one-on-one face-to-face sleep education sessions (one in each trimester) which included assessments of their own sleep and depressive symptoms. They also completed two post-intervention assessments: one at six weeks postnatal and one at 12 weeks postnatal.

The intervention group were matched to a group of pregnant women from the *E Moe, Māmā* cohort study who were also nulliparous, had a history of diagnosed depression, were of sole New Zealand European ethnicity with a singleton pregnancy (n=76). The EMM study surveyed a community sample of 1057 women during their third trimester of pregnancy (mean 36 weeks gestation) and at 12 weeks post birth. Data was collected from October 2009 to October 2011. Details of the recruitment process for EMM are described elsewhere (Signal et al., 2016). Both studies were conducted by the Sleep Wake Research Centre using identical questions, cut off scores, and data entry and analysis processes. If participants in either group had elevated depressive symptoms, or thoughts of self-harm, the protocol response was for the researchers (with the participants' consent) to provide a letter to their doctor or maternity health care provider.

Self-reported depressive symptoms and five dimensions of self-reported sleep data collected at 36 weeks gestation and 12 weeks postnatal were compared between the two groups.

6.3.1 Sleep HAPi study design

The *Sleep HAPi* study design is shown in figure 6.1.

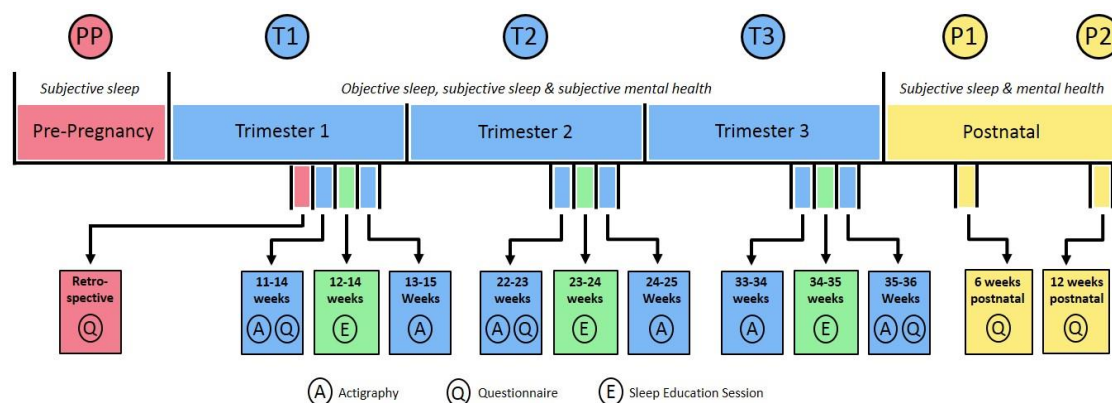


Figure 6.1 *Sleep HAPi* study design

The *Sleep HAPi* intervention was developed by the study researchers and aimed at increasing women’s understanding of the benefits of good sleep and consequences of poor sleep, practices and factors that either promote or hinder sleep as well as ‘normalising’ the sleep changes experienced in pregnancy and improving overall sleep health practices. The sleep education material covered three main sleep topics: 1) general sleep and circadian information; 2) how and why sleep changes in each trimester; and 3) trimester-specific sleep support strategies. Further information about session topics can be requested from the authors. To enhance the application of theoretical principles and create greater self-awareness of sleep behaviour and patterns, each woman also received feedback on their own actigraphy and self-reported data (actigraphy data are reported elsewhere).

The education sessions in each trimester were scheduled at times and places convenient to the women (homes, cafés, community libraries, university meeting spaces), and were one-on-one and face-to-face. Printed information was presented in a folder that allowed subsequent

trimester information and actigraphy printouts to be progressively added, creating a comprehensive and personalised 'Sleep in Pregnancy' booklet (52 pages in total). Sessions were approximately one to one and a half hours in trimester one, and 45-60 minutes in trimesters two and three. There was no expectation that all of the information and advice would be used by all women, rather that they would have a 'tool kit' of knowledge they could use when necessary.

Over a 12-month period from February 2017 to February 2018, 52 women responded to recruitment advertisements, 22 were screened and accepted into the study. Seven withdrew resulting in 15 participants completing the study. One woman was lost to follow up after the intervention was completed.

6.3.2 Measures

Women in both the intervention and comparison groups completed paper-based questionnaires which collected sleep, mood, demographic and general health information using identical questions at 36 weeks gestation and 12 weeks postnatal.

6.3.2.1 Sleep Measures

Buysse's (2014) 'Sleep Health' principles underpinned the selection of measures used to assess sleep. This approach considers sleep as a multidimensional model that "*promotes physical and mental well-being*". We investigated four of Buysse's (2014) five sleep health dimensions: quality, quantity, continuity, and daytime sleepiness. The fifth sleep dimension, sleep timing, was not available for the comparison group, and instead data on sleep onset insomnia were included in analyses.

Self-reported sleep duration was measured at each time point by the question “How many hours sleep, including naps, do you usually get in 24 hours?”. Sleep quality, latency and continuity were assessed using the relevant General Sleep Disturbance Scale (GSDS) subscales which have been demonstrated to be valid and reliable in multiple studies of childbearing women (K. A. Lee & Gay, 2004). Each item in the GSDS was rated from 0 (never) to 7 (every day) and if a subscale is comprised of two or more items, the mean was calculated. Sleep quality was assessed using the GSDS Quality Subscale items; “How often in the last week did you feel rested upon awakening at the end of a sleep period?”, “How often in the last week did you sleep poorly?” and “How often in the last week did you feel satisfied with the quality of your sleep?”. The first and last items are reversed scored. In this sample, Cronbach’s alpha was 0.89 (36 weeks gestation) and 0.85 (12 weeks postnatal). Sleep latency was assessed using the GSDS Onset Insomnia Subscale item; “How often in the last week did you have difficulty getting to sleep?”. Sleep continuity was measured by the GSDS Maintenance Insomnia Subscale items; “How often in the last week did you wake up during your sleep period?” and “How often in the last week did you wake up too early at the end of your sleep period?”. Daytime Sleepiness was measured by the Epworth Sleepiness Scale (ESS). The ESS assesses daytime sleepiness in eight everyday situations using the question “How likely are you to doze off in the following situations, in contrast to feeling just tired...?”. The ESS has been deemed reliable and valid for use in pregnant populations (Baumgartel et al., 2013) and excessive daytime sleepiness is typically defined as a total score ≥ 10 (Johns, 1991). In this sample, Cronbach’s alpha was 0.75 (36 weeks gestation) and 0.70 (12 weeks postnatal).

6.3.2.2 Mental Health Measures

Depressive symptoms were measured by the 10-item Edinburgh Postnatal Depression Scale (EPDS), with scores at or above 13 considered clinically significant (Cox et al., 1987). Women selected a response that described how they felt over the past seven days on ten items. The EPDS has been validated as a screening tool, and used internationally to detect depressive symptomatology in the perinatal period (Kozinszky & Dudas, 2015). While the EPDS was originally developed to be a unitary measure of (postnatal) depression, it has also been found to have a distinct 2-factor structure used to identify probable anxiety and/or depression disorders, via a depression subscale (EPDS-7D; items 1, 2, 6, 7, 8, 9 & 10) and an anxiety subscale (EPDS-3A items 3, 4 & 5) (Jane Phillips et al., 2009). In this sample, Cronbach's alpha for the EPDS total score was 0.85 (36 weeks gestation) and 0.76 (12 weeks postnatal), for the EPDS depression subscale it was 0.82 (36 weeks gestation) and 0.75 (12 weeks postnatal), and for the EPDS anxiety subscale it was 0.82 (36 weeks gestation) and 0.68 (12 weeks postnatal).

6.3.2.3 Demographic, Health and Lifestyle Measures

Participants provided information on age, gestational age, parity, ethnicity, history of diagnosed depression, pre-pregnancy height and weight to compute body mass index (BMI), requiring assisted reproductive technology to become pregnant, planned pregnancy and current work commitments (including currently working; hours of work; employed in shiftwork, defined as working for pay, profit or income for at least three hours between the hours of midnight and 5am) at 36 weeks gestation.

6.3.2.4 Statistical Analysis

Descriptive statistics (means, standard deviations, proportions) were calculated in SPSS (version 25, IBM SPSS Statistics for Windows, Armonk, NY). Linear mixed model analysis of variance was

conducted using SAS (version 9.4, SAS Institute Inc., Cary, NC) to compare sleep and depressive symptoms between intervention and comparison groups. Covariates in the models at both 36 weeks gestation and 12 weeks postnatal were: maternal age; relationship happiness (8 point scale [range 0-7] where <3 signifies greater happiness, ≥ 3 signifies less happiness or not applicable); and stressful life events (measured by the 13-item Pregnancy Risk Monitoring System Stressful Life Events (PRAMS SLEs), where low stress was considered <2 stressors, and high stress ≥ 2 stressors). The Kenward-Roger adjustment was applied to the degrees of freedom estimation (Littell et al., 2007). Normality, linearity and constant variance assumptions were visually checked and the Shapiro-Wilk test used to assess the distribution of the residuals (Tabachnick & Fidell, 2012). When continuous measures met distributional assumptions of normality, t-tests were used to test group differences; otherwise, the nonparametric Mann-Whitney U test was used. Where outlying residual values were identified in the linear mixed models, the model was re-run without the outlier(s). If removing the outlier(s) altered the findings of the model, the reported results exclude the outlier(s), otherwise the results are reported including the outlier(s). Post-hoc t-tests were used to investigate comparisons of interest where main effects were statistically significant. Bonferroni's adjusted p -values were calculated for post-hoc tests. A 2-sided p -value of <0.05 was considered significant.

6.3.2.5 Ethical approval

Sleep HAPi was approved by the Massey University Human Ethics Committee: Human Ethics Southern A Committee (SOA 16/29) and the Australian and New Zealand Clinical Trials Registry (ACTRN12617000055303). *E Moe, Māmā* was approved by the Central Health and Disability Ethics Committee (CEN/09/09/070/AM05).

6.4 Results

6.4.1 Sample characteristics

Complete data sets were available for 15 women at 36 weeks gestation and 14 women at 12 weeks postnatal in the intervention study. Complete data sets were available for 76 women in the comparison study. In both studies, all women were nulliparous, sole New Zealand European, had a history of depression and a singleton pregnancy. As illustrated in table 6.1, the intervention and comparison groups were similar on most demographic and sleep characteristics, only differing in their current work status and requiring ART to become pregnant.

6.4.2 Sleep characteristics

As illustrated in Figure 6.2, univariate analyses show that in late pregnancy, the intervention group had significantly better measures of sleep quality ($p=0.017$) (Figure 6.2, panel B), sleep continuity ($p=0.017$) (Figure 6.2, panel C) and sleep latency ($p=0.001$) (Figure 6.2, panel D) compared to the comparison group, but no significant differences were seen for sleep duration (Figure 6.2, panel A) or daytimes sleepiness (Figure 6.2, panel E). At the postnatal time point, the intervention group were significantly better on the measure of sleep latency ($p=0.010$) (Figure 6.2, panel D), but no differences were observed for other sleep dimensions.

Table 6.1 Sample characteristics.

	36 Weeks Gestation Mean & SD or n (%)			12 Weeks Postnatal Mean & SD or n (%)		
	Intervention (SH) (n=15)	Control (EMM) (n=76)	<i>p</i> value	Intervention (SH) (n=14)	Control (EMM) (n=76)	<i>p</i> value
Maternal Age	31.95 ± 5.20	31.36 ± 5.13	0.683			
Family History of Mood Disorder	12 (80)	50 (66)	0.243			
Pregnancy						
Gestation (weeks)	36.13 ± 0.51	35.85 ± 0.89	0.098			
Planned Pregnancy	13 (87)	57 (75)	0.297			
Assisted Reproductive Technology	5 (33)	6 (8)	0.016			
Infant Age (weeks)				12.29 ± 0.46	12.01 ± 0.88	0.114
BMI	24.11 ± 3.09	25.36 ± 5.54	0.236			
Work Status						
Currently Working	7 (47)	58 (76)	0.020	1 (7)	2 (0)	0.400
Hours of Work (of those working)	39.07 ± 1.64	36.73 ± 11.52	0.596	10 ± 0.00	6.5 ± 2.12	0.377
Night worker [#]	0 (0)	2 (3)	0.789	0 (0)	0 (0)	
Partner Relationship						
Happy	13 (80)	66 (87)	0.431	10 (71)	60 (83)	0.378
Unhappy	1 (7)	7 (9)		3 (21)	11 (15)	
Not Applicable	1 (7)	1 (1)		1 (7)	1 (1)	
PRAMS SLEs						
≥2	6 (40)	32 (42)	0.880	3 (21)	33 (43)	0.148

[#] Worked for pay, profit or income for at least 3 hours between the hours of midnight and 5am.

BMI = Body mass index. PRAMS SLEs = Pregnancy Risk Assessment Monitoring System Stressful Life Events

SH = Sleep HAPi, EMM = E Moe, Māmā

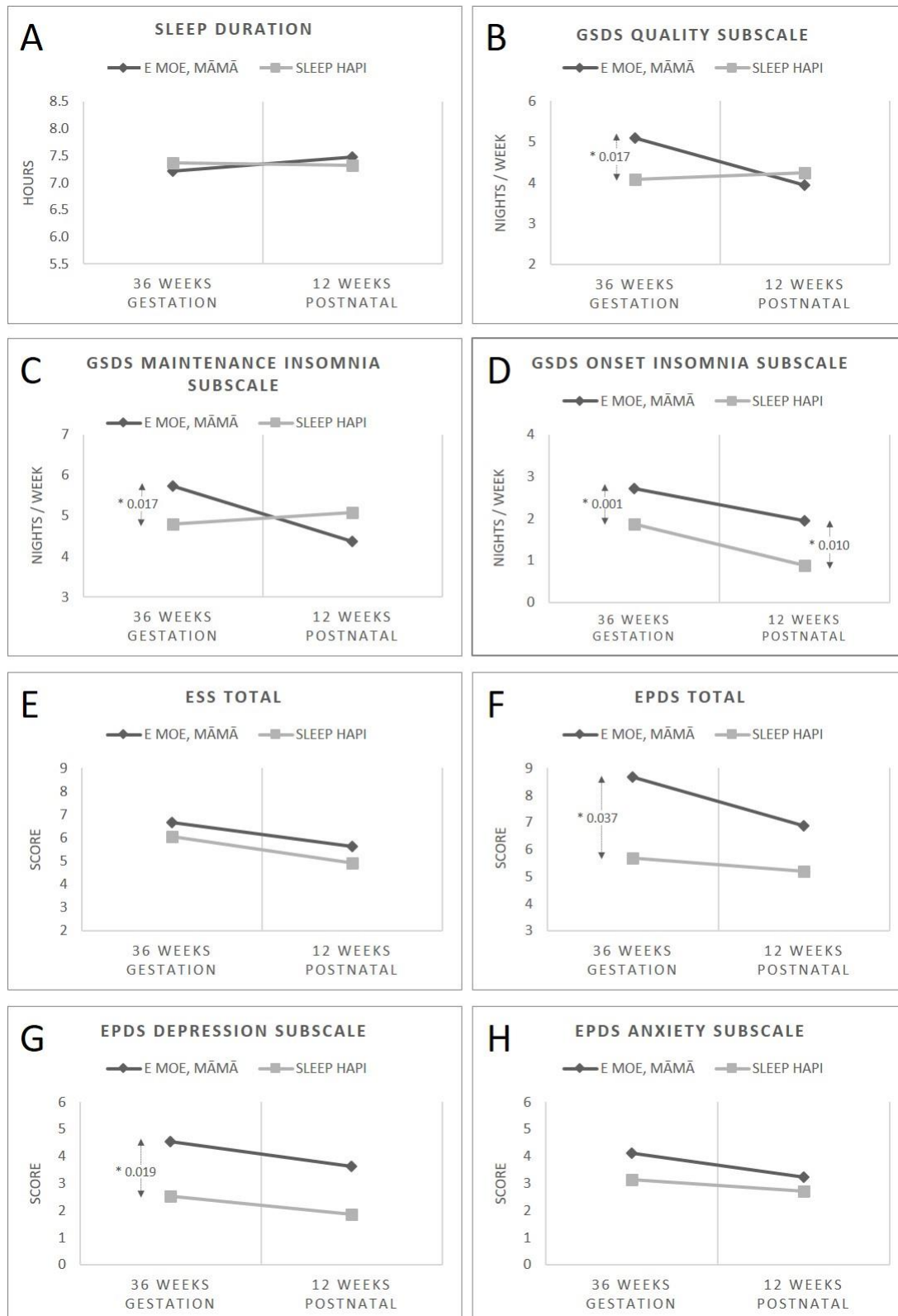


Figure 6.2 Univariate analyses of sleep and depressive symptoms. GSDS = General Sleep Disturbance Scale, ESS = Epworth sleepiness Scale, EPDS = Edinburgh Postnatal Depression Scale.

Linear mixed model results are described in Table 6.2. For sleep latency, linear mixed models showed a significant main effect of group ($F_{(1,86)}=16.06$; $p=0.000$) and time ($F_{(1,88)}=5.86$; $p=0.018$), indicating that the intervention group had fewer difficulties falling asleep at both time points and all women had less difficulty falling asleep at the postnatal time point. The covariates of maternal age ($F_{(1,86)}=16.06$; $p=0.000$) and stressful life events ($F_{(1,86)}=16.06$; $p=0.000$) were also significant, with younger women and women with fewer stressful life events having more nights per week where they had difficulty falling asleep.

In the models for daytime sleepiness, there was a significant main effect of time ($F_{(1,85)}=7.02$; $p=0.010$), but no group or interaction effect, indicating that women reported being less sleepy postnatally compared to late pregnancy.

The models for sleep quality and continuity showed a time-by-group interaction ($F_{(1,84)}=4.17$; $p=0.044$ and $F_{(1,85)}=6.28$; $p=0.014$ respectively), with post-hocs showing that the comparison group had improvements in sleep quality ($p<.0001$) and continuity ($p<.0001$) from pregnancy to postnatal. There were no differences between groups at either time point. Women with greater relationship satisfaction had better sleep quality ($F_{(1,85)}=7.23$; $p=0.008$) and fewer nights per week where they woke early or during their sleep ($F_{(1,85)}=4.22$; $p=0.042$). Maternal age was also significantly associated with sleep continuity, with younger women having more nights per week where they woke early or during their sleep ($F_{(1,91)}=4.47$; $p=0.037$).

For sleep duration, linear mixed models showed no main effect or interaction effects for group and time. However, relationship satisfaction was independently associated with this aspect of sleep ($F_{(1,85)}=8.42$; $p=0.004$), such that women who reported greater relationship happiness also reported longer sleep durations.

Table 6.2 Linear mixed model analysis of variance results.

	Late Pregnancy Mean & SD or n (%)			Postnatal Mean & SD or n (%)			Group Intervention vs Comparison	Timepoint Late Pregnancy vs Postnatal	Interaction Timepoint * Group	Significant Covariate
	Intervention (n = 15)	Comparison (n = 76)	p value	Intervention (n = 14)	Comparison (n = 76)	p value				
Duration										
Sleep Duration (hours)	7.37 ± 0.93	7.22 ± 1.55	0.399	7.33 ± 1.49	7.48 ± 1.23	0.467	F _(1,85) =0.07 p=0.793	F _(1,87) =3017 p=0.078	F _(1,86) =0.46 p=0.500	Relationship F_(1,167)=8.42 p=0.004
Quality										
Good Nights Sleep (nights/wk)	3.33 ± 1.18	2.26 ± 1.91	0.024	2.71 ± 2.13	3.42 ± 2.37	0.302	F _(1,86) =0.40 p=0.527	F _(1,88) =0.77 p=0.381	F _(1,87) = 4.79 p=0.031	None
GSDS Total	45.87 ± 12.59	65.84 ± 15.96	0.000	44.93 ± 19.40	51.97 ± 18.98	0.431	F_(1,84)=11.38 p=0.001	F_(1,85)=5.75 p=0.019	F_(1,84)=6.81 p=0.011	Relationship - F_(1,165)=8.94 p=0.003
GSDS Quality Subscale (nights/wk)	4.09 ± 1.70	5.09 ± 1.79	0.017	4.24 ± 2.10	3.94 ± 2.01	0.573	F _(1,84) =1.00 p=0.321	F _(1,85) =3.91 p=0.051	F_(1,84)=4.17 p=0.044	Relationship - F_(1,166)=7.23 p=0.008
Continuity										
GSDS Maintenance Insomnia Subscale (nights/wk)	4.80 ± 1.42	5.73 ± 1.41	0.017	5.07 ± 2.4	4.36 ± 2.25	0.214	F _(1,88) =0.02 p=0.882	F _(1,90) =1.34 p=0.251	F_(1,89)=6.28 p=0.014	Relationship - F_(1,160)=4.22 p=0.042; Age - F_(1,91)=4.47 p=0.037
Daytime Sleepiness										
ESS Total	6.07 ± 3.90	6.68 ± 3.80	0.575	4.93 ± 4.39	5.63 ± 3.81	0.539	F _(1,85) =0.50 p=0.483	F_(1,85)=7.02 p=0.010	F _(1,83) =0.04 p=0.848	None
Latency										
GSDS Onset Insomnia Subscale (nights/wk)	1.87 ± 1.55	2.71 ± 2.13	0.001	0.87 ± 0.83	1.94 ± 1.79	0.010	F_(1,86)=16.06 p=0.000	F _(1,89) =1.87 p=0.175	F _(1,88) =0.39 p=0.536	Age - F_(1,92)=6.86 p=0.010; PRAMS - F_(1,145)=4.92 p=0.028
EPDS Score										
Mean (Total)	5.67 ± 3.37	8.67 ± 4.95	0.037	5.21 ± 3.38	6.86 ± 4.03	0.206	F_(1,84)=5.12 p=0.026	F_(1,86)=10.35 p=0.002	F _(1,85) =1.14 p=0.288	Relationship - F_(1,169)=6.11 p=0.014
Highscorer (Total) (≥13)	0 (0)	16 (21)	0.042	1 (7)	9 (12)	0.516				
Mean (Depression Subscale)	2.53 ± 1.87	4.55 ± 3.24	0.019	2.50 ± 2.25	3.63 ± 2.96	0.255	F_(1,85)=5.18 p=0.025	F_(1,87)=6.20 p=0.015	F _(1,86) =0.98 p=0.326	Relationship - F_(1,169)=8.97 p=0.003
Mean (Anxiety Subscale)	3.13 ± 4.84	4.12 ± 2.36	0.182	2.71 ± 2.02	3.22 ± 1.79	0.299	F _(1,84) =2.53 p=0.115	F_(1,86)=8.74 p=0.004	F _(1,85) =0.54 p=0.464	None

GSDS = General Sleep Disturbance Scale, ESS = Epworth Sleepiness Scale, EPDS = Edinburgh Postnatal Depression Scale, PRAMS = Pregnancy Risk Monitoring System

6.4.3 Depressive symptoms

In late pregnancy, univariate analyses (Figure 6.2) show that the intervention group had significantly fewer depressive symptoms ($p=0.037$) (Figure 6.2, panel F), compared to the comparison group. This was also evident in the number of women scoring at or above 13 on the EPDS (indicating probable depression), with 21% of the comparison group having clinically significant depressive symptoms, compared to none of the intervention group ($\chi^2=0.042$). A significant difference was seen between the two groups on the depression subscale ($p=0.019$) (Figure 6.2, panel G), but not the anxiety subscale ($p=0.182$) (Figure 6.2, panel H).

These differences in EPDS scores were also evident in the linear mixed modelling results (Table 6.2). There was a significant main effect of group ($F_{(1,86)}=5.12$; $p=0.026$) and time ($F_{(1,86)}=10.35$; $p=0.002$) but no interaction effect, illustrating that the intervention group experienced fewer depressive symptoms at both time points, although depressive symptoms in both groups reduced over time. This pattern was also seen in the EDPS depression subscale, with a main effect of group ($F_{(1,86)}=5.18$; $p=0.025$) and time ($F_{(1,86)}=6.20$; $p=0.015$) but no significant interaction effect. Women who reported greater satisfaction with their relationship also lower scores on the EPDS total score ($F_{(1,169)}=6.11$; $p=0.014$) and depression subscale ($F_{(1,169)}=8.97$; $p=0.003$).

There was a significant main effect of time for the EPDS anxiety subscale ($F_{(1,85)}=8.74$; $p=0.004$), but no group or interaction effect, indicating that anxiety levels improved between late pregnancy and early postnatal across both groups.

6.5 Discussion

This pilot study sought to determine if a longitudinal sleep education intervention for women with a history of depression throughout pregnancy was effective in optimising sleep and minimising women's depressive symptoms. At the end of pregnancy, the intervention group had significantly fewer depressive symptoms than the comparison group and none of the intervention group had EPDS scores representative of clinically significant depression, compared to 21% of the comparison group. This is particularly pertinent considering that women with a history of depression are twice as likely to experience a relapse in pregnancy (Robertson et al., 2004). The differences between groups remained significant after controlling for age, relationship satisfaction and stressful life events. These preliminary findings suggest that a longitudinal sleep education intervention that spans pregnancy may assist women at risk of depression to remain healthy.

The findings support well-evidenced reciprocal relationships between sleep and depressive symptoms (Lawson et al., 2015). In addition to having significantly fewer depressive symptoms, the intervention group also experienced significantly better sleep quality, continuity and sleep initiation (latency) in late pregnancy compared to the comparison group, although only sleep initiation remained significant after controlling for covariates. Previous research has shown that mothers who find it easier to fall asleep also experience fewer depressive symptoms in both pregnancy (Dørheim et al., 2012) and after birth (Marques et al., 2011).

We posit that though poor sleep may be unavoidable for some women in pregnancy, having an understanding of the expected sleep changes and having strategies to counter some of the adverse effects of these changes could enhance a woman's ability to respond and increase their capacity to accept the changes. Felder et al. (2018) suggests that individuals could be less psychologically impacted if they have decreased cognitive and emotional reactivity and

increased acceptance of difficult sleep experiences. Information provided in the intervention focused on the importance of consistent sleep times, prioritising sleep and strategies for greater sleep continuity. This too could have contributed to a greater stability in sleep, which in turn could attenuate the impact of depression. Women's mood may also have benefited from the extra support provided by the research team and/or the clinical support they received when referred (n=4 from the intervention group, n=16 in the comparison group).

Most of the differences between groups did not persist at 12 weeks postnatal. It is possible that the positive effects of the sleep education weakened over time, however patterns of sleep and depressive symptoms in the intervention group appear to remain stable or improve from late pregnancy to early postnatal. The comparison group demonstrated greater improvement on some aspects of sleep and depressive symptoms from late pregnancy to 12 weeks postnatal which may be a reflection of the usual change in sleep across this timeframe, though it is important to note that these improvements may not be linear. Another explanation may be that although both groups were referred to their doctor or maternity health care provider if there was evidence of thoughts of self-harm or elevated depressive symptoms, the six months of early and continued engagement of women in the intervention group may have contributed to the stabilisation and/or improvement in sleep and depressive symptoms at the late pregnancy time point.

Relationship dissatisfaction has been reported to be associated with poorer sleep (Kent, Uchino, Cribbet, Bowen, & Smith, 2015) and depressive symptoms (S. W. Whitton & Whisman, 2010). Similarly, in the present study sleep duration, sleep quality and sleep continuity and depressive symptoms were significantly associated with women reporting less happiness in their partner relationship. Younger maternal age was also associated with poorer sleep quality and more nights per week where women woke early or during their sleep. Unexpectedly, women with

greater life stressors had fewer nights per week where they had difficulty getting to sleep. While it is difficult to explain this finding, it may be these women are experiencing greater fatigue in late pregnancy or early postnatal and therefore have less difficulty with sleep latency than other aspects of sleep throughout this time period.

In this study, the homogeneity between groups, especially when considering key risk factors for perinatal depression (history of diagnosed depression (individual and family), parity, age, BMI, planned pregnancy), is a novel strength. However, the uniqueness of the sample also limits the generalisability to other populations, particularly when considering Indigenous New Zealand Māori women, who are known to have poorer sleep and greater severity and prevalence of mental health problems than women of New Zealand European ethnicity (Paine & Gander, 2013). Other study limitations include a study design that did not involve random assignment, but instead made use of a matched comparison group from another study, and thus observed differences may be due to unidentified differences that were not controlled between groups. A blinded con-current control group is necessary to provide a more robust evaluation of intervention effectiveness. This intervention was a pilot study and the testing of intervention feasibility and acceptability and results are described in detail elsewhere. Participation in the sleep education intervention was voluntary and required women to approach the study team at enrolment. Participants were thus aware of the intervention and may have included those with existing concerns about sleep and who were particularly motivated to improve their sleep. However, since the intervention group experienced better sleep and fewer depressive symptoms, this would only amplify the efficacy of the intervention.

Sleep measures were based on self-reported questionnaires that require women to subjectively evaluate their sleep and thus are open to recall bias. While it has been suggested that those experiencing depression may be less accurate in perceiving their sleep (Rotenberg, Indursky,

Kayumov, Sirota, & Melamed, 2000), others have argued that subjective evaluations of sleep are more highly associated with depressive symptoms (Coo, Milgrom, & Trinder, 2014), thus it is unclear if women experience altered sleep perceptions or actual sleep disruption. Stability in sleep timing and symptoms of sleep disorders were not considered in this analysis, and both have been found to be associated with women experiencing depressive symptoms in pregnancy (Signal, 2019, October). The identification of depressive symptoms was assessed using a well validated self-report measure (EPDS) and not clinical interview, so it is unclear how many women would receive a diagnosis of depression. For informed consent and ethical approval, the intervention group were required to be antidepressant medication free for three months prior to study commencement. This was not a criteria for the comparison group. Furthermore, antidepressant and sleep medication use were not controlled for during the data collection period. Both limitations may confound results.

The study also has several strengths. While sleep education interventions are limited (with many concentrating on the early postnatal period, typically focussed on infant sleep), this is the first study of its kind to implement a longitudinal sleep education intervention throughout all trimesters of pregnancy. The intervention was designed to capitalise on a life stage where change is great, but women are generally amenable to testing new patterns of behaviour especially as they are motivated to improve their health for the benefit of their child. Pinquart & Teubert's (2010) meta-analysis of preventive parenting education programs concluded that ideally, intervention length should be three to six months with commencement before problems develop. The 6-month intervention in this study not only provided women with the opportunity to learn about sleep and sleep changes in pregnancy, but also allowed for implementation and practice of various sleep strategies. The value of this approach is supported by Brown et al. (2002) who showed that practicing good sleep habits, instead of just having the knowledge, was strongly related to good overall sleep quality. Furthermore, it has been shown that women

want early, tailored and realistic education delivered in a relevant, timely manner, but not so far in advance that it becomes overwhelming (Entsieh & Hallström, 2016; Verbiest et al., 2018). This concept is advocated in two pregnancy sleep interventions by Lee et al. (K. A. Lee & Gay, 2017; K. A. Lee et al., 2016) who has also suggested early, rather than late gestational intervention.

An additional strength of the study was that cut off scores on the EPDS indicate major or probable clinical depression, rather than just mild, transient or possible depression (Cox et al., 1987; Khanlari et al., 2019). This study also utilises Buysse's (2014) sleep health model and assesses multiple dimensions of sleep, endorsing Paulson & Miller-Graff's (J. L. Paulson & Miller-Graff, 2019) recent proposal that various sleep dimensions, or more importantly combinations of dimensions, are more predictive of mood changes at particular time points in pregnancy.

6.6 Conclusion

This pilot study demonstrates that longitudinal sleep education may be effective in optimising sleep and minimising depressive symptoms for nulliparous pregnant women with a history of depression, a sub-population that has been surprising under-researched in intervention studies considering the strength of findings linking history of depression with perinatal depression relapse. Our findings support the current impetus and recommendation for sleep education in pregnant women.

Acknowledgements

We gratefully acknowledge the contribution of the women who participated in the *Sleep HAPi* and *E Moe, Māmā* studies, and Dr Margo van den Berg for her statistical support. We would also like to thank the *E Moe, Māmā* localities for supporting promotion of the study and assisting with participant recruitment; Ms Monique Priston, Prof Kathryn Lee, Dr Alexander Smith, the research assistants and the *E Moe, Māmā* study advisory group for their advice, support and roles in enabling the *E Moe, Māmā* study.

Funding

The author(s) disclose receipt of the following financial support for the research, authorship, and/or publication of this article: Clare Ladyman is the recipient of a Massey University Doctoral Scholarship. The *E Moe, Māmā* study was supported by the Health Research Council of New Zealand, grant numbers 09/255 and 08/547.

Declaration of interest statement

The author(s) declare there are no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Data availability statement

The data that support the findings of this study are held at the Sleep/Wake Research Centre, Massey University as required by study's ethical approval. The study has processes in place for collaborating with external parties for the analysis of this data. The data are not publicly available due to ethical constraints.

7 DISCUSSION

Healthy sleep is rapidly becoming recognised as one of the three key pillars of health; of equal importance to a nutritious diet and regular exercise. Healthy sleep across adulthood is an important predictor of longevity and wellbeing, while poor sleep is related to an increased all-cause mortality, and associated with an extensive list of disease and disorder, including heart disease, cancer, diabetes and mood disorders (Bertisch et al., 2018; Grandner, Hale, Moore, & Patel, 2010; Rod et al., 2011; Yin et al., 2017). This thesis has focussed on evaluating the relationship between sleep and depression across pregnancy (figure 7.1). The strong bi-directional relationship between sleep and depression is crucial in pregnancy, which is generally considered a time when sleep disruption is common. Poor sleep and depression are related to many well-established risk factors for adverse pregnancy, fetal and child outcomes.

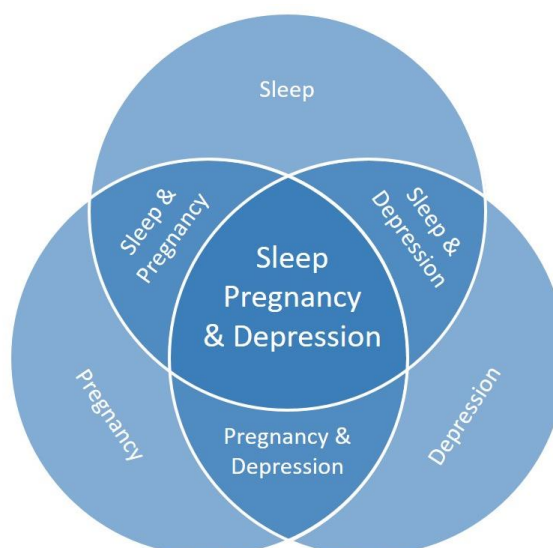


Figure 7.1 Sleep, depression and pregnancy interactions

Chapter 1 highlighted important gaps in the current literature. There is a lack of understanding of normal sleep characteristics throughout pregnancy; a shortage of research on sleep and depression in the first trimester and longitudinally throughout pregnancy; a paucity of literature investigating the longer term patterns of maternal sleep health and depression extending beyond 12 months after childbirth, although the limited longitudinal studies indicate chronic patterns of depression continuing many years past birth for some women; insufficient evidenced based pregnancy sleep information available to women and healthcare providers; and a shortage of interventions that attempt to prevent or minimise depression by normalising and optimising sleep in pregnancy.

Thus, the research in this thesis aimed to investigate the relationships between sleep and depressive symptoms throughout an extended perinatal period, from early pregnancy to three years post birth and was prompted by three research questions.

1. What does sleep health look like for healthy women in each trimester of pregnancy?
2. Do patterns of depressive symptoms persist from late pregnancy to three years post birth and is this related to sleep?
3. If there is an association between sleep and depressive symptoms, will an intervention optimising sleep throughout pregnancy help women to reach late pregnancy with minimal depressive symptoms?

To answer these questions, three separate studies were undertaken. Study 1 was a scoping review exploring what normal sleep looks like for pregnant women (Chapter 3). Study 2 examined the time course of depressive symptoms from late pregnancy to three-year post birth (Chapter 4), and Study 3 assessed the feasibility, acceptability (Chapter 5) and efficacy (Chapter 6) of an early intervention aimed at minimising depression symptoms throughout pregnancy.

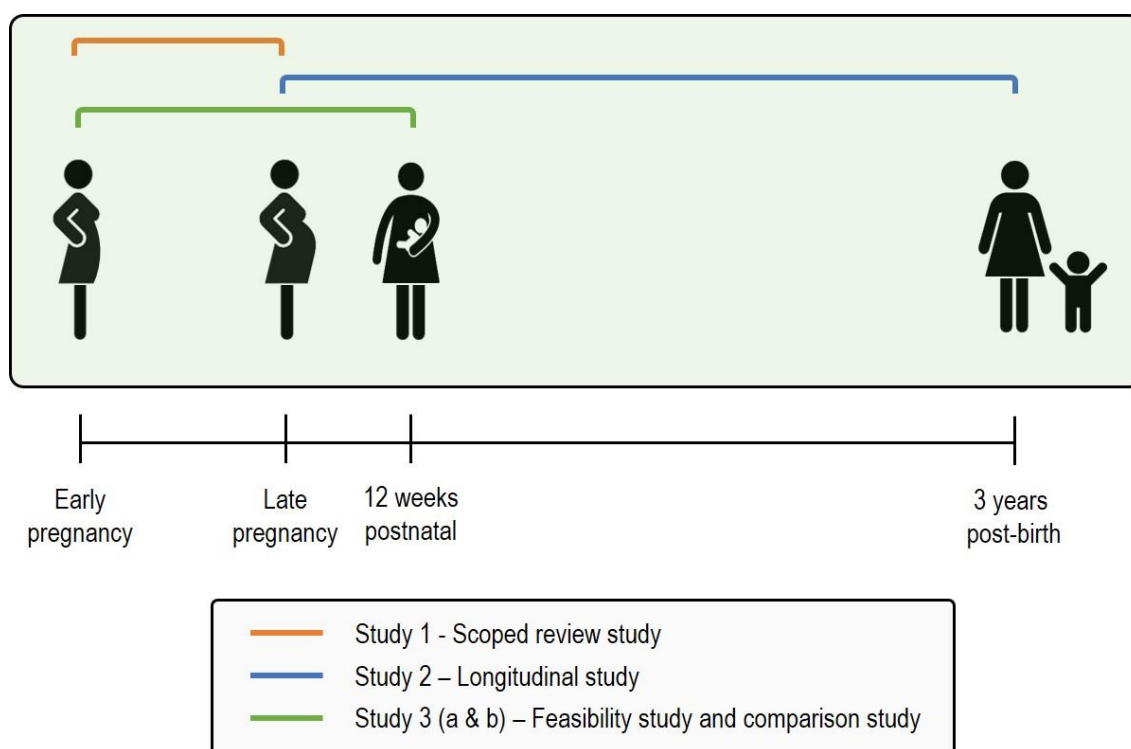


Figure 7.2 Theses study design.

The Sleep Health conceptual model identified by Buysse (2014) is a common thread throughout the studies and provides a comprehensive representation of the multi-dimensionality of sleep. Sleep is a complex physiological process and cannot be portrayed by a single measure. As described by Paulson & Miller-Graff (2019), it may be that various sleep dimensions, or more importantly combinations of dimensions, are more predictive of mood changes at particular time points in pregnancy. Though previous maternal sleep research has suggested that sleep quality is a dimension of sleep closely related to depressive symptoms (Bei et al., 2010; Dørheim et al., 2009; Huang et al., 2004), this research has emphasised the complexity of sleep and suggests there are the numerous ways in which it may be associated with mental health.

7.1 Contribution to the Literature

Key findings, clinical implications and future research recommendations from studies 1, 2 and 3 are summarised in figure 7.3, and discussed below.

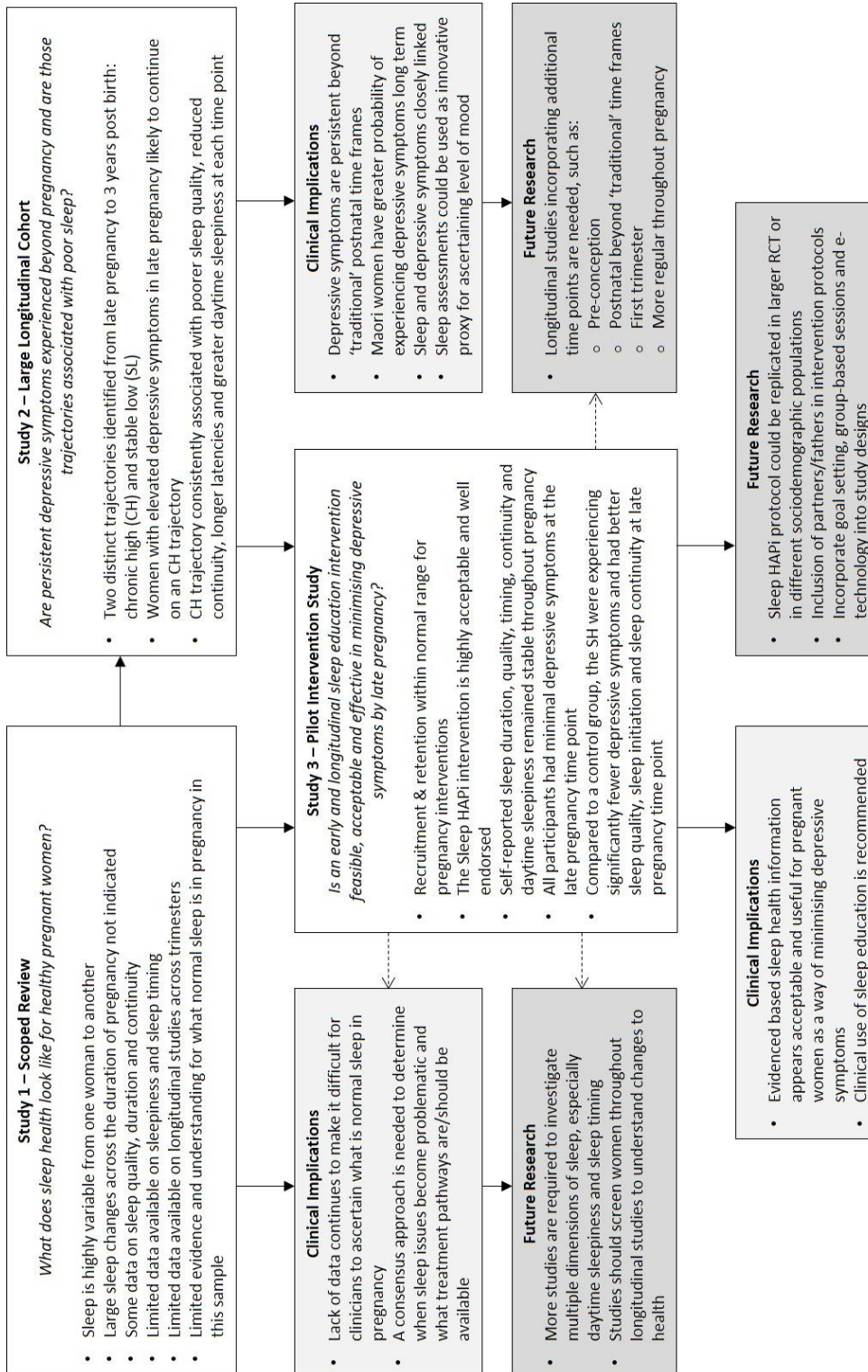


Figure 7.3 Summary of key findings, clinical implications and future research recommendations.

7.2 Key Findings

7.2.1 Study 1 – Scoped review

Developing the concept of sleep as a health asset, the Scoped Review in Chapter 3 focussed on examining “what sleep health looks like for pregnant women”. Thus the 24 studies included in the review had all excluded women who had mood, sleep or pregnancy complications, or pregnancy-related health issues.

There were three main findings for this subsample of healthy women. First, although sleep in pregnancy is highly variable among woman, these studies did not find significant changes to sleep throughout pregnancy. Although it is widely considered that pregnancy is a risk factor for poor sleep, this might not be the case for all women, although comparisons with pre-pregnancy sleep would need to be examined to confirm this. There has also been a broad over-generalisation that sleep quality declines as pregnancy progresses, but the lack of trimester one studies limits this conclusion. Additional longitudinal studies that include women in trimester one are needed to accurately describe the patterns of change in sleep and depression throughout pregnancy.

Secondly, the review highlighted the limited understanding of what is considered “normal” or “healthy” sleep at this life stage, especially considering the limited number of studies with large sample sizes and longitudinal designs. This is an important finding, because without normative data, it is difficult to understand the impact of sleep problems on healthy pregnancy or other pathologies, such as mental health disorders.

Thirdly, the review illustrated the lack of understanding of the different dimensions of sleep during pregnancy. Sleep health, as described by Buysse (2014), includes five dimensions of sleep, each of which can impact health outcomes. Pregnancy sleep research has primarily

focussed on sleep quality and quantity and to a certain extent continuity (or disturbance). Limited studies suggest that daytime sleepiness and sleep timing may be important in healthy pregnancy, but there is a scarcity of research investigating these links. This finding prompted the inclusion of Buysse's five sleep health dimensions into the subsequent research conducted as part of this thesis.

7.2.2 Study 2 – Longitudinal study

Study 2 examined whether depressive symptoms existing in late pregnancy persisted through 12 weeks postnatal and until three years post birth, and if these trajectories were associated with different dimensions of sleep health. The findings presented provide New Zealand's first information on longitudinal patterns of depressive symptoms experienced from late pregnancy to three years post birth, for both Indigenous Māori and non-Māori women. They also add important new evidence to the limited global literature on depression trajectories. Furthermore, only a handful of studies have investigated depressive symptoms trajectories in relation to sleep. A unique aspect of Study 2 was the investigation of multiple sleep dimensions in association with chronically elevated depressive symptoms.

Study 2 produced two key findings. The first was the identification of two distinct depressive symptom classes, 'stable mild' (SM) and 'chronic high' (CH), from late pregnancy to three years post birth, revealing that women who were experiencing elevated depressive symptoms in late pregnancy were highly likely to continue on an elevated depressive symptom trajectory through until three years post birth. Of equal importance, a woman with minimal levels of depressive symptoms in late pregnancy was highly likely to continue on a trajectory of minimal depressive symptoms through until three years post birth. Chronically elevated depressive symptom trajectories have previously been identified by a small number of authors, particularly as the

popularity of group-based modelling (such as LCA) has grown in recent years (Ashman, Dawson, & Panagiotides, 2008; Luoma et al., 2015; G. Wang et al., 2018).

The ‘chronic high’ pattern was found among both Indigenous Māori and non-Māori women, but Māori women had a greater probability of experiencing clinically significant depressive symptoms from pregnancy through until their child is three years of age. These findings support previous literature showing that Māori women have greater exposure to factors associated with depression and experience significant barriers to accessing high quality pregnancy and postnatal health care services (Makowharemahihi et al., 2014).

The second key finding was that four out of five sleep dimensions were consistently associated with being in the ‘chronic high’ trajectory group, namely poorer sleep quality, reduced continuity, longer latencies and greater daytime sleepiness at each time point, except daytime sleepiness at the three-year post birth timepoint. Understanding the impact of multiple dimensions of sleep on depressive symptoms is useful in the development and application of sleep interventions.

7.2.3 Study 3 – Intervention study

The insights gained from Studies 1 and 2 guided Study 3, which aimed to determine whether providing women with information on general sleep, expected sleep changes in each trimester and advice to optimise sleep throughout pregnancy, could alter the risk of experiencing elevated depressive symptoms by late pregnancy and hence the possibility of being in a ‘chronic high’ depressive trajectory group into their child’s preschool years.

As discussed in Chapter 1, sleep is one of only a few modifiable risk factors for depression, and sleep education interventions provide a non-intrusive, non-pharmacological and cost-effective option for treating depressive symptomology in pregnancy. The need for early sleep

interventions has been highlighted by numerous authors (Da Costa et al., 2010; Haney et al., 2014; K. A. Lee & Gay, 2017; K. A. Lee et al., 2016; Qiu et al., 2014; Ryan et al., 2005; Williams et al., 2010; Zhong et al., 2018).

Furthermore, pregnancy is considered a key teachable life stage, with women keen to improve their health for the benefit of their baby (Phelan et al., 2011). Pregnant women actively seek health information, particularly on discomforts, emotional changes, physical changes, and expectations and beliefs during their pregnancy (Berman, 2006), and most often in early pregnancy (Sayakhot & Carolan-Olah, 2016). However, there is little evidenced-based information on sleep available to mothers.

The design and trial of the *Sleep HAPi* intervention aimed to answer three questions:

- 1) Is an early and longitudinal sleep education intervention feasible and acceptable to pregnant women?
- 2) Is an early and longitudinal sleep education intervention effective in optimising sleep and minimising depressive symptoms for nulliparous pregnant women with a history of depression?
- 3) How do sleep and depressive symptoms changes over a nine-month period, from 12 weeks gestation to 12 weeks postnatal?

The identified lack of research on the first trimester, together with having strict inclusion and exclusion criteria, were indicators that recruitment for this study would be challenging. The time and effort required to recruit 22 women was greater than expected, however all who were eligible to enrol did so, and once enrolled, they were greatly enthusiastic about their participation. Retention rates were 68% and 64% for pregnancy and the postpartum period respectively and 99.7% of study components were completed. This is an endorsement of the

study given it occurred at a complex and demanding time in women's lives, and is normal to high compared to other interventions studies in the perinatal period (Bosaeus et al., 2015; Knight & Wyatt, 2010; McNulty et al., 2013).

Various aspects of the intervention were considered highly acceptable, including method, time and length of intervention delivery, participant burden, information value, digestibility and relevance. Overall, women felt positive about their participation and stated they would definitely recommend the study to others.

Self-reported sleep duration, quality, timing, continuity and daytime sleepiness remained stable throughout pregnancy. This is consistent with the finding from the Scoped Review (Chapter 3) suggesting that changes in sleep across pregnancy in healthy women may not be as marked as previously thought. However, it cannot be excluded that the sleep education intervention helped stabilise sleep in our sample, compared to women in other studies who have did not receive an intervention to improve their sleep.

Newland et al. (2016) proposed that it may not be poor sleep per se that contributes to depression, but rather the variability or instability of sleep over a period of time. Thus, stabilising sleep across pregnancy may have contributed to the Study 3 finding that women with elevated depressive symptoms in early pregnancy had improved by the end of pregnancy and those with minimal depressive symptoms in early pregnancy remained that way throughout pregnancy.

The *Sleep HAPi* intervention may also have reframed pregnancy-related changes to sleep or provided realistic expectations of 'normal' pregnancy sleep, thus reducing a women's concern and anxiety and enhancing their management of poor sleep. Felder et al. (2018) have suggested that individuals with decreased cognitive and emotional reactivity and increased acceptance of difficult sleep experiences could be less psychologically impacted.

The efficacy of the intervention was evaluated by comparing the 15 women in the *Sleep HAPi* trial with a matched group of 76 women from the E Moe Māmā study (Signal et al., 2016) on the same self-reported depressive symptoms and the five sleep dimensions, in the third trimester and 12 weeks postnatal. In late pregnancy, *Sleep HAPi* mothers had better sleep quality, sleep initiation, and sleep continuity. *Sleep HAPi* mothers also had fewer depressive symptoms, none of which were clinically significant, while 20% of the control group had clinically significant symptoms. These results are important, given the trajectory described in Study 2 where women who had minimal depressive symptoms in late pregnancy were also less likely to have symptoms across the next three years.

7.3 Limitations

Specific limitations from each study have been highlighted in the relevant ‘Discussion’ sections in each chapter/paper. Limitations that apply to the research as a whole are considered here.

Studies 1 and 2 were both longitudinal and all women were community dwelling during their participation, so could have been influenced by numerous uncontrolled socio-physiological factors. On the other hand, this means that the findings are sufficiently robust to be applicable in everyday life. The majority of this program of research relies on subjective reports of sleep and depressive symptoms. An exception to this was using actigraphy as an objective measure of sleep in Study 3, which showed a high correlation with subjective sleep reports. It should be noted however, that actigraphy has not been validated in a pregnant population.

The gold standard for assessing psychiatric conditions is a structured clinical interview, but for resourcing and financial reasons this was not viable for the studies in this thesis. The Kessler (K10) has also been widely used in population surveys (Australian Bureau of Statistics, 2002;

Kessler & Üstün, 2004; New Zealand Ministry of Health, 2006) and the EPDS and BDI II have been used extensively in perinatal populations and diverse ethnic samples including Samoan and Tongan women living in New Zealand (Ekeroma et al., 2012). However, neither the EPDS or the BDI has not been validated for use with pregnant or postnatal Māori women.

The BDI-II has been developed to be used on multiple occasions in longitudinal research and for tracking changes across treatment periods (Sprinkle et al., 2002). However, multiple completions of the questionnaires may have resulted in increased familiarity with the items or women paying less attention to the questions. Participants in the *Sleep HAPi* study, were also aware that elevated scores on the EPDS or BDI-II resulted in their LMC being contacted. Although women did not know how scores were calculated and the cut-offs employed for referral, women may have misrepresented their responses if they were concerned about their LMC being notified.

To ensure the scope of this thesis was manageable, the current research did not analyse measures of anxiety (other than using the EPDS anxiety subscale of the EPDS in the intervention study, see Chapter 6). Anxiety is associated with both depressive symptoms and poor sleep (Alvaro, Roberts, & Harris, 2013) and could be a confounding factor in the present research. Future studies would benefit from exploring the relationship between sleep, depressive symptoms and symptoms of anxiety.

The retrospective nature of many sleep measures, depression scales and demographic questions may have introduced recall bias or not captured the major changes that can occur for women across a relatively short period of time. In addition, there are differences between measures in the timeframes to which the items refer. For example, the EPDS assesses depressive symptoms over the past 7 days, the BDI-II evaluates the past 2 weeks, while the Kessler examines psychological distress over the past 30 days. The PSQI assesses sleep quality over the past 30

days, the GSDS and sleep duration question examines sleep over the past 7 days and there is no prescribed timeframe for ESS questions.

Seasonality was not controlled for in any of the studies. Since the circadian system is strongly influenced by photoperiod, it is possible that sleep timing could have changed over the 12 months of data recording (Beauvalet et al., 2017). Sleep duration and mood may also be affected by seasonality. Chronotypes and menstrual cycles (of *Moe Kura* women at 3 years), were also not controlled for and are areas where further investigation is recommended.

The *Sleep HAPi* intervention has some specific limitations. Foremost, the small single arm pilot study limits the generalisability of the findings and the assessment of efficacy. The intervention focussed on sleep as a positive component of health and thus a health asset, however the measures employed in these studies framed sleep as a problem rather than in a positive way. For example, measures of sleep including the PSQI, ESS and GSDS generally use terminology that tend to 'problematise' sleep, such as "trouble" falling asleep, "difficulty" in staying awake. Such an approach is at risk of 'confirmation bias' and is a widespread challenge in health research and the medical field in general (Althubaiti, 2016; B. C. K. Choi & Pak, 2005). The study did also not include validated measures of sleep hygiene knowledge (such as the Sleep Hygiene Questionnaire, SHQ), which could have been utilised as a pre/post intervention measure.

It is also possible that a "good participant" effect influenced the results of Study 3. It could be argued that the success of the intervention was at least partly due to the rapport formed between the researcher and participant. Any effects of the demographic of the researcher, as an older experienced mother and researcher, are unclear. This is especially relevant if the sleep education sessions are to be run by community-based health care providers. At a minimum they would need significant training in sleep science to be able to deliver the intervention.

7.4 Clinical implications

Pregnancy represents a time of high engagement with health care professionals. The Centre of Perinatal Excellence (Australia) has recommended that every woman be screened for mood disorders during pregnancy and postnatally (Austin & Highet, 2017), while the USA National Institute for Health and Care Excellence (NICE) guidelines (2014) specifically recommends all women are routinely screened at their first antenatal appointment. Though New Zealand women typically engage with a LMC in the first trimester, there is no formal or mandated perinatal maternal mental health assessment or screening programme in New Zealand (New Zealand Ministry of Health, 2018a). Yet the first trimester offers a unique window of opportunity to predict and prevent many adverse maternal and birth outcomes in the short term and may also reduce some chronic intergenerational conditions (Poon et al., 2018), thus screening for depressive symptoms at this time point is highly recommended.

The expectation in our society that having a baby should be a joyful experience may result in women feeling too embarrassed or ashamed to discuss depression with their health care providers. So too, health care professional workloads often have limited time for raising and exploring mood symptomology during antenatal appointments (Hanlon & Beckmann 2015). It is clear from this research and previous literature, that sleep is a clinically useful marker for underlying mental health or wellbeing risks (K. A. Lee & Gay, 2004) and therefore an assessment of sleep could provide clinicians with “innovative proxy for mood” and a suitable lead-in to more in-depth discussions of mood related issues (Stremmler et al., 2019).

Results from Study 2 clearly show that depressive symptomology extends past the traditional ‘postnatal’ timeframes. Previous research has shown that women, their child(ren) and families benefit if the mother is psychologically healthy. The scope of the maternal care would benefit from being extended. Fahey (2013) states:

“The promotion of maternal health cannot end at the birth of the newborn, nor at the 6-week postpartum visit. Women have physical and emotional needs directly related to pregnancy and childbirth that take longer than 6 weeks to resolve.”

While the perinatal timeframe has now been extended to cover pregnancy, more can be done by perinatal organisations to lobby and advocate for the extension of timeframes beyond the specified 4 weeks postnatal. Even without extensions to official timeframes, it is important for clinicians (GP’s, health nurses) to be cognisant of the potential for chronicity in poor maternal mental health beyond the first-year post birth.

At the other end of the perinatal spectrum, better early prenatal care is known to be an important maternal care policy associated with improved maternal health and pregnancy outcomes. The New Zealand Perinatal and Maternal Mortality Review Committee (PMMRC) recommends early initiation of antenatal care (before ten weeks’ gestation) (Perinatal and Maternal Mortality Review Committee, 2018). The rationale for care initiation before ten weeks’ gestation includes the time-sensitive nature of first-trimester screening tests, and the early provision of health promotion, education and nutritional information for pregnant women, as well as risk assessment and timely referral to specialist services.

The present research has added to the existing literature, confirming the strong link between sleep and depression in the perinatal period. Given that poor sleep and depression are established risk factors for adverse pregnancy, birth and child and maternal outcomes (O'Brien et al., 2019) this indicates that screening for sleep problems coupled with high quality sleep education would be a worthwhile addition to the care mothers receive in order to reduce the likelihood of poor mental health, and assist in the maintenance of good mental health. However, sleep education and training, either in general or specifically in the perinatal period,

is limited for maternity care providers (either midwives, childbirth educators or obstetricians). Maternity services in New Zealand provide education on nutrition and exercise in pregnancy but have not been able to provide evidenced-based sleep information to their clients/patients. The sleep education information developed in Study 3 could prove to be a valuable frontline strategy in a stepped care approach to improve maternal mental health care and offers an intervention that avoids the medicalisation of (yet another) pregnancy characteristic (Sword et al., 2012).

7.5 Recommendations for future research

To date, there are limited studies examining sleep and depressive symptoms in pregnancy (including review papers) that include data from the first trimester. This promotes the tendency for authors to prematurely describe patterns of sleep and depressive symptoms based on two time points. A recent intensification of early pregnancy research has highlighted just how critical the first trimester is in identifying factors in the development of sleep and depression patterns. More research spanning the full length of pregnancy is greatly needed so comparative data are available across all trimesters.

Data collection for Study 3 commenced in the first trimester. However, pre-conception would be the ideal starting point for the characterisation of maternal sleep and mood symptomology. Very little prospective evidence exists on longitudinal patterns from this time point, but it seems likely that pre-conception sleep would provide a robust comparison for the changes in pregnancy sleep and that poor sleep pre-conception may be relevant to the sleep experience in pregnancy or postnatally (figure 7.4).

Further to the recommendations above, there is a need to incorporate additional data collection time points during the perinatal period. Though participant burden and research resources would need to be considered, monthly data collection, such as the study by Mindell et al. (2015),

may provide a more valuable understanding of the changes women are experiencing throughout pregnancy, as well as insight into the timing of greatest vulnerability for sleep and depression changes, especially when large change can occur within a trimester. Similarly, gestational weeks need to be well defined in study populations, so correct comparisons and categorisations can be made between studies.

Additional data time points are also relevant for the postnatal period. Authors have described maternal depressive symptoms as highly variable and heterogeneous in their onset, course, duration and severity (Campbell, Matestic, von Stauffenberg, Mohan, & Kirchner, 2007; Nandi et al., 2009; Putnam et al., 2015; Van Der Waerden et al., 2015). There would be great value in collecting data at regular time points to elucidate if women are prone to depressive symptoms at a particular point in the perinatal period or if periods of poor sleep or depressive symptoms exert their effects at later time points (M.-W. Chang et al., 2015; Skouteris et al., 2008). While there are a small number of studies exploring long-term trajectories of depressive symptoms (past three years post birth), more studies would be helpful in further understanding the long-term patterns of sleep and depressive symptoms (figure 7.4).

Integrating pregnancy and postnatal time points into future research could also allow for a cohesive model of perinatal sleep and mental health care to be developed. Studies to date have generally focused on either pregnancy (Sanaati et al., 2017; Rezaei et al., 2015; Tomfohr-Madsen et al., 2016) or postnatal (Owais et al., 2018; Kempler et al., 2016) sleep education interventions to improve mood, but it does not appear that any intervention studies have combined these two important and connected life stages. Providing women with an integrated package of evidenced based sleep and mental health education material, that covers both maternal sleep and mood throughout the perinatal period, as well as incorporating information on baby sleep could prove to be a valuable addition to maternal health care.

It is recommended that the *Sleep HAPi* study be replicated in a larger randomised controlled trial with a more diverse sample to gain a greater understanding of its utility and efficacy. It would be advantageous to test the protocol on diverse populations that have been shown to be more vulnerable to experiencing perinatal depression, such as differing ethnic backgrounds (specifically in the New Zealand context, Māori or Pasifika women), teenage mothers, women undergoing assisted reproductive technology or women at risk of poor pregnancy outcomes (i.e. obese or other comorbidities, multiple pregnancies, unplanned pregnancies). Parity has also been shown in previous research to be a predictor of depression and poor sleep and could warrant further investigation (K. A. Lee, Zaffke, et al., 2000; Waters & Lee, 1996). Furthermore, findings from this research have identified that not all groups of pregnant women are equally susceptible to large changes in sleep and more detailed studies of diverse groups of women are warranted.

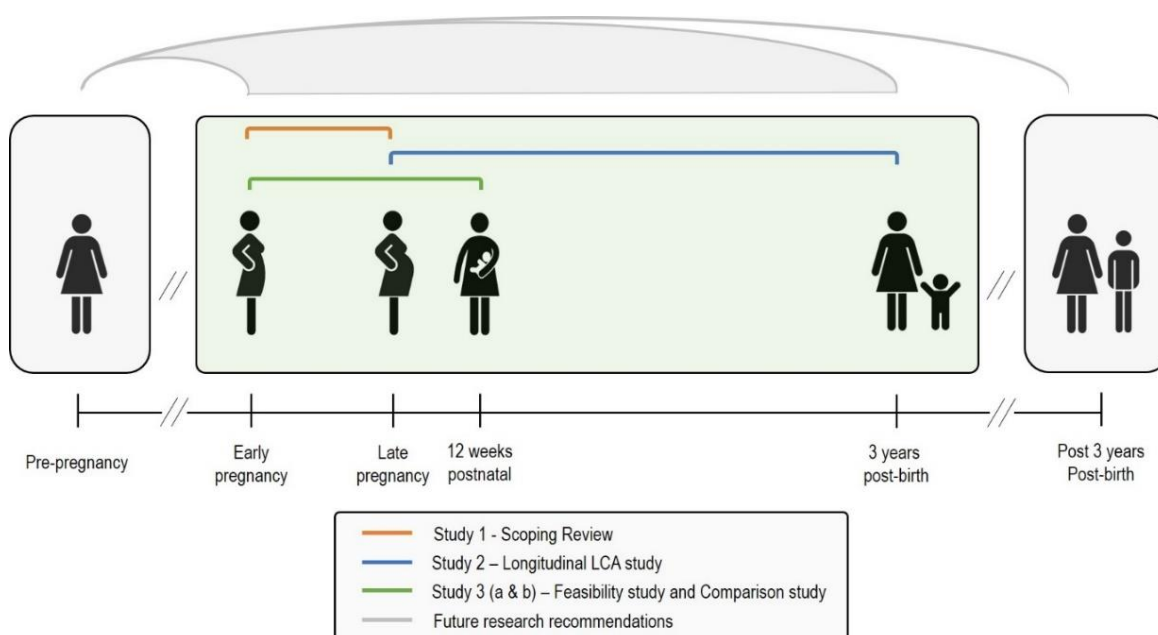


Figure 7.4 Future research recommendations pre-conception and postnatally.

The effect of partner / paternal contribution to perinatal sleep and depression has been largely overlooked to date. A study by Da Costa (2017) investigating the information seeking behaviour of fathers with pregnant partners showed that 89% of fathers spent an average of 6 hours on the internet per month searching for information on pregnancy, and additionally, over half the fathers in the study are keen for information on sleep. These findings suggest that interventions including partners / fathers could prove beneficial both for fathers and as a support for mothers (Entsieh & Hallström, 2016). Furthermore, including fathers in sleep education could further promote, encourage and reinforce healthy family sleep patterns and behaviour, and paternal reports of sleep could help corroborate maternal reports.

Buysse's Sleep Health model (2014) provided a novel conceptual structure to the research, and there would be great benefit in future research continuing to consider sleep in multiple dimensions and reveal associations between these dimensions and aspects of health. However, Buysse's model does not include sleep dimensions specific to pregnancy, such as sleep position. For pregnant women, safe sleeping positions are a crucial aspect to their baby's health and should be incorporated into sleep health material for this population.

Additional data on symptoms of sleep disordered breathing (such as snoring, breathing pauses, waking to a gasp) were collected in the E Moe Māmā / Moe Kura and Sleep HAPi questionnaires, but were not explored in this program of research. These symptoms indicate an increased risk of suffering Obstructive Sleep Apnea (OSA), which has also been associated with increased odds of experiencing depressive symptoms, with a particularly strong effect for women with a history of depression (Redhead, 2020). This suggests that screening for symptoms of OSA in pregnancy is an important addition in future perinatal sleep research, particularly in identifying women prone to future depressive episodes.

The present research did not systematically investigate what strategies women used and how long they persisted when implementing new strategies. Feedback from participants regarding the sleep strategies they found most helpful were asked in open ended questions and responses varied considerably. This points to sleep strategies and advice being highly individual, and to the value of providing women with a broad range of suggestions so that they can choose what strategies are most important and helpful at the right time.

Nevertheless, future intervention studies could examine if women are using and benefitting from specific behaviours or strategies or use goal setting techniques to assess the usefulness or efficacy of sleep education. This would enable ongoing improvement of the education material and assessment of whether additional referral pathways and stepped-care protocols are needed for more complicated issues, such as insomnia or sleep disorders. Designing a group-based intervention could also be considered, given the results from the present research and previous literature showing that social support is a key risk factor in experiencing depressive symptoms in pregnancy. Intervention studies that include family members or friends and/or measures of social support may allow early detection of poor maternal support systems, increase feelings of inclusion, and hence lower the vulnerability to depression (Sattler et al., 2017; Tanner Stapleton et al., 2012).

Feedback from *Sleep HAPi* could be used to improve the sleep education intervention. Common responses from women included providing electronic versions of questionnaires, sleep diaries and study communications and the use of private digital platform technology to simplify and improve the speed and accuracy of data management. Women also suggested having a 'sexier' and less conspicuous actiwatch. Two women in the study were displeased by the attractiveness and bulkiness of watch, stating they were worried that colleagues would notice and enquire about the reasons for wearing it, when they had not yet announced their pregnancy.

7.6 Conclusion

Healthy sleep is vital to wellbeing (Czeisler, 2015) but for some women, achieving restorative and satisfying sleep consistently throughout pregnancy is challenging. As the risk of experiencing depressive symptoms increases with poor sleep and poor sleep influences the development and trajectory of depressive symptoms, sleep is an important and modifiable factor in the prevention and treatment of depression (Franzen & Buysse, 2008).

Overall, this thesis has added important findings on the longitudinal relationship between sleep and depressive symptoms throughout the extended perinatal period, as well as developing and piloting a novel sleep education intervention throughout pregnancy. All three studies provide insight and promise for future sleep education interventions with larger and more diverse samples. The *Sleep HAPi* sleep education information booklet has sparked interest in the wider health community, with psychology professionals, sleep researchers, and maternal health care providers keen to use the information with clients, patients and as material in future research studies. This interest has led to Massey University Press publishing the information as a book in both print and electronic formats, due for release in mid-2020.

The findings linking sleep and depressive symptoms in the perinatal period are relevant to policy makers in the health, and particularly the mental health, sectors. They confirm that a significant number of women in New Zealand experience mood difficulties throughout the perinatal period and importantly into their child's preschool years, which may have multiple and severe consequences. Studies such as the *Sleep HAPi* study provide impetus for interventions targeting both sleep and depression to reduce the risk of further depressive episodes and improving outcomes for women, children, families and society.

Mothers are important too

After my boys were born, there were appointments.

To check their latch.

To check their weight.

To check their hearing.

To check the colour of their skin for signs of jaundice.

There were appointments.

There were regular pokes and prods.

Their well-being was front and centre.

I'd say, when it comes to our health-care system, they were well taken care of.

Then there was me.

A first-time mom without a clue.

Engorged, bleeding, and stitched up.

Sent home with some painkillers and stool softeners.

Thrown into motherhood with the expectation my instincts would kick in.

That I would know how to handle colic and late-night feedings.

That breastfeeding would come as nature intended.

That my husband would sense my spiral into depression.

That I would know how to live in my new and very foreign body.

That this stomach wouldn't make me feel hideous.

And my mind wouldn't make me feel less than they deserved.

No one poked me.

No one prodded.

No one checked my stitches, my healing, or my sanity until eight weeks postpartum.

And even then, it was a pat on the back and I was sent on my way.

Our world forgets about mothers.

We slip through the cracks.

We become background noise.

And in that we learn our role...

Our place in our family unit...

To always come last.

Folks, we can't put mothers last.

Our babies need us.

To be healthy.

To know that we are worthy.

To know that Motherhood, while natural, can sometimes feel like the least natural role in our
life.

And that deserves attention.

That mothers deserve attention.

We need our world to fuss over us the way they fuss over ten fresh fingers and ten fresh toes.

We need to be seen.

We need to be heard.

We need someone to not only ask if we're okay but to check time and time again, just to be sure.

We're not just a uterus.

We're not just a lifeline to a new and precious soul.

We're mothers.

And we need someone to make sure we're ok, too.

Anneliese Lawton

REFERENCES

- Accortt, E. E., Cheadle, A. C. D., & Dunkel Schetter, C. (2014). Prenatal depression and adverse birth outcomes: An updated systematic review. *Maternal & Child Health Journal, 19*(6), 1306-1337. doi:10.1007/s10995-014-1637-2
- Affonso, D. D., Lovett, S., Paul, S. M., & Sheptak, S. (1990). A standardized interview that differentiates pregnancy and postpartum symptoms from perinatal clinical depression. *Birth, 17*(3), 121-130. doi:10.1111/j.1523-536x.1990.tb00716.x
- Agnew, H. W., Webb, W. B., & Williams, R. L. (1966). The first night effect: An EEG study of sleep. *Psychophysiology, 2*(3), 263-266. doi:10.1111/j.1469-8986.1966.tb02650.x
- Aksu, S., Varol, F. G., & Sahin, H. N. (2017). Long-term postpartum health problems in Turkish women: Prevalence and associations with self-rated health. *Contemporary Nurse, 53*(2), 167-181. doi:10.1080/10376178.2016.1258315
- Alhusen, J. L., & Alvarez, C. (2016). Perinatal depression: A clinical update. *The Nurse Practitioner, 41*(5), 50-55. doi:10.1097/01.NPR.0000480589.09290.3e
- Allen RP, Picchietti D, Hening WA, Trenkwalder C, Walters AS, Montplaisir J. (2003). Restless legs syndrome: diagnostic criteria, special considerations, and epidemiology. A report from the restless legs syndrome diagnosis and epidemiology workshop at the National Institutes of Health. *Sleep Medicine, 4*, 101-119. doi:10.1016/j.sleep.2014.03.025
- Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare, 9*, 211-217. doi:10.2147/JMDH.S104807
- Althuisen, E., van Poppel, M. N. M., Seidell, J. C., & van Mechelen, W. (2009). Correlates of absolute and excessive weight gain during pregnancy. *Journal of Women's Health, 18*(10), 1559-1566. doi:10.1089/jwh.2008.1275
- Alvaro, P. K., Roberts, R. M., & Harris, J. K. (2013). A systematic review assessing bidirectionality between sleep disturbances, anxiety, and depression. *Sleep, 36*(7), 1059-1068. doi:10.5665/sleep.2810
- American College of Obstetricians and Gynecologists. (2015). ACOG Committee Opinion No. 630: Screening for perinatal depression. *Obstetrics and Gynecology, 125*(5), 1268-1271. doi:10.1097/01.AOG.0000465192.34779.dc
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders (4th ed.)*. Washington, DC: American Psychiatric Press Inc.

- American Psychiatric Association. (2010). *Practice guideline for the treatment of patients with major depressive disorder (3rd ed.)*. Washington, DC: American Psychiatric Association.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. Washington, DC: American Psychiatric Association.
- Ancoli-Israel, S., Cole, R., Alessi, C., Chambers, M., Moorcroft, W., & Pollak, C. P. (2003). The role of actigraphy in the study of sleep and circadian rhythms. *Sleep*, 26(3), 342-392. doi:10.1093/sleep/26.3.342
- Apter, G., Devouche, E., Garez, V., Valente, M., Genet, M.-C., Gratier, M., & Belaisch-Allart, J. (2013). Pregnancy, somatic complaints and depression: A French population-based study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 171(1), 35-39. doi:10.1016/j.ejogrb.2013.08.013
- Areias, M. E., Kumar, R., Barros, H., & Figueiredo, E. (1996). Comparative incidence of depression in women and men, during pregnancy and after childbirth. Validation of the Edinburgh Postnatal Depression Scale in Portuguese mothers. *The British Journal of Psychiatry*, 169(1), 30-35. doi:10.1192/bjp.169.1.30
- Arifin, S. R. M., Cheyne, H., & Maxwell, M. (2018). Review of the prevalence of postnatal depression across cultures. *AIMS Public Health*, 5(3), 260-295. doi:10.3934/publichealth.2018.3.260
- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19-32. doi:10.1080/1364557032000119616
- Armitage, R., Flynn, H., Hoffmann, R., Vazquez, D., Lopez, J., & Marcus, S. (2009). Early developmental changes in sleep in infants: The impact of maternal depression. *Sleep*, 32(5), 693-696. doi:10.1093/sleep/32.5.693
- Armstrong, C. (2008). ACOG guidelines on psychiatric medication use during pregnancy and lactation. *American Family Physician*, 78(6), 772-778.
- Ashman, S. B., Dawson, G., & Panagiotides, H. (2008). Trajectories of maternal depression over 7 years: Relations with child psychophysiology and behavior and role of contextual risks. *Development and Psychopathology*, 20(1), 55-77. doi:10.1017/S0954579408000035
- Assefa, S. Z., Diaz-Abad, M., Wickwire, E. M., & Scharf, S. M. (2015). The functions of sleep. *AIMS Neuroscience*, 2(3), 155-171. doi:10.3934/Neuroscience.2015.3.155
- Atkinson, J., Salmond, C., & Crampton, P. (2014). *NZDep2013 Index of Deprivation*. Wellington, NZ: Department of Public Health, University of Otago.

- Austin, M.-P., & Highet, N. (2017). *Mental health care in the perinatal period: Australian Clinical Practice Guideline*. Melbourne, VIC: Centre of Perinatal Excellence.
- Australian Bureau of Statistics. (2002). *National Health Survey: Summary of results*. Canberra, ACT: Australian Bureau of Statistics.
- Australian Sleep Health Foundation. (2019a). Pregnancy and sleep. Retrieved 04/12/2019 from <https://www.sleephealthfoundation.org.au/pregnancy-and-sleep.html>
- Australian Sleep Health Foundation. (2019b). Sleep and mental health. Retrieved 21/07/2018 from <https://www.sleephealthfoundation.org.au/news/sleep-blog/sleep-and-mental-health.html>
- Ayano, G., Tesfaw, G., & Shumet, S. (2019). Prevalence and determinants of antenatal depression in Ethiopia: A systematic review and meta-analysis. *PLoS ONE*, *14*(2), 1-17. doi:10.1371/journal.pone.0211764
- Bai, G., Korfage, I. J., Hafkamp-de Groen, E., Jaddoe, V. W., Mautner, E., & Raat, H. (2016). Associations between nausea, vomiting, fatigue and health-related quality of life of women in early pregnancy: The generation R study. *PLoS ONE*, *11*(11), 1-14. doi:10.1371/journal.pone.0166133
- Baiardi, S., Cirignotta, F., Cicolin, A., Garbazza, C., D'Agostino, A., Gambini, O., . . . Manconi, M. (2016). Chronobiology, sleep-related risk factors and light therapy in perinatal depression: the "Life-ON" project. *BMC Psychiatry*, *16*(1), 374-374. doi:10.1186/s12888-016-1086-0
- Bais, B., Lindeboom, R., van, R., Leontien, Tulen, J., Hoogendijk, W., Lambregtse-van den, B., Mijke, & Kamperman, A. (2019). The impact of objective and subjective sleep parameters on depressive symptoms during pregnancy in women with a mental disorder: An explorative study. *International Journal of Environmental Research and Public Health*, *16*(9), 1587. doi:10.3390/ijerph16091587
- Baker, J. H., Okun, M. L., Rothenberger, S. D., & Kline, C. E. (2016). Exercise during early pregnancy is associated with greater sleep continuity. *Behavioral Sleep Medicine*, 1-14. doi:10.1080/15402002.2016.1228649
- Baratte-Beebe, K. R., & Lee, K. (1999). Sources of midsleep awakenings in childbearing women. *Clinical Nursing Research*, *8*(4), 386-397. doi:10.1177/10547739922158377
- Barker, E. D., Kirkham, N., Ng, J., & Jensen, S. K. G. (2013). Prenatal maternal depression symptoms and nutrition, and child cognitive function. *The British Journal of Psychiatry*, *203*(6), 417-421. doi:10.1192/bjp.bp.113.129486

- Bartlett, D. J., Marshall, N. S., Williams, A., & Grunstein, R. R. (2008). Sleep health New South Wales: Chronic sleep restriction and daytime sleepiness. *Internal Medicine Journal*, *38*(1), 24-31. doi:10.1111/j.1445-5994.2007.01395.x
- Battle, C. L., Salisbury, A. L., Schofield, C. A., & Ortiz-Hernandez, S. (2013). Perinatal antidepressant use: Understanding women's preferences and concerns. *Journal of Psychiatric Practice*, *19*(6), 443-453. doi:10.1097/01.pra.0000438183.74359.46
- Bauer, A., Knapp, M., & Parsonage, M. (2016). Lifetime costs of perinatal anxiety and depression. *Journal of Affective Disorders*, *192*, 83-90. doi:10.1016/j.jad.2015.12.005
- Baumgartel, K. L., Terhorst, L., Conley, Y. P., & Roberts, J. M. (2013). Psychometric evaluation of the Epworth Sleepiness Scale in an obstetric population. *Sleep Medicine*, *14*(1), 116-121. doi:10.1016/j.sleep.2012.10.007
- Beauvalet, J. C., Quiles, C. L., Oliveira, M. A. B., Ilgenfritz, C. A. V., Hidalgo, M. P., & Tonon, A. C. (2017). Social jetlag in health and behavioral research: A systematic review. *ChronoPhysiology and Therapy*, *7*, 19-31. doi:10.2147/CPT.S108750
- Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. F. (1996). Comparison of Beck Depression Inventories-IA and -II in psychiatric outpatients. *Journal of Personality Assessment*, *67*(3), 588. doi:10.1207/s15327752jpa6703_13
- Beddoe, A. E., Lee, K. A., Weiss, S. J., Kennedy, H. P., & Yang, C.-P. P. (2010). Effects of mindful yoga on sleep in pregnant women: A pilot study. *Biological Research for Nursing*, *11*(4), 363-370. doi:10.1177/1099800409356320
- Beebe, K. R., & Lee, K. A. (2007). Sleep disturbance in late pregnancy and early labor. *The Journal of Perinatal & Neonatal Nursing*, *21*(2), 103-108. doi:10.1097/01.JPN.0000270626.66369.26
- Beersma, D. G., & Gordijn, M. C. (2007). Circadian control of the sleep-wake cycle. *Physiology & Behavior*, *90*(2), 190-195. doi:10.1016/j.physbeh.2006.09.010
- Bei, B., Coo, S., Baker, F. C., & Trinder, J. (2015). Sleep in women: A review. *Australian Psychologist*, *50*(1), 14-24. doi:10.1111/ap.12095
- Bei, B., Coo, S., & Trinder, J. (2015). Sleep and mood during pregnancy and the postpartum period. *Sleep Medicine Clinics*, *10*(1), 25-33. doi:10.1016/j.jsmc.2014.11.011
- Bei, B., Milgrom, J., Ericksen, J., & Trinder, J. (2010). Subjective perception of sleep, but not its objective quality, is associated with immediate postpartum mood disturbances in healthy women. *Sleep*, *33*(4), 531-538. doi:10.1093/sleep/33.4.531

- Benca, R. M., Okawa, M., Uchiyama, M., Ozaki, S., Nakajima, T., Shibui, K., & Obermeyer, W. H. (1997). Review article: Sleep and mood disorders. *Sleep Medicine Reviews, 1*(1), 45-56. doi:10.1016/S1087-0792(97)90005-8
- Bennett, H. A., Einarson, A., Taddio, A., Koren, G., & Einarson, T. R. (2004). Prevalence of depression during pregnancy: Systematic review. *Obstetrics & Gynecology, 103*(4), 698-709. doi:10.1097/01.AOG.0000116689.75396.5f
- Berman, R. O. (2006). Perceived learning needs of minority expectant women and barriers to prenatal education. *Journal of Perinatal Education, 15*(2), 36-42. doi:10.1624/105812406X107807
- Bernard-Bonnin, A.-C. (2004). Maternal depression and child development. *Paediatrics & Child Health, 9*(8), 575-583. doi:10.1093/pch/9.8.575
- Bertisch, S. M., Pollock, B. D., Mittleman, M. A., Buysse, D. J., Bazzano, L. A., Gottlieb, D. J., & Redline, S. (2018). Insomnia with objective short sleep duration and risk of incident cardiovascular disease and all-cause mortality: Sleep Heart Health Study. *Sleep, 41*(6), 1-9. doi:10.1093/sleep/zsy047
- Best Practice NZ. (2012). Nocturnal leg cramps: Is there any relief? *Best Practice Journal, 49*, 24-28.
- Biaggi, A., Conroy, S., Pawlby, S., & Pariante, C. M. (2016). Identifying the women at risk of antenatal anxiety and depression: A systematic review. *Journal of Affective Disorders, 191*, 62-77. doi:10.1016/j.jad.2015.11.014
- Bialobok, K. M., & Monga, M. (2000). Fatigue and work in pregnancy. *Current Opinion in Obstetrics & Gynecology, 12*(6), 497-500. doi:10.1097/00001703-200012000-00007
- Birndorf, C. A., Madden, A., Portera, L., & Leon, A. C. (2001). Psychiatric symptoms, functional impairment, and receptivity toward mental health treatment among obstetrical patients. *International Journal of Psychiatry in Medicine, 31*(4), 355-365. doi:10.2190/5VPD-WGL1-MTWN-6JA6
- Blair, L. M., Porter, K., Leblebicioglu, B., & Christian, L. M. (2015). Poor sleep quality and associated inflammation predict preterm birth: Heightened risk among African Americans. *Sleep, 38*(8), 1259-1267. doi:10.5665/sleep.4904
- Bleker, L. S., Roseboom, T. J., Vrijkotte, T. G., Reynolds, R. M., & de Rooij, S. R. (2017). Determinants of cortisol during pregnancy – the ABCD cohort. *Psychoneuroendocrinology, 83*, 172-181. doi:10.1016/j.psyneuen.2017.05.026
- Boath, E., Bradley, E., & Henshaw, C. (2004). Women's views of antidepressants in the treatment of postnatal depression. *Journal of Psychosomatic Obstetrics & Gynecology, 25*(3/4), 221-233. doi:10.1080/01674820400017889

- Bonari, L., Koren, G., Einarson, T. R., Jasper, J. D., Taddio, A., & Einarson, A. (2005). Use of antidepressants by pregnant women: Evaluation of perception of risk, efficacy of evidence based counseling and determinants of decision making. *Archives of Women's Mental Health, 8*(4), 214-220. doi:10.1007/s00737-005-0094-8
- Borbély, A. A. (1982). A two process model of sleep regulation. *Human Neurobiology, 1*(3), 195-204.
- Borbély, A. A., Daan, S., Wirz-Justice, A., & Deboer, T. (2016). The two-process model of sleep regulation: A reappraisal. *Journal of Sleep Research, 25*(2), 131-143. doi:10.1111/jsr.12371
- Bosaeus, M., Hussain, A., Karlsson, T., Andersson, L., Hulthén, L., Svelander, C., . . . Ellegård, L. (2015). A randomized longitudinal dietary intervention study during pregnancy: Effects on fish intake, phospholipids, and body composition. *Nutrition Journal, 14*(1), 1-27. doi:10.1186/1475-2891-14-1
- Bourjeily, G. (2009). Sleep disorders in pregnancy. *Obstetric Medicine, 2*(3), 100-106. doi:10.1258/om.2009.090015
- Bourjeily, G., Miller, M. A., Raker, C. A., & Chalhoub, M. (2010). Pregnancy and fetal outcomes of symptoms of sleep-disordered breathing. *European Respiratory Journal, 36*(4), 849-855. doi:10.1183/09031936.00021810
- Braunstein, G. D., Rasor, J., Danzer, H., Adler, D., & Wade, M. E. (1976). Serum human chorionic gonadotropin levels throughout normal pregnancy. *American Journal of Obstetrics and Gynecology, 126*(6), 678-681.
- Breslau, N., Roth, T., Rosenthal, L., & Andreski, P. (1996). Sleep disturbance and psychiatric disorders: A longitudinal epidemiological study of young adults. *Biological Psychiatry, 39*(6), 411-418. doi:10.1016/0006-3223(95)00188-3
- Brown, F. C., Buboltz, W. C., & Soper, B. (2002). Relationship of sleep hygiene awareness, sleep hygiene practices, and sleep quality in university students. *Behavioral Medicine, 28*(1), 33-38. doi:10.1080/08964280209596396
- Brown, S., & Lumley, J. (2000). Physical health problems after childbirth and maternal depression at six to seven months postpartum. *British Journal of Obstetrics and Gynaecology, 107*(10), 1194-1201. doi:10.1111/j.1471-0528.2000.tb11607.x
- Brunner, D. P., Münch, M., Biedermann, K., & Huch, R. (1994). Changes in sleep and sleep electroencephalogram during pregnancy. *Sleep, 17*(7), 576-582.
- Brunton, P. J. (2013). Effects of maternal exposure to social stress during pregnancy: consequences for mother and offspring. *Reproduction, 146*, 175-189. doi:10.1530/REP-13-0258

- Bublitz, M. H., Bourjeily, G., D'Angelo, C., & Stroud, L. R. (2018). Maternal sleep quality and diurnal cortisol regulation over pregnancy. *Behavioral Sleep Medicine, 16*(3), 282-293. doi:10.1080/15402002.2016.1210147
- Buist, A. E., Barnett, B. E. W., Milgrom, J., Pope, S., Condon, J. T., Ellwood, D. A., . . . Hayes, B. A. (2002). To screen or not to screen - That is the question in perinatal depression. *The Medical Journal of Australia, 177*(7), S101-105. doi:10.5694/j.1326-5377.2002.tb04866.x
- Burke, L. (2003). The impact of maternal depression on familial relationships. *International Review of Psychiatry, 15*(3), 243-255. doi:10.1080/0954026031000136866
- Butkov, N., & Lee-Chiong, T. (2007). *Fundamentals of Sleep Technology*. Philadelphia, Pennsylvania: Lippincott Williams & Wilkins.
- Buyalos, R. P., Glassman, L. M., Rifka, S. M., Falk, R. J., Macarthy, P. O., Tyson, V. J., & DiMattina, M. (1992). Serum beta-human chorionic gonadotropin, estradiol and progesterone as early predictors of pathologic pregnancy. *The Journal of Reproductive Medicine, 37*(3), 261-266.
- Buysse, D. J. (2014). Sleep health: Can we define it? Does it matter? *Sleep, 37*(1), 9-17. doi:10.5665/sleep.3298
- Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193-213. doi:10.1016/0165-1781(89)90047-4
- Campagne, D. M. (2018). Antidepressant use in pregnancy: Are we closer to consensus? *Archives of Women's Mental Health, 22*(2), 189-197. doi:10.1007/s00737-018-0906-2
- Campbell, S. B., Brownell, C. A., Hungerford, A., Spieker, S. J., Mohan, R., & Blessing, J. S. (2004). The course of maternal depressive symptoms and maternal sensitivity as predictors of attachment security at 36 months. *Development and Psychopathology, 16*(2), 231-252. doi:10.1017/S0954579404044499
- Campbell, S. B., Matestic, P., von Stauffenberg, C., Mohan, R., & Kirchner, T. (2007). Trajectories of maternal depressive symptoms, maternal sensitivity, and children's functioning at school entry. *Developmental Psychology, 43*(5), 1202-1215. doi:10.1037/0012-1649.43.5.1202
- Canadian Society for Exercise Physiology. (2016). Canadian 24-hour movement guidelines for children and youth: An intergration of physical activity, sedentary behavior, and sleep. Retrieved from www.csep.ca/guidelines

- Cannon, S., Lastella, M., Vincze, L., Vandelanotte, C., & Hayman, M. (In press). A review of pregnancy information on nutrition, physical activity and sleep websites. *Women and Birth* doi:10.1016/j.wombi.2018.12.007
- Caparroz, F. A., Gregorio, L. L., Bongiovanni, G., Izu, S. C., & Kosugi, E. M. (2016). Rhinitis and pregnancy: Literature review. *Brazilian Journal of Otorhinolaryngology*, 82(1), 105-111. doi:10.1016/j.bjorl.2015.04.011
- Cappuccio, F. P., D'Elia, L., Strazzullo, P., & Miller, M. A. (2010). Sleep duration and all-cause mortality: A systematic review and meta-analysis of prospective studies. *Sleep*, 33(5), 585-592. doi:10.1093/sleep/33.5.585
- Cappuccio, F. P., & Miller, M. A. (2017). Sleep and cardio-metabolic disease. *Current Cardiology Reports*, 19(11), 110. doi: 10.1007/s11886-017-0916-0
- Carlomagno, G., Tilotta, M., Minini, M., & Unfer, V. (2018). From implantation to birth: Insight into molecular melatonin functions. *International Journal of Molecular Sciences*, 19(9), 2801-2816. doi:10.3390/ijms19092802
- Carney, C. E., Buysse, D. J., Ancoli-Israel, S., Edinger, J. D., Krystal, A. D., Lichstein, K. L., & Morin, C. M. (2012). The consensus sleep diary: Standardizing prospective sleep self-monitoring. *Sleep*, 35(2), 287-302. doi:10.5665/sleep.1642
- Carroll, J. E., Teti, D. M., Hall, M. H., & Christian, L. M. (2019). Maternal sleep in pregnancy and postpartum Part II: Biomechanisms and intervention strategies. *Current Psychiatry Reports*, 21(3), 19. doi:10.1007/s11920-019-1000-9
- Carskadon, M. A., & Dement, W. C. (2017). Normal human sleep: An overview. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (6th ed.). Philadelphia, PA: Elsevier.
- Cato, K., Sylvén, S. M., Lindbäck, J., Skalkidou, A., & Rubertsson, C. (2017). Risk factors for exclusive breastfeeding lasting less than two months: Identifying women in need of targeted breastfeeding support. *PLoS ONE*, 12(6), 1-13. doi:10.1371/journal.pone.0179402
- Centers for Disease Control and Prevention. (2018). PRAMS Questionnaires. Retrieved 09/12/2019 from <https://www.cdc.gov/prams/Questionnaire.htm>
- Chang, J. J., Pien, G. W., Duntley, S. P., & Macones, G. A. (2010). Sleep deprivation during pregnancy and maternal and fetal outcomes: Is there a relationship? *Sleep Medicine Reviews*, 14(2), 107-114. doi:10.1016/j.smr.2009.05.001
- Chang, M.-W., Brown, R., Nitzke, S., Smith, B., & Eghtedary, K. (2015). Stress, sleep, depression and dietary intakes among low-income overweight and obese pregnant women. *Maternal & Child Health Journal*, 19(5), 1047-1059. doi:10.1007/s10995-014-1604-y

- Chaudron, L. H., Szilagyi, P. G., Tang, W., Anson, E., Talbot, N. L., Wadkins, H. I. M., . . . Wisner, K. L. (2010). Accuracy of depression screening tools for identifying postpartum depression among urban mothers. *Pediatrics, 125*(3), 609-617. doi:10.1542/peds.2008-3261
- Chen, S.-J., Shi, L., Bao, Y.-P., Sun, Y.-K., Lin, X., Que, J.-Y., . . . Lu, L. (2018). Prevalence of restless legs syndrome during pregnancy: A systematic review and meta-analysis. *Sleep Medicine Reviews, 40*, 43-54. doi:10.1016/j.smrv.2017.10.003
- Choi, B. C. K., & Pak, A. W. P. (2005). A catalog of biases in questionnaires. *Preventing Chronic Disease, 2*(1), A13.
- Choi, S. K., Park, Y. G., Park, I. Y., Ko, H. S., & Shin, J. C. (2014). Impact of antenatal depression on perinatal outcomes and postpartum depression in Korean women. *Journal of Research in Medical Sciences, 19*(9), 807-812.
- Chou, F., Lin, L., Cooney, A. T., Walker, L. O., & Riggs, M. W. (2003). Psychosocial factors related to nausea, vomiting, and fatigue in early pregnancy. *Journal of Nursing Scholarship, 35*(2), 119-125. doi:10.1111/j.1547-5069.2003.00119.x
- Christian, L. M., Carroll, J. E., Porter, K., & Hall, M. H. (2019). Sleep quality across pregnancy and postpartum: Effects of parity and race. *Sleep Health, 5*(4), 327-334. doi:10.1016/j.sleh.2019.03.005
- Christian, L. M., Carroll, J. E., Teti, D. M., & Hall, M. H. (2019). Maternal sleep in pregnancy and postpartum Part I: Mental, physical, and interpersonal consequences. *Current Psychiatry Reports, 21*(3), 20. doi:10.1007/s11920-019-0999-y
- Chuang, C.-H., Jeng, S.-F., Hsieh, W.-S., Liao, H.-F., Su, Y.-N., & Chen, P.-C. (2011). Maternal psychosocial factors around delivery, and the behavior of 2-year-old children. *Pediatrics International, 53*(5), 656-661. doi:10.1111/j.1442-200X.2010.03315.x
- Cohen, L. S., Altshuler, L. L., Harlow, B. L., Nonacs, R., Newport, D. J., Viguera, A. C., . . . Stowe, Z. N. (2006). Relapse of major depression during pregnancy in women who maintain or discontinue antidepressant treatment. *JAMA: Journal of the American Medical Association, 295*(5), 499-507. doi:10.1001/jama.295.5.499
- Condon, J. T., & Corkindale, C. (1997). The correlates of antenatal attachment in pregnant women. *British Journal of Medical Psychology, 70*, 359-372.
- Conrad, K. P. (2011). Maternal vasodilation in pregnancy: The emerging role of relaxin. *American Journal of Physiology, 301*(2), 267-278. doi:10.1152/ajpregu.00156.2011
- Coo Calcagni, S., Bei, B., Milgrom, J., & Trinder, J. (2012). The relationship between sleep and mood in first-time and experienced mothers. *Behavioral Sleep Medicine, 10*(3), 167-179. doi:10.1080/15402002.2012.668147

- Coo, S., Milgrom, J., Kuppens, P., Cox, P., & Trinder, J. (2014). Exploring the association between maternal mood and self-reports of sleep during the perinatal period. *Journal of Obstetric, Gynecologic & Neonatal Nursing, 43*(4), 465-477. doi:10.1111/1552-6909.12464
- Coo, S., Milgrom, J., & Trinder, J. (2014). Mood and objective and subjective measures of sleep during late pregnancy and the postpartum period. *Behavioral Sleep Medicine, 12*(4), 317-330. doi:10.1080/15402002.2013.801348
- Cooper, R. (2014). *Diagnosing the Diagnostic and Statistical Manual of Mental Disorders (5th ed.)*. Arlington, VA: American Psychiatric Publishing.
- Cooper, W. O., Willy, M. E., Pont, S. J., & Ray, W. A. (2007). Increasing use of antidepressants in pregnancy. *American Journal of Obstetrics and Gynecology, 196*(6), 544-544. doi:10.1016/j.ajog.2007.01.033
- Coverdale, J. H., McCullough, L. B., Chervenak, F. A., & Bayer, T. (1996). Clinical implications and management strategies when depression occurs during pregnancy. *The Australian & New Zealand Journal of Obstetrics & Gynaecology, 36*(4), 424-429.
- Cowan, C. P., & Cowan, P., A. (1995). Interventions to ease the transition to parenthood: Why they are needed and what they can do. *Family Relations, 44*(4), 412-423. doi:10.2307/584997
- Cox, J. L., Chapman, G., Murray, D., & Jones, P. (1996). Validation of the Edinburgh Postnatal Depression Scale (EPDS) in non-postnatal women. *Journal of Affective Disorders, 39*(3), 185-189. doi:10.1016/0165-0327(96)00008-0
- Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry, 150*, 782-786.
- Cronin, R. S., Li, M., Thompson, J. M. D., Anderson, N. H., Mitchell, E. A., McCowan, L. M. E., . . . O'Brien, L. M. (2019). An individual participant data meta-analysis of maternal going-to-sleep position, interactions with fetal vulnerability, and the risk of late stillbirth. *Eclinicalmedicine, 10*, 49-57. doi:10.1016/j.eclinm.2019.03.014
- Cronin, R. S., Okesene-Gafa, K., Thompson, J. M. D., Taylor, R. S., McCowan, L. M. E., Chelimo, C., . . . Hutchison, B. L. (2017). Survey of maternal sleep practices in late pregnancy in a multi-ethnic sample in South Auckland, New Zealand. *BMC Pregnancy and Childbirth, 17*(1) doi:10.1186/s12884-017-1378-5
- Crowe, T. K., Sanchez, V., Howard, A., Western, B., & Barger, S. (2018). Veterans transitioning from isolation to integration: A look at veteran/service dog partnerships. *Disability and Rehabilitation, 40*(24), 2953-2961. doi:10.1080/09638288.2017.1363301

- Crowley, S., O'Buckley, T., Schiller, C., Stuebe, A., Morrow, A., & Girdler, S. (2016). Blunted neuroactive steroid and HPA axis responses to stress are associated with reduced sleep quality and negative affect in pregnancy: A pilot study. *Psychopharmacology*, 233(7), 1299-1310. doi:10.1007/s00213-016-4217-x
- Čuržik, D., & Begić, N. J. (2012). The utility of BDI-II in assessment of pre-and postpartum depression symptoms and their relation to labor pain. *Psychiatria Danubina*, 24(2), 167-174.
- Cusick, S., & Georgieff, M. K. (2019). UNICEF: The first 1000 days of life the brains window of opportunity. Retrieved 06/06/2019 from <https://www.unicef-irc.org/article/958-the-first-1000-days-of-life-the-brains-window-of-opportunity.html>
- Czeisler, C. A. (2015). Duration, timing and quality of sleep are each vital for health, performance and safety. *Sleep Health*, 1(1), 5-8. doi:10.1016/j.sleh.2014.12.008
- Czeisler, C. A., & Buxton, O. M. (2017). Human circadian timing system and sleep/wake regulation. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (6th ed., pp. 362-376). Philadelphia, PA: Elsevier.
- Da Costa, D., Dritsa, M., Verreault, N., Balaa, C., Kudzman, J., & Khalifé, S. (2010). Sleep problems and depressed mood negatively impact health-related quality of life during pregnancy. *Archives of Women's Mental Health*, 13(3), 249-257. doi:10.1007/s00737-009-0104-3
- Da Costa, D., Zekowitz, P., Letourneau, N., Howlett, A., Dennis, C.-L., Russell, B., . . . Khalifé, S. (2017). HealthyDads.ca: What do men want in a website designed to promote emotional wellness and healthy behaviors during the transition to parenthood? *Journal of Medical Internet Research*, 19(10), 1-15.
- Datta, S., Mavanji, V., Ulloor, J., & Patterson, E. H. (2004). Activation of phasic pontine-wave generator prevents rapid eye movement sleep deprivation-induced learning impairment in the rat: A mechanism for sleep-dependent plasticity. *The Journal of Neuroscience*, 24(6), 1416-1427. doi:10.1523/JNEUROSCI.4111-03.2004
- Davis, D. C. (1996). The discomforts of pregnancy. *JOGNN: Journal of Obstetric, Gynecologic, & Neonatal Nursing*, 25(1), 73-81. doi:10.1111/j.1552-6909.1996.tb02516.x
- de Souza, L., Benedito-Silva, A. A., Pires, M. L. N., Poyares, D., Tufik, S., & Calil, H. M. (2003). Further validation of actigraphy for sleep studies. *Sleep*, 26(1), 81-85. doi:10.1093/sleep/26.1.81
- Deitz, P. M., Williams, S. B., Callaghan, W. M., Bachman, D. J., Whitlock, E. P., & Hornbrook, M. C. (2007). Clinically identified maternal depression before, during, and after pregnancies ending in live births. *American Journal of Psychiatry*, 164(10), 1515-1520. doi:10.1176/appi.ajp.2007.06111893

- Dennis, C.-L. (2004). Can we identify mothers at risk for postpartum depression in the immediate postpartum period using the Edinburgh Postnatal Depression Scale? *Journal of Affective Disorders, 78*(2), 163-169. doi:10.1016/S0165-0327(02)00299-9
- Dennis, C.-L., & Dowswell, T. (2013). Interventions (other than pharmacological, psychosocial or psychological) for treating antenatal depression. *Cochrane Database of Systematic Reviews, 7*, CD006795. doi:10.1002/14651858.CD006795.pub3
- Dennis, C.-L., & Ross, L. (2006). Women's perceptions of partner support and conflict in the development of postpartum depressive symptoms. *Journal of Advanced Nursing, 56*(6), 588-599. doi:10.1111/j.1365-2648.2006.04059.x
- Dennis, C.-L., Ross, L. E., & Grigoriadis, S. (2007). Psychosocial and psychological interventions for treating antenatal depression. *Cochrane Database of Systematic Reviews, 3*, 1465-1858. doi:10.1002/14651858.CD006309.pub2
- Dijk, D. J., Duffy, J. F., Riel, E., Shanahan, T. L., & Czeisler, C. A. (1999). Ageing and the circadian and homeostatic regulation of human sleep during forced desynchrony of rest, melatonin and temperature rhythms. *Journal of Physiology, 516*(2), 611-627. doi:10.1111/j.1469-7793.1999.0611v.x
- Doering, J. J., Morin, K., & Stetzer, F. C. (2009). Severe fatigue and depressive symptoms in lower-income urban postpartum women. *Western Journal of Nursing Research, 31*(5), 599-612. doi:10.1177/0193945909333890
- Dørheim, S. K., Bjorvatn, B., & Eberhard-Gran, M. (2012). Insomnia and depressive symptoms in late pregnancy: A population-based study. *Behavioral Sleep Medicine, 10*(3), 152-166. doi:10.1080/15402002.2012.660588
- Dørheim, S. K., Bondevik, G. T., Eberhard-Gran, M., & Bjorvatn, B. (2009). Sleep and depression in postpartum women: A population-based study. *Sleep, 32*(7), 847-855. doi:10.1093/sleep/32.7.847
- Douglas, P. S., & Hill, P. S. (2013). Behavioral sleep interventions in the first six months of life do not improve outcomes for mothers or infants: A systematic review. *Journal of Developmental and Behavioral Pediatrics, 34*(7), 497-507. doi:10.1097/DBP.0b013e31829cfa6
- Drago, A. (2008). SSRIs impact on sleep architecture: Guidelines for clinician use. *Clinical Neuropsychiatry, 5*(3), 115-131.
- Dreyer, K., Williamson, R. A. P., Hargreaves, D. S., Rosen, R., & Deeny, S. R. (2018). Associations between parental mental health and other family factors and healthcare utilisation among children and young people: A retrospective, cross-sectional study of linked healthcare data. *BMJ Paediatrics Open, 2*(1), e000266. doi:10.1136/bmjpo-2018-000266

- Dunietz, G. L., Lisabeth, L. D., Shedden, K., Shamim-Uzzaman, Q. A., Bullough, A. S., Chames, M. C., . . . O'Brien, L. M. (2017). Restless legs syndrome and sleep-wake disturbances in pregnancy. *Journal of Clinical Sleep Medicine, 13*(7), 863-870. doi:10.5664/jcsm.6654
- Durie, M. (2017). Indigenous suicide: The Turamarama Declaration. *Te Mauri - Pimatisiwin: Journal of Indigenous Wellbeing, 2*(2), 59-67.
- Dzaja, A., Arber, S., Hislop, J., Kerkhofs, M., Kopp, C., Pollmächer, T., . . . Porkka-Heiskanen, T. (2005). Women's sleep in health and disease. *Journal of Psychiatric Research, 39*(1), 55-76. doi:10.1016/j.jpsychires.2004.05.008
- Dzaja, A., Wehrle, R., Lancel, M., & Pollmächer, T. (2009). Elevated estradiol plasma levels in women with restless legs during pregnancy. *Sleep, 32*(2), 169-174. doi:10.1093/sleep/32.2.169
- Eaton, W. W., Badawi, M., & Melton, B. (1995). Prodromes and precursors: Epidemiologic data for primary prevention of disorders with slow onset. *The American Journal of Psychiatry, 152*(7), 967-972. doi:10.1176/ajp.152.7.967
- Eberhard-Gran, M., Eskild, A., Tambs, K., Opjordsmoen, S., & Ove Samuelsen, S. (2001). Review of validation studies of the Edinburgh Postnatal Depression Scale. *Acta Psychiatrica Scandinavica, 104*(4), 243-249. doi:10.1034/j.1600-0447.2001.00187.x
- Ebert, R. M., Wood, A., & Okun, M. L. (2015). Minimal effect of daytime napping behavior on nocturnal sleep in pregnant women. *Journal of Clinical Sleep Medicine, 11*(6), 635-643. doi:10.5664/jcsm.4774
- Eccles, R. (2000). Nasal airflow in health and disease. *Acta Oto-Laryngologica, 120*(5), 580-595. doi:10.1080/000164800750000388
- Eichler, J., Schmidt, R., Hiemisch, A., Kiess, W., & Hilbert, A. (2019). Gestational weight gain, physical activity, sleep problems, substance use, and food intake as proximal risk factors of stress and depressive symptoms during pregnancy. *BMC Pregnancy and Childbirth, 19*(1), 175-175. doi:10.1186/s12884-019-2328-1
- Ekeroma, A. J., Ikenasio-Thorpe, B., Weeks, S., Kokaua, J., Puniani, K., Stone, P., & Foliaki, S. A. (2012). Validation of the Edinburgh Postnatal Depression Scale (EPDS) as a screening tool for postnatal depression in Samoan and Tongan women living in New Zealand. *The New Zealand Medical Journal, 125*(1355), 41-49.
- Elek, S. M., Hudson, D. B., & Fleck, M. O. (1997). Expectant parents' experience with fatigue and sleep during pregnancy. *Birth, 24*(1), 49-54.
- Ellegård, E. K., & Karlsson, G. (2006). Pregnancy rhinitis. *Immunology and Allergy Clinics of North America, 26*(1), 119-135. doi:10.1016/j.iac.2005.10.007

- Employment New Zealand. (2018). Parental leave eligibility. Retrieved 05/12/2019 from <https://www.employment.govt.nz/leave-and-holidays/parental-leave/eligibility/>
- English, S., Sorinola, O., Grammatopoulos, D. K., Steele, A., Wernisch, L., Williams, A., & Blacklay, J. (2018). Modelling of psychosocial and lifestyle predictors of peripartum depressive symptoms associated with distinct risk trajectories: A prospective cohort study. *Scientific Reports*, *8*(1), 12799. doi:10.1038/s41598-018-30874-z
- Entsieh, A. A., & Hallström, I. K. (2016). First-time parents' prenatal needs for early parenthood preparation: A systematic review and meta-synthesis of qualitative literature. *Midwifery*, *39*, 1-11. doi:10.1016/j.midw.2016.04.006
- Evans, J., Heron, J., Francomb, H., Oke, S., & Golding, J. (2001). Cohort study of depressed mood during pregnancy and after childbirth. *BMJ: British Medical Journal*, *323*(7307), 257-260. doi:10.1136/bmj.323.7307.257
- Evans, M. L., Dick, M. J., & Clark, A. S. (1995). Sleep during the week before labor: Relationships to labor outcomes. *Clinical Nursing Research*, *4*(3), 238-249.
- Facco, F. L., Grobman, W. A., Kramer, J., Ho, K. H., & Zee, P. C. (2010). Self-reported short sleep duration and frequent snoring in pregnancy: Impact on glucose metabolism. *American Journal of Obstetrics and Gynecology*, *203*(2), 142e141-142e145. doi:10.1016/j.ajog.2010.03.041
- Facco, F. L., Grobman, W. A., Reid, K. J., Parker, C. B., Hunter, S. M., Silver, R. M., . . . Zee, P. C. (2017). Objectively measured short sleep duration and later sleep midpoint in pregnancy are associated with a higher risk of gestational diabetes. *American Journal of Obstetrics & Gynecology*, *217*(447), 1-13. doi:10.1016/j.ajog.2017.05.066
- Facco, F. L., Kramer, J., Ho, K., Zee, P. C., & Grobman, W. A. (2010). Sleep disturbances in pregnancy. *Obstetrics and Gynecology*, *115*(1), 77-83. doi:10.1097/AOG.0b013e3181c4f8ec
- Fahey, J. O., & Shenassa, E. (2013). Understanding and meeting the needs of women in the postpartum period: The perinatal maternal health promotion model. *Journal of Midwifery & Women's Health*, *58*(6), 613-621. doi:10.1111/jmwh.12139
- Faisal-Cury, A., & Menezes, P. R. (2012). Antenatal depression strongly predicts postnatal depression in primary health care. *Revista Brasileira de Psiquiatria*, *34*(4), 446-450. doi:10.1016/j.rbp.2012.01.003
- Falah-Hassani, K., Shiri, R., Vigod, S., & Dennis, C.-L. (2015). Prevalence of postpartum depression among immigrant women: A systematic review and meta-analysis. *Journal of Psychiatric Research*, *70*, 67-82. doi:10.1016/j.jpsychires.2015.08.010

- Fan, F., Zou, Y., Ma, A., Yue, Y., Mao, W., & Ma, X. (2009). Hormonal changes and somatopsychologic manifestations in the first trimester of pregnancy and post partum. *International Journal of Gynaecology and Obstetrics*, *105*(1), 46-49. doi:10.1016/j.ijgo.2008.12.001
- Fang, H., Tu, S., Sheng, J., & Shao, A. (2019). Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. *Journal Of Cellular And Molecular Medicine*, *23*(4), 2324-2332. doi:10.1111/jcmm.14170
- Farrell, P. C., & Richards, G. (2017). Recognition and treatment of sleep-disordered breathing: An important component of chronic disease management. *Journal of Translational Medicine*, *15*(1), 114. doi: 10.1186/s12967-017-1211-y
- Felder, J. N., Laraia, B., Coleman-Phox, K., Bush, N., Suresh, M., Thomas, M., . . . Prather, A. A. (2018). Poor sleep quality, psychological distress, and the buffering effect of mindfulness training during pregnancy. *Behavioral Sleep Medicine*, *16*(6), 611-624. doi:10.1080/15402002.2016.1266488
- Feldman, R., Granat, A., Pariente, C., Kanety, H., Kuint, J., & Gilboa-Schechtman, E. (2009). Maternal depression and anxiety across the postpartum year and infant social engagement, fear regulation, and stress reactivity. *Journal of the American Academy of Child & Adolescent Psychiatry*, *48*(9), 919-927. doi:10.1097/CHI.0b013e3181b21651
- Fellmeth, G., Opondo, C., Henderson, J., Redshaw, M., McNeill, J., Lynn, F., & Alderdice, F. (2019). Identifying postnatal depression: Comparison of a self-reported depression item with Edinburgh Postnatal Depression Scale scores at three months postpartum. *Journal of Affective Disorders*, *251*, 8-14. doi:10.1016/j.jad.2019.03.002
- Fenwick, J., Hauck, Y., Downie, J., & Butt, J. (2005). The childbirth expectations of a self-selected cohort of Western Australian women. *Midwifery*, *21*(1), 23-35. doi:10.1016/j.midw.2004.07.001
- Ferrara, M., & De Gennaro, L. (2001). How much sleep do we need? *Sleep Medicine Reviews*, *5*(2), 155-179. doi:10.1053/smr.2000.0138
- Ferraro, Z. M., Chaput, J.-P., Gruslin, A., & Adamo, K. B. (2014). The potential value of sleep hygiene for a healthy pregnancy: A brief review. *ISRN Family Medicine*, *2014*. doi:10.1155/2014/928293
- Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: A review. *Infant Behavior and Development*, *33*(1), 1-6. doi:10.1016/j.infbeh.2009.10.005
- Field, T., Diego, M., Hernandez-Reif, M., Figueiredo, B., Schanberg, S., & Kuhn, C. (2007). Sleep disturbances in depressed pregnant women and their newborns. *Infant Behavior & Development*, *30*(1), 127-133. doi:10.1016/j.infbeh.2006.08.002

- Finan, P. H., Quartana, P. J., & Smith, M. T. (2015). The effects of sleep continuity disruption on positive mood and sleep architecture in healthy adults. *Sleep, 38*(11), 1735-1742. doi:10.5665/sleep.5154
- Finnbogadóttir, H., Svalenius, E. C., & Persson, E. K. (2003). Expectant first-time fathers' experiences of pregnancy. *Midwifery, 19*(2), 96-105. doi:10.1016/S0266-6138(03)00003-2
- Forty, L., Jones, L., Macgregor, S., Caesar, S., Cooper, C., Hough, A., . . . Jones, I. (2006). Familiality of postpartum depression in unipolar disorder: Results of a family study. *American Journal of Psychiatry, 163*(9), 1549-1553. doi:10.1176/ajp.2006.163.9.1549
- Foster, R. G., Peirson, S. N., Wulff, K., Winnebeck, E., Vetter, C., & Roenneberg, T. (2013). Sleep and circadian rhythm disruption in social jetlag and mental illness. In M. U. Gillette (Ed.), *Chronobiology: Biological Timing in Health and Disease*. Oxford, UK: Academic Press.
- Franken, P. (2002). Long-term vs. short-term processes regulating REM sleep. *Journal of Sleep Research, 11*(1), 17-28. doi:10.1046/j.1365-2869.2002.00275.x
- Franklin, K. A., Holmgren, P., Jönsson, F., Poromaa, N., Stenlund, H., & Svanborg, E. (2000). Snoring, pregnancy-induced hypertension, and growth retardation of the fetus. *CHEST, 117*(1), 137-141. doi:10.1378/chest.117.1.137
- Franzen, P. L., & Buysse, D. J. (2008). Sleep disturbances and depression: Risk relationships for subsequent depression and therapeutic implications. *Dialogues in Clinical Neuroscience, 10*(4), 473-481.
- Frew, P. M., Saint-Victor, D. S., Isaacs, M. B., Kim, S., Swamy, G. K., Sheffield, J. S., . . . Ault, K. (2014). Recruitment and retention of pregnant women into clinical research trials: An overview of challenges, facilitators, and best practices. *Clinical Infectious Diseases, 59*(7), S400-S407. doi:10.1093/cid/ciu726
- Gangwisch, J. E., Heymsfield, S. B., Boden-Albala, B., Buijs, R. M., Kreier, F., Pickering, T. G., . . . Malaspina, D. (2006). Short sleep duration as a risk factor for hypertension: Analyses of the first national health and nutrition examination survey. *Hypertension, 47*(5), 833-839. doi:10.1161/01.HYP.0000217362.34748.e0
- Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: A systematic review of prevalence and incidence. *Obstetrics & Gynecology, 106*(5), 1071-1083. doi:10.1097/01.AOG.0000183597.31630.db
- Gaynes, B. N., Gavin, N., Meltzer-Brody, S., Lohr, K. N., Swinson, T., Gartlehner, G., . . . Miller, W. C. (2005). *Evidence report/technology assessment No. 119: Perinatal depression: prevalence, screening accuracy, and screening outcomes* (Review). Rockville, MD:

- Agency for Healthcare Research and Quality. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK37740/>
- Gelaye, B., Addae, G., Neway, B., Larrabure-Torrealva, G. T., Qiu, C., Stoner, L., . . . Williams, M. A. (2017). Poor sleep quality, antepartum depression and suicidal ideation among pregnant women. *Journal of Affective Disorders, 209*, 195-200. doi:10.1016/j.jad.2016.11.020
- Gelaye, B., Barrios, Y. V., Zhong, Q.-Y., Rondon, M. B., Borba, C. P. C., Sánchez, S. E., . . . Williams, M. A. (2015). Association of poor subjective sleep quality with suicidal ideation among pregnant Peruvian women. *General Hospital Psychiatry, 37*(5), 441-447. doi:10.1016/j.genhosppsy.2015.04.014
- Gellis, L. A., & Lichstein, K. L. (2009). Sleep hygiene practices of good and poor sleepers in the United States: An internet-based study. *Behavior Therapy, 40*(1), 1-9. doi:10.1016/j.beth.2008.02.001
- Gibson, J., McKenzie-McHarg, K., Shakespeare, J., Price, J., & Gray, R. (2009). A systematic review of studies validating the Edinburgh Postnatal Depression Scale in antepartum and postpartum women. *Acta Psychiatrica Scandinavica, 119*(5), 350-364. doi:10.1111/j.1600-0447.2009.01363.x
- Goedhart, G., Snijders, A. C., Hesselink, A. E., van Poppel, M. N., Bonsel, G. J., & Vrijkotte, T. G. M. (2010). Maternal depressive symptoms in relation to perinatal mortality and morbidity: Results from a large multiethnic cohort study. *Psychosomatic Medicine, 72*(8), 769-776. doi:10.1097/PSY.0b013e3181ee4a62
- Goldenberg, R. L., Culhane, J. F., Iams, J. D., & Romero, R. (2008). Epidemiology and causes of preterm birth. *The Lancet, 371*(9606), 75-84. doi:10.1016/S0140-6736(08)60074-4
- Goldsmith, L. T., & Weiss, G. (2009). Relaxin in human pregnancy. *Annals of the New York Academy of Sciences, 1160*(1), 130-135. doi:10.1111/j.1749-6632.2008.03800.x
- González, G., Moraes, M., Ghione, A., Sosa, C., Umpierrez, E., Duarte, M., & Cal, J. (2017). Maternal postnatal depression and its impact on child neurodevelopment: A cohort study. *Revista Chilena de Pediatría, 88*(3), 360-366. doi:10.4067/S0370-41062017000300008
- Goodman, J. H. (2004). Paternal postpartum depression, its relationship to maternal postpartum depression, and implications for family health. *Journal of Advanced Nursing, 45*(1), 26-35. doi:10.1046/j.1365-2648.2003.02857.x
- Goodman, J. H. (2009). Women's attitudes, preferences, and perceived barriers to treatment for perinatal depression. *Birth, 36*(1), 60-69. doi:10.1111/j.1523-536X.2008.00296.x

- Gordon, A., Raynes-Greenow, C., Bond, D., Morris, J., Rawlinson, W., & Jeffery, H. (2015). Sleep position, fetal growth restriction, and late-pregnancy stillbirth: The Sydney Stillbirth Study. *Obstetrics & Gynecology*, *125*(2), 347-355. doi:10.1097/AOG.0000000000000627
- Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology*, *6*, 285-312. doi:10.1146/annurev.clinpsy.121208.131305
- Government Inquiry into Mental Health and Addiction. (2018). *He Ara Oranga: Report of the Government Inquiry into Mental Health and Addiction*. Wellington, NZ: Government Inquiry into Mental Health and Addiction. Retrieved from <https://mentalhealth.inquiry.govt.nz/assets/Summary-reports/He-Ara-Oranga.pdf>
- Goyal, D., Gay, C., & Lee, K. (2009). Fragmented maternal sleep is more strongly correlated with depressive symptoms than infant temperament at three months postpartum. *Archives of Women's Mental Health*, *12*(4), 229-237. doi:10.1007/s00737-009-0070-9
- Grandner, M. A., Hale, L., Moore, M., & Patel, N. P. (2010). Mortality associated with short sleep duration: The evidence, the possible mechanisms, and the future. *Sleep Medicine Reviews*, *14*(3), 191-203. doi:10.1016/j.smrv.2009.07.006
- Grigoriadis, S., VonderPorten, E. H., Mamisashvili, L., Tomlinson, G., Dennis, C.-L., Koren, G., . . . Ross, L. E. (2013). The impact of maternal depression during pregnancy on perinatal outcomes: A systematic review and meta-analysis. *The Journal of Clinical Psychiatry*, *74*(4), e321-e341. doi:10.4088/JCP.12r07968
- Hairston, I. S., Solnik-Menilo, T., Deviri, D., & Handelzalts, J. E. (2016). Maternal depressed mood moderates the impact of infant sleep on mother-infant bonding. *Archives of Women's Mental Health*, *19*(6), 1029-1039. doi:10.1007/s00737-016-0652-2
- Hall, W. A., Stoll, K., Hutton, E. K., & Brown, H. (2012). A prospective study of effects of psychological factors and sleep on obstetric interventions, mode of birth, and neonatal outcomes among low-risk British Columbian women. *BMC Pregnancy & Childbirth*, *12*, 78. doi:10.1186/1471-2393-12-78
- Hammerton, G., Mahedy, L., Mars, B., Harold, G. T., Thapar, A., Zammit, S., & Collishaw, S. (2015). Association between maternal depression symptoms across the first eleven years of their child's life and subsequent offspring suicidal ideation. *PLoS ONE*, *10*(7), 1-18. doi:10.1371/journal.pone.0131885
- Han, S. (2013). *Pregnancy in practice: Expectation and experience in the contemporary US*. New York: Berghahn Books.

- Haney, A., Buysse, D. J., Okun, M. L., Rosario, B. L., & Chen, Y. F. (2014). Sleep disturbance and cardiometabolic risk factors in early pregnancy: A preliminary study. *Sleep Medicine, 15*(4), 444-450. doi:10.1016/j.sleep.2014.01.003
- Hastings, M. H., Brancaccio, M., & Maywood, E. S. (2014). Circadian pacemaking in cells and circuits of the suprachiasmatic nucleus. *Journal of Neuroendocrinology, 26*(1), 2-10. doi:10.1111/jne.12125
- Hawkins, M., Iradukunda, F., & Paterno, M. (2019). Feasibility of a sleep self-management intervention in pregnancy using a personalized health monitoring device: Protocol for a pilot randomized controlled trial. *Journal of Medical Internet Research, 21*(5), e12455. doi:10.2196/12455
- Health Navigator. (2019). Sleep in pregnancy. Retrieved 04/12/2019 from <https://www.healthnavigator.org.nz/healthy-living/pregnancy/sleep-in-pregnancy/>
- Heazell, A. E. P., Li, M., Budd, J., Thompson, J. M. D., Stacey, T., Cronin, R. S., . . . McCowan, L. M. E. (2018). Association between maternal sleep practices and late stillbirth - findings from a stillbirth case-control study. *BJOG: An International Journal of Obstetrics & Gynaecology, 125*, 254-262. doi:10.1111/1471-0528.14967
- Hedman, C., Pohjasvaara, T., Tolonen, U., Suhonen-Malm, A. S., & Myllylä, V. V. (2002). Effects of pregnancy on mothers' sleep. *Sleep Medicine, 3*(1), 37-42.
- Heffron, T. M. (2014). Sleep Well, Be Well: A national health priority. Retrieved 04-06-2019 from <http://sleepeducation.org/news/2014/05/16/sleep-well-be-well-a-national-health-priority>
- Heinicke, C. M., Beckwith, L., & Thompson, A. (1988). Early intervention in the family system: A framework and review. *Infant Mental Health Journal, 9*(2), 111-141. doi:10.1002/1097-0355
- Hensley, J. G. (2009). Leg cramps and restless legs syndrome during pregnancy. *Journal of Midwifery & Women's Health, 54*(3), 211-218. doi:10.1016/j.jmwh.2009.01.003
- Herring, S. J., Foster, G. D., Pien, G. W., Massa, K., Nelson, D. B., Gehrman, P. R., & Davey, A. (2013). Do pregnant women accurately report sleep time? A comparison between self-reported and objective measures of sleep duration in pregnancy among a sample of urban mothers. *Sleep and Breathing, 17*(4), 1323-1327. doi:10.1007/s11325-013-0835-2
- Hertz, G., Fast, A., Feinsilver, S. H., Albertario, C. L., Schulman, H., & Fein, A. M. (1992). Sleep in normal late pregnancy. *Sleep, 15*(3), 246-251.

- Hickie, I. B., Naismith, S. L., Robillard, R., Scott, E. M., & Hermens, D. F. (2013). Manipulating the sleep-wake cycle and circadian rhythms to improve clinical management of major depression. *BMC Medicine*, *11*(1), 1-27. doi:10.1186/1741-7015-11-79
- Hidalgo, M. P., Caumo, W., Posser, M., Coccaro, S. B., Camozzato, A. L., & Chaves, M. L. F. (2009). Relationship between depressive mood and chronotype in healthy subjects. *Psychiatry & Clinical Neurosciences*, *63*(3), 283-290. doi:10.1111/j.1440-1819.2009.01965.x
- Highet, N., Gemmill, A. W., & Milgrom, J. (2011). Depression in the perinatal period: Awareness, attitudes and knowledge in the Australian population. *Australian & New Zealand Journal of Psychiatry*, *45*(3), 223-231. doi:10.3109/00048674.2010.547842
- Highet, N., Stevenson, A. L., Purtell, C., & Coo, S. (2014). Qualitative insights into women's personal experiences of perinatal depression and anxiety. *Women and Birth*, *27*, 179-184. doi:10.1016/j.wombi.2014.05.003
- Hillman, D. R., & Lack, L. C. (2013). Public health implications of sleep loss: The community burden. *Medical Journal of Australia*, *199*(8), S7-10. doi:10.5694/mja13.10620
- Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., . . . Adams Hillard, P. J. (2015). National sleep foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health*, *1*(1), 40-43. doi:10.1016/j.sleh.2014.12.010
- Hiscock, H., Bayer, J. K., Hampton, A., Ukoumunne, O. C., & Wake, M. (2008). Long-term mother and child mental health effects of a population-based infant sleep intervention: Cluster-randomized, controlled trial. *Pediatrics*, *122*(2), E621-E627. doi:10.1542/peds.2007-3783
- Hollenbach, D., Broker, R., Herlehy, S., & Stuber, K. (2013). Non-pharmacological interventions for sleep quality and insomnia during pregnancy: A systematic review. *Journal of the Canadian Chiropractic Association*, *57*(3), 260-270.
- Howe, L. D., Signal, T. L., Paine, S.-J., Sweeney, B., Priston, M., Muller, D., . . . Gander, P. (2015). Self-reported sleep in late pregnancy in relation to birth size and fetal distress: The E Moe, Māmā prospective cohort study. *BMJ Open*, *5*(10), e008910. doi:10.1136/bmjopen-2015-008910
- Huang, C., Carter, P. A., & Guo, J. (2004). A comparison of sleep and daytime sleepiness in depressed and non-depressed mothers during the early postpartum period. *Journal of Nursing Research*, *12*(4), 287-295. doi:10.1097/01.JNR.0000387513.75114.bb
- Huberty, J., Dinkel, D., Beets, M., & Coleman, J. (2013). Describing the use of the internet for health, physical activity, and nutrition information in pregnant women. *Maternal & Child Health Journal*, *17*(8), 1363-1372. doi:10.1007/s10995-012-1160-2

- Hunter, D. J. (2008). Health needs more than health care: The need for a new paradigm. *European Journal of Public Health, 18*(3), 217-220. doi:10.1093/eurpub/ckn039
- Huria T, Palmer SC, Pitama S, et al. (2019) Consolidated criteria for strengthening reporting of health research involving indigenous peoples: The CONSIDER statement. *BMC Medical Research Methodology 19*:173-181.
- Hux, V. J., Roberts, J. M., & Okun, M. L. (2017). Higher allostatic load in early pregnancy is associated with chronic stressors and poorer sleep quality. *Sleep Medicine, 33*, 85-90. doi:10.1016/j.sleep.2016.09.001
- Hytten, F. (1985). Blood volume changes in normal pregnancy. *Clinics In Haematology, 14*(3), 601-612.
- Innocenti, G. M., & Price, D. J. (2005). Exuberance in the development of cortical networks. *Nature Reviews Neuroscience, 6*(12), 955-965. doi:10.1038/nrn1790
- Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., & Hall, M. H. (2015). The role of sleep hygiene in promoting public health: A review of empirical evidence. *Sleep Medicine Reviews, 22*, 23-36. doi:10.1016/j.smr.2014.10.001
- Isaac, F., & Greenwood, K. M. (2011). The relationship between insomnia and depressive symptoms: Genuine or artifact? *Neuropsychiatric Disease and Treatment, 7*, 57-63. doi:10.2147/NDT.S16267
- Jaussent, I., Dauvilliers, Y., Morin, C. M., & Ivers, H. (2017). Incidence, worsening and risk factors of daytime sleepiness in a population-based 5-year longitudinal study. *Scientific Reports, 7*(1) doi:10.1038/s41598-017-01547-0
- Jednak, M. A., Shadigian, E. M., Kim, M. S., Woods, M. L., Hooper, F. G., Owyang, C., & Hasler, W. L. (1999). Protein meals reduce nausea and gastric slow wave dysrhythmic activity in first trimester pregnancy. *American Journal of Physiology, 277*(4), G855-G861. doi:10.1152/ajpgi.1999.277.4.G855
- Jefferson, C. D., Drake, C. L., Scofield, H. M., Myers, E., McClure, T., Roehrs, T., & Roth, T. (2005). Sleep hygiene practices in a population-based sample of insomniacs. *Sleep, 28*(5), 611-615. doi:10.1093/sleep/28.5.611
- Jensen, D., Webb, K. A., & O'Donnell, D. E. (2007). Chemical and mechanical adaptations of the respiratory system at rest and during exercise in human pregnancy. *Applied Physiology, Nutrition & Metabolism, 32*(6), 1239-1250. doi:10.1139/H07-120
- Jeong, H.-G., Lim, J.-S., Lee, M.-S., Kim, S.-H., Jung, I.-K., & Joe, S.-H. (2013). The association of psychosocial factors and obstetric history with depression in pregnant women: Focus on the role of emotional support. *General Hospital Psychiatry, 35*(4), 354-358. doi:10.1016/j.genhosppsych.2013.02.009

- Jerath, R., Harden, K., Crawford, M., Barnes, V. A., & Jensen, M. (2014). Role of cardiorespiratory synchronization and sleep physiology: Effects on membrane potential in the restorative functions of sleep. *Sleep Medicine, 15*(3), 279-288. doi:10.1016/j.sleep.2013.10.017
- Ji, S., Long, Q., Jeffrey Newport, D., Na, H., Knight, B., Zach, E. B., . . . Stowe, Z. N. (2011). Validity of depression rating scales during pregnancy and the postpartum period: Impact of trimester and parity. *Journal of Psychiatric Research, 45*(2), 213-219. doi:10.1016/j.jpsychires.2010.05.017
- Jike, M., Itani, O., Watanabe, N., Buysse, D., & Kaneita, Y. (2017). Long sleep duration and health outcomes: A systematic review, meta-analysis and meta-regression. *Sleep Medicine Reviews, 39*, 25-36. doi:10.1016/j.smrv.2017.06.011. [Epub ahead of print]
- Jimenez-Solem, E., Andersen, J. T., Petersen, M., Broedbaek, K., Andersen, N. L., Torp-Pedersen, C., & Poulsen, H. E. (2013). Prevalence of antidepressant use during pregnancy in Denmark, a nation-wide cohort study. *PLoS ONE, 8*(4), e63034. doi:10.1371/journal.pone.0063034
- Jin, J. (2016). Treatments for nausea and vomiting during pregnancy. *JAMA: Journal of the American Medical Association, 316*(13), 1420-1420. doi:10.1001/jama.2016.14737
- Johansen, S. L., Robakis, T. K., Williams, K. E., & Rasgon, N. L. (2019). Management of perinatal depression with non-drug interventions. *BMJ: British Medical Journal, 364*, l322-1336. doi:10.1136/bmj.l322
- Johns, M. W. (1991). A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. *Sleep, 14*(6), 540-545. doi:10.1093/sleep/14.6.540
- Jomeen, J., & Martin, C. R. (2007). Assessment and relationship of sleep quality to depression in early pregnancy. *Journal of Reproductive & Infant Psychology, 25*(1), 87-99. doi:10.1080/02646830601117308
- Kamysheva, E., Skouteris, H., Wertheim, E. H., Paxton, S. J., & Milgrom, J. (2010). A prospective investigation of the relationships among sleep quality, physical symptoms, and depressive symptoms during pregnancy. *Journal of Affective Disorders, 123*(1-3), 317-320. doi:10.1016/j.jad.2009.09.015
- Kavanaugh, K., & Hershberger, P. (2005). Perinatal loss in low-income African American parents. *Journal of Obstetric, Gynecologic & Neonatal Nursing, 34*(5), 595-605. doi:10.1177/0884217505280000
- Kelly, R. H., Russo, J., & Katon, W. (2001). Somatic complaints among pregnant women cared for in obstetrics: Normal pregnancy or depressive and anxiety symptom amplification revisited? *General Hospital Psychiatry, 23*(3), 107-113. doi:10.1016/S0163-8343(01)00129-3

- Kempler, L., Sharpe, L., & Bartlett, D. (2012). Sleep education during pregnancy for new mothers. *BMC Pregnancy & Childbirth*, *12*(1), 155-164. doi:10.1186/1471-2393-12-155.
- Kempler, L., Sharpe, L., Miller, C. B., & Bartlett, D. J. (2016). Do psychosocial sleep interventions improve infant sleep or maternal mood in the postnatal period? A systematic review and meta-analysis of randomised controlled trials. *Sleep Medicine Reviews*, *29*, 15-22. doi:10.1016/j.smr.2015.08.002
- Kennedy, H. P., Gardiner, A., Gay, C., & Lee, K. A. (2007). Negotiating sleep: A qualitative study of new mothers. *Journal of Perinatal & Neonatal Nursing*, *21*(2), 114-122. doi:10.1097/01.JPN.0000270628.51122.1d
- Kent, R. G., Uchino, B. N., Cribbet, M. R., Bowen, K., & Smith, T. W. (2015). Social relationships and sleep quality. *Annals of Behavioral Medicine*, *49*, 912-917. doi:10.1007/s12160-015-9711-6
- Kerr, L. K., & Kerr, L. D., Jr. (2001). Screening tools for depression in primary care: The effects of culture, gender, and somatic symptoms on the detection of depression. *The Western Journal of Medicine*, *175*(5), 349-352.
- Kerstis, B., Aarts, C., Tillman, C., Persson, H., Engström, G., Edlund, B., . . . Skalkidou, A. (2016). Association between parental depressive symptoms and impaired bonding with the infant. *Archives of Women's Mental Health*, *19*(1), 87-94. doi:10.1007/s00737-015-0522-3
- Kessler, R. C., & Üstün, T. B. (2004). The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research*, *13*(2), 93-117. doi:10.1002/mpr.168
- Kettunen, P., Koistinen, E., & Hintikka, J. (2014). Is postpartum depression a homogenous disorder: Time of onset, severity, symptoms and hopelessness in relation to the course of depression. *BMC Pregnancy & Childbirth*, *14*, 402-410. doi:10.1186/s12884-014-0402-2
- Khanlari, S., Barnett Am, B., Ogbo, F. A., & Eastwood, J. (2019). Re-examination of perinatal mental health policy frameworks for women signalling distress on the Edinburgh Postnatal Depression Scale (EPDS) completed during their antenatal booking-in consultation: A call for population health intervention. *BMC Pregnancy and Childbirth*, *19*(1), 221-231. doi:10.1186/s12884-019-2378-4
- Khazaie, H., Ghadami, M. R., Knight, D. C., Emamian, F., & Tahmasian, M. (2013). Insomnia treatment in the third trimester of pregnancy reduces postpartum depression symptoms: A randomized clinical trial. *Psychiatry Research*, *210*(3), 901-905. doi:10.1016/j.psychres.2013.08.017

- Kim, D. R., Hantsoo, L., Thase, M. E., Sammel, M., & Epperson, C. N. (2014). Computer-assisted cognitive behavioral therapy for pregnant women with major depressive disorder. *Journal of Women's Health, 23*(10), 842-848. doi:10.1089/jwh.2014.4867
- Kingston, D., McDonald, S., Tough, S., & Austin, M. P. (2015). Association between prenatal and postnatal psychological distress and toddler cognitive development: A systematic review. *PLoS ONE, 10*(5), 1-16. doi:10.1371/journal.pone.0126929
- Kinser, P. A., & Lyon, D. E. (2014). A conceptual framework of stress vulnerability, depression, and health outcomes in women: Potential uses in research on complementary therapies for depression. *Brain and Behavior, 4*(5), 665-674. doi:10.1002/brb3.249
- Kitamura, T., Shima, S., Sugawara, M., & Toda, M. A. (1993). Psychological and social correlates of the onset of affective disorders among pregnant women. *Psychological Medicine, 23*(4), 967-975. doi:10.1017/S003329170002643X
- Kivlighan, K. T., DiPietro, J. A., Costigan, K. A., & Laudenslager, M. L. (2008). Diurnal rhythm of cortisol during late pregnancy: Associations with maternal psychological well-being and fetal growth. *Psychoneuroendocrinology, 33*(9), 1225-1235. doi:10.1016/j.psyneuen.2008.06.008
- Klebanoff, M. A., Shiono, P. H., & Rhoads, G. G. (1990). Outcomes of pregnancy in a national sample of resident physicians. *New England Journal of Medicine, 323*(15), 1040-1045. doi:10.1056/nejm199010113231506
- Knight, B. A., & Wyatt, K. (2010). Barriers encountered when recruiting obese pregnant women to a dietary intervention. *Nursing Times, 106*(32), 20-22.
- Kohn, M., & Murray, B. J. (2008). Sleep and quality of life in pregnancy and postpartum,. In J. C. Verster, S. R. Pandi-Perumal, & D. L. Streiner (Eds.), *Sleep and quality of life in clinical medicine* (pp. 497-504). Totawa, NJ: Humana Press.
- Koo, B. B. (2015). Restless leg syndrome across the globe: Epidemiology of the restless legs syndrome/Willis-Ekbom Disease. *Sleep Medicine Clinics, 10*(3), 189-205. doi:10.1016/j.jsmc.2015.05.004
- Koslow, S., Ruiz, P., & Nemeroff, C. (Eds.). (2014). *A concise guide to understanding suicide: Epidemiology, pathophysiology and prevention* (1st ed.). Cambridge, United Kingdom: Cambridge University Press.
- Kosmadopoulos, A., Sargent, C., Darwent, D., Zhou, X., & Roach, G. D. (2014). Alternatives to polysomnography (PSG): A validation of wrist actigraphy and a partial-PSG system. *Behavior Research Methods, 46*(4), 1032-1041. doi:10.3758/s13428-013-0438-7
- Kothari, M. J., Shefner, J. M., & Eichler, A. F. (2019). Carpal tunnel syndrome: Clinical manifestations and diagnosis. Retrieved 09/09/2019 from

<https://www.uptodate.com/contents/carpal-tunnel-syndrome-clinical-manifestations-and-diagnosis>

- Kozinszky, Z., & Dudas, R. B. (2015). Validation studies of the Edinburgh Postnatal Depression Scale for the antenatal period. *Journal of Affective Disorders, 176*, 95-105. doi:10.1016/j.jad.2015.01.044
- Krahn, L. E., Tovar, M. D., & Miller, B. (2015). Are pets in the bedroom a problem? *Mayo Clinic Proceedings, 90*(12), 1663-1665. doi:10.1016/j.mayocp.2015.08.012
- Krawczak, E. M., Minuzzi, L., Hidalgo, M. P., & Frey, B. N. (2016). Do changes in subjective sleep and biological rhythms predict worsening in postpartum depressive symptoms? A prospective study across the perinatal period. *Archives of Women's Mental Health, 19*, 591-598. doi:10.1007/s00737-016-0612-x
- Krueger, P. M., & Friedman, E. M. (2009). Sleep duration in the United States: A cross-sectional population-based study. *American Journal of Epidemiology, 169*(9), 1052-1063. doi:10.1093/aje/kwp023
- Krystal, A. D., & Edinger, J. D. (2008). Measuring sleep quality. *Sleep Medicine, 9*(1), S10-S17. doi:10.1016/S1389-9457(08)70011-X.
- Kuo, S.-Y., Yang, Y.-L., Kuo, P.-C., Tseng, C.-M., & Tzeng, Y.-L. (2012). Trajectories of depressive symptoms and fatigue among postpartum women. *Journal of Obstetric, Gynecologic & Neonatal Nursing, 41*(2), 216-226. doi:10.1111/j.1552-6909.2011.01331.x
- Kuo, W.-H., Wilson, T. E., Holman, S., Fuentes-Afflick, E., O'Sullivan, M. J., & Minkoff, H. (2004). Depressive symptoms in the immediate postpartum period among hispanic women in three U.S. cities. *Journal of Immigrant Health, 6*(4), 145. doi:10.1023/b:joih.0000045252.10412.fa
- Kushida, C. A., Chang, A., Gadkary, C., Guilleminault, C., Carrillo, O., & Dement, W. C. (2001). Comparison of actigraphic, polysomnographic, and subjective assessment of sleep parameters in sleep-disordered patients. *Sleep Medicine, 2*(5), 389-396. doi:10.1016/S1389-9457(00)00098-8
- Ladyman, C., & Signal, T. L. (2018). Sleep health in pregnancy: A scoping review. *Sleep Medicine Clinics, 13*(3), 307-333. doi:10.1016/j.jsmc.2018.04.004
- Lagan, B. M., Sinclair, M., & Kernohan, W. G. (2010). Internet use in pregnancy informs women's decision making: A web-based survey. *Birth, 37*(2), 106-115. doi:10.1111/j.1523-536X.2010.00390.x
- Lahti-Pulkkinen, M., Mina, T. H., Riha, R. L., Räikkönen, K., Pesonen, A. K., Drake, A. J., . . . Reynolds, R. M. (2018). Maternal antenatal daytime sleepiness and child

- neuropsychiatric and neurocognitive development. *Psychological Medicine*, 49(12), 2081-2090. doi:10.1017/S003329171800291X
- Lancaster, C. A., Gold, K. J., Flynn, H. A., Yoo, H., Marcus, S. M., & Davis, M. M. (2010). Risk factors for depressive symptoms during pregnancy: A systematic review. *American Journal of Obstetrics & Gynecology*, 202(1), 5-14. doi:10.1016/j.ajog.2009.09.007
- Landhuis, C., Poulton, R., Welch, D., & Hancox, R. (2008). Childhood sleep time and long-term risk for obesity: A 32-year prospective birth cohort study. *Pediatrics*, 122(5), 955-960. doi:10.1542/peds.2007-3521
- Lawson, A., Murphy, K. E., Sloan, E., Uleryk, E., & Dalfen, A. (2015). The relationship between sleep and postpartum mental disorders: A systematic review. *Journal of Affective Disorders*, 176, 65-77. doi:10.1016/j.jad.2015.01.017
- Lee, K. A. (1992). Self-reported sleep disturbances in employed women. *Sleep*, 15(6), 493-498. doi:10.1093/sleep/15.6.493
- Lee, K. A. (1998). Alterations in sleep during pregnancy and postpartum: A review of 30 years of research. *Sleep Medicine Reviews*, 2(4), 231-242.
- Lee, K. A., & Gay, C. L. (2004). Sleep in late pregnancy predicts length of labor and type of delivery. *American Journal of Obstetrics & Gynecology*, 191(6), 2041-2046. doi:10.1016/j.ajog.2004.05.086
- Lee, K. A., & Gay, C. L. (2017). Improving sleep for hospitalized antepartum patients: A non-randomized controlled pilot study. *Journal of Clinical Sleep Medicine*, 13(12), 1445-1453. doi:10.5664/jcsm.6846
- Lee, K. A., Gay, C. L., & Alsten, C.R., (2016). Sleep enhancement training for pregnant women. *Obstetrics & Gynecology*, 128(5), 967-971. doi:10.1097/AOG.0000000000001654
- Lee, K. A., McEnany, G., & Zaffke, M. E. (2000). REM sleep and mood state in childbearing women: Sleepy or weepy? *Sleep*, 23(7), 877-885.
- Lee, K. A., & Zaffke, M. (1999). Longitudinal changes in fatigue and energy during pregnancy and the postpartum period. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 28(2), 183-191. doi:10.1111/j.1552-6909.1999.tb01983.x
- Lee, K. A., Zaffke, M. E., & McEnany, G. (2000). Parity and sleep patterns during and after pregnancy. *Obstetrics & Gynecology*, 95(1), 14-18. doi:10.1016/s0029-7844(99)00486-x
- Lee, N. M., & Saha, S. (2011). Nausea and vomiting of pregnancy. *Gastroenterology Clinics of North America*, 40(2), 309-334. doi:10.1016/j.gtc.2011.03.009

- Lee, S.-Y. (2007). Validating the General Sleep Disturbance Scale among Chinese American parents with hospitalized infants. *Journal of Transcultural Nursing, 18*(2), 111-117. doi:10.1177/1043659606298502
- Leigh, B., & Milgrom, J. (2008). Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC Psychiatry, 8*(24) doi:10.1186/1471-244X-8-24
- Letourneau, N. L., Dennis, C.-L., Benzies, K., Duffett-Leger, L., Stewart, M., Tryphonopoulos, P. D., . . . Watson, W. (2012). Postpartum depression is a family affair: Addressing the impact on mothers, fathers, and children. *Issues in Mental Health Nursing, 33*(7), 445-457. doi:10.3109/01612840.2012.673054
- Levandovski, R., Dantas, G., Hidalgo, M. P. L., Roenneberg, T., Allebrandt, K. V., Fernandes, L. C., . . . Torres, I. (2011). Depression scores associate with chronotype and social jetlag in a rural population. *Chronobiology International, 28*(9), 771-778. doi:10.3109/07420528.2011.602445
- Li, D., Liu, L., & Odouli, R. (2009). Presence of depressive symptoms during early pregnancy and the risk of preterm delivery: A prospective cohort study. *Human Reproduction, 24*(1), 146-153. doi:10.1093/humrep/den342
- Liburd, L. C., & Sniezek, J. E. (2007). Changing times: New possibilities for community health and well-being. *Preventing Chronic Disease, 4*(3), A73.
- Littell, R. C., Milliken, G. A., Stroup, W. W., Wolfinger, R. D., & Schabenberger, O. (2007). *SAS® for mixed models* (2nd ed.). Cary, NC, 2006: SAS Institute.
- Littner, M., Kushida, C. A., Anderson, W. M., Bailey, D., Berry, R. B., Davila, D. G., . . . Johnson, S. F. (2003). Practice parameters for the role of actigraphy in the study of sleep and circadian rhythms: An update for 2002. *Sleep, 26*(3), 337-341. doi:10.1093/sleep/26.3.337
- Llewellyn, A. M., Stowe, Z. N., & Nemeroff, C. B. (1997). Depression during pregnancy and the puerperium. *Journal of Clinical Psychiatry, 58*(S15), 26-32.
- Luoma, I., Korhonen, M., Salmelin, R. K., Helminen, M., & Tamminena, T. (2015). Long-term trajectories of maternal depressive symptoms and their antenatal predictors. *Journal of Affective Disorders, 170*, 30-38. doi:10.1016/j.jad.2014.08.017
- Magee, C. A., Caputi, P., & Iverson, D. C. (2011). Relationships between self-rated health, quality of life and sleep duration in middle aged and elderly Australians. *Sleep Medicine, 12*(4), 346-350. doi:10.1016/j.sleep.2010.09.013
- Mahendran, R., Puthussery, S., & Amalan, M. (2019). Prevalence of antenatal depression in South Asia: A systematic review and meta-analysis. *Journal of Epidemiology and Community Health, 73*(8), 768-777. doi:10.1136/jech-2018-211819

- Makowharemaihhi, C., Lawton, B. A., Ngata, T., Brown, S., Cram, F., & Robson, B. (2014). Initiation of maternity care for young Māori women under 20 years of age. *New Zealand Medical Journal*, *127*(1393), 52-61.
- Malfertheiner, S. F., Malfertheiner, M. V., Kropf, S., Costa, S.-D., & Malfertheiner, P. (2012). A prospective longitudinal cohort study: Evolution of GERD symptoms during the course of pregnancy. *BMC Gastroenterology*, *12*(1), 131-137. doi:10.1186/1471-230X-12-131
- Manber, R., Blasey, C., & Allen, J. J. B. (2008). Depression symptoms during pregnancy. *Archives of Women's Mental Health*, *11*(1), 43-48. doi:10.1007/s00737-008-0216-1
- Manconi, M., Govoni, V., De Vito, A., Tiberio Economou, N., Cesnik, E., Mollica, G., & Granieri, E. (2004). Pregnancy as a risk factor for restless legs syndrome. *Sleep Medicine*, *5*(3), 305-308. doi:10.1016/j.sleep.2004.01.013
- Manconi, M., Ulfberg, J., Berger, K., Ghorayeb, I., Wesström, J., Fulda, S., . . . Pollmächer, T. (2012). When gender matters: Restless Legs Syndrome: Report of the "RLS and woman" workshop endorsed by the European RLS Study Group. *Sleep Medicine Reviews*, *16*(4), 297-307. doi:10.1016/j.smr.2011.08.006
- Marcus, S. M., Flynn, H. A., Blow, F. C., & Barry, K. L. (2003). Depressive symptoms among pregnant women screened in obstetrics settings. *Journal of Women's Health*, *12*(4), 373-380. doi:10.1089/154099903765448880
- Marcus, S. M., & Heringhausen, J. E. (2009). Depression in childbearing women: When depression complicates pregnancy. *Primary Care*, *36*(1), 151-166. doi:10.1016/j.pop.2008.10.011
- Marino, M., Li, Y., Rueschman, M. N., Winkelman, J. W., Ellenbogen, J. M., Solet, J. M., . . . Buxton, O. M. (2013). Measuring sleep: Accuracy, sensitivity, and specificity of wrist actigraphy compared to polysomnography. *Sleep*, *36*(11), 1747-1755. doi:10.5665/sleep.3142
- Marques, M., Bos, S., Soares, M. J., Maia, B., Pereira, A. T., Valente, J., . . . Azevedo, M. H. (2011). Is insomnia in late pregnancy a risk factor for postpartum depression/depressive symptomatology? *Psychiatry Research*, *186*(2-3), 272-280. doi:10.1016/j.psychres.2010.06.029
- Marshall, S. A., Senadheera, S. N., Parry, L. J., & Girling, J. E. (2017). The role of relaxin in normal and abnormal uterine function during the menstrual cycle and early pregnancy. *Reproductive Sciences*, *24*(3), 342-354. doi:10.1177/1933719116657189
- Martin-Fairey, C. A., Zhao, P., Wan, L., Roenneberg, T., Fay, J., Ma, X., . . . Herzog, E. D. (2019). Pregnancy induces an earlier chronotype in both mice and women. *Journal of Biological Rhythms*, *34*(3), 323-331. doi:10.1177/0748730419844650

- Maschi, S., Clavenna, A., Campi, R., Schiavetti, B., Bernat, M., & Bonati, M. (2008). Neonatal outcome following pregnancy exposure to antidepressants: A prospective controlled cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology*, *115*(2), 283-289. doi:10.1111/j.1471-0528.2007.01518.x
- Matijasevich, A., Murray, J., Cooper, P. J., Anselmi, L., Barros, A. J. D., Barros, F. C., & Santos, I. S. (2015). Trajectories of maternal depression and offspring psychopathology at 6 years: 2004 Pelotas cohort study. *Journal of Affective Disorders*, *174*, 424-431. doi:10.1016/j.jad.2014.12.012
- Matthey S, Henshaw C, Elliott S, et al. (2006) Variability in use of cut-off scores and formats on the Edinburgh Postnatal Depression Scale: Implications for clinical and research practice. *Archive of Womens Mental Health* 9: 309-315.
- McCall, W. V., Kimball, J., Boggs, N., Lasater, B., Rosenquist, P. B., Blocker, J. N., . . . McDonald, W. M. (2010). Treatment of insomnia in depressed insomniacs: Effects on health-related quality of life, objective and self-reported sleep, and depression. *Journal of Clinical Sleep Medicine*, *6*(4), 322-329.
- McCowan, L. M. E., Thompson, J. M. D., Cronin, R. S., Li, M., Stacey, T., Stone, P. R., . . . Mitchell, E. A. (2017). Going to sleep in the supine position is a modifiable risk factor for late pregnancy stillbirth; Findings from the New Zealand multicentre stillbirth case-control study. *PLoS ONE*, *12*(6), 1-14. doi:10.1371/journal.pone.0179396
- McIntyre, J. P. R., Ingham, C. M., Hutchinson, B. L., Thompson, J. M. D., McCowan, L. M., Stone, P. R., . . . Mitchell, E. A. (2016). A description of sleep behaviour in healthy late pregnancy, and the accuracy of self-reports. *BMC Pregnancy & Childbirth*, *16*, 115-122. doi:10.1186/s12884-016-0905-0
- McMahon, C., Trapolinia, T., & Barnett, B. (2008). Maternal state of mind regarding attachment predicts persistence of postnatal depression in the preschool years. *Journal of Affective Disorders*, *107*(1-3), 199-203. doi:10.1016/j.jad.2007.07.017
- McNulty, B., McNulty, H., Marshall, B., Ward, M., Molloy, A. M., M., S., . . . Pentieva, K. (2013). Impact of continuing folic acid after the first trimester of pregnancy: Findings of a randomized trial of folic acid supplementation in the second and third trimesters. *The American Journal of Clinical Nutrition*, *98*(1), 92-98. doi:10.3945/ajcn.112.057489
- McParlin, C., O'Donnell, A., Roson, S. C., Beyer, F., Moloney, E., Bryant, A., . . . Luke, V. (2016). Treatments for hyperemesis gravidarum and nausea and vomiting in pregnancy: A systematic review. *JAMA: The Journal of the American Medical Association*, *316*(13), 1392-1401. doi:10.1001/jama.2016.14337
- Meems, M., Spek, V., Pop, V. J. M., Truijens, S. E. M., & Visser, L. H. (2015). Prevalence, course and determinants of carpal tunnel syndrome symptoms during pregnancy: A

- prospective study. *BJOG: An International Journal of Obstetrics & Gynaecology*, 122(8), 1112-1118. doi:10.1111/1471-0528.13360
- Meerlo, P., Havekes, R., & Steiger, A. (2015). Chronically restricted or disrupted sleep as a causal factor in the development of depression. *Current Topics in Behavioral Neurosciences*, 25, 459-481. doi:10.1007/7854_2015_367
- Meijer, J. L., Bockting, C. L. H., Beijers, C., Verbeek, T., Stant, A. D., Ormel, J., . . . Burger, H. (2011). PRegnancy Outcomes after a Maternity Intervention for Stressful Emotions (PROMISES): Study protocol for a randomised controlled trial. *Trials*, 12, 157-164. doi:10.1186/1745-6215-12-157
- Mellor, R., Chua, S. C., & Boyce, P. (2014). Antenatal depression: An artefact of sleep disturbance? *Archives of Women's Mental Health*, 17(4), 291-302. doi:10.1007/s00737-014-0427-6
- Meltzer, L. J., Hiruma, L. S., Avis, K., Montgomery-Downs, H., & Valentin, J. (2015). Comparison of a commercial accelerometer with polysomnography and actigraphy in children and adolescents. *Sleep*, 38(8), 1323-1330. doi:10.5665/sleep.4918
- Mezick, E. (2013). Sleep Continuity. In M. D. Gellman & J. R. Turner (Eds.), *Encyclopedia of Behavioral Medicine* (pp. 1805-1806). New York, NY: Springer New York. doi:10.1007/978-1-4419-1005-9_843
- Micheli, K., Komninos, I., Bagkeris, E., Roumeliotaki, T., Koutis, A., Kogevinas, M., & Chatzi, L. (2011). Sleep patterns in late pregnancy and risk of preterm birth and fetal growth restriction. *Epidemiology*, 22(5), 738-744. doi:10.1097/EDE.0b013e31822546fd
- Mihelic, M., Morawska, A., & Filus, A. (2018). Preparing parents for parenthood: Protocol for a randomized controlled trial of a preventative parenting intervention for expectant parents. *BMC Pregnancy & Childbirth*, 18(1), 311-323. doi:10.1186/s12884-018-1939-2
- Mindell, J. A., Cook, R. A., & Nikolovski, J. (2015). Sleep patterns and sleep disturbances across pregnancy. *Sleep Medicine*, 16(4), 483-488. doi:10.1016/j.sleep.2014.12.006
- Mindell, J. A., & Jacobson, B. J. (2000). Sleep disturbances during pregnancy. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 29(6), 590-597. doi:10.1111/j.1552-6909.2000.tb02072.x
- Misra, R. (2007). The Scope of Antenatal Care. In I. Donald (Ed.), *Practical Obstetric Problems*. London, England: Edward Arnold Limited.
- Molenaar, N. M., Kamperman, A. M., Boyce, P., & Bergink, V. (2018). Guidelines on treatment of perinatal depression with antidepressants: An international review. *Australian & New Zealand Journal of Obstetrics & Gynaecology*, 52(4), 320-327. doi:10.1177/0004867418762057

- Monderer, R. S., Wu, W. P., & Thorpy, M. J. (2010). Nocturnal leg cramps. *Current Neurology and Neuroscience Reports*, 10(1), 53-59. doi:10.1007/s11910-009-0079-5
- Montgomery-Downs, H. E., Insana, S. P., Clegg-Kraynok, M. M., & Mancini, L. M. (2010). Normative longitudinal maternal sleep: The first 4 postpartum months. *American Journal of Obstetrics and Gynecology*, 203(5), 465 e461-467. doi:10.1016/j.ajog.2010.06.057
- Montgomery, K. S. (2002). An update on water needs during pregnancy and beyond. *The Journal of Perinatal Education*, 11(3), 40-42. doi:10.1624/105812402X88830
- Moorcroft, W. H. (2013). *Understanding sleep and dreaming* (2nd ed.). Boston, MA: Springer.
- Moore, T. G., Arefadib, N., Deery, A., & West, S. (2017). *The first thousand days: An evidence paper*. Parkville, Victoria: Centre for Community Child Health, Murdoch Children's Research Institute.
- Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). The Insomnia Severity Index: Psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*, 34(5), 601-608. doi:10.1093/sleep/34.5.601
- Mukherjee, S., Fennie, K., Madhivanan, P., Trepka, M. J., & Coxe, S. (2017). Antenatal stressful life events and postpartum depressive symptoms in the United States: The role of women's socioeconomic status indices at the state level. *Journal of Women's Health*, 26(3), 276-285. doi:10.1089/jwh.2016.5872
- Murphy, M. J., & Peterson, M. J. (2015). Sleep disturbances in depression. *Sleep Medicine Clinics*, 10(1), 17-23. doi:10.1016/j.jsmc.2014.11.009
- Murray, L., Arteche, A., Fearon, P., Halligan, S., Cooper, P., & Goodyer, I. (2011). Maternal postnatal depression and the development of depression in offspring up to 16 years of age. *Journal of the American Academy of Child and Adolescent Psychiatry*, 50(5), 460-470. doi:10.1016/j.jaac.2011.02.001
- Murray, L., & Carothers, A. D. (1990). The validation of the Edinburgh Post-natal Depression Scale on a community sample. *The British Journal of Psychiatry*, 157, 288-290. doi:10.1192/bjp.157.2.288
- Musters, C., McDonald, E., & Jones, I. (2008). Management of postnatal depression. *BMJ*, 337, a736. doi:10.1136/bmj.a736
- Nagin, D. S., & Tremblay, R. E. (2005). Developmental trajectory groups: Fact or a useful statistical fiction? *Criminology*, 43(4), 873-904. doi:10.1111/j.1745-9125.2005.00026.x

- Nakamura, Y., Tamura, H., Kashida, S., Takayama, H., Yamagata, Y., Karube, A., . . . Kato, H. (2001). Changes of serum melatonin level and its relationship to feto-placental unit during pregnancy. *Journal of Pineal Research*, 30(1), 29-33.
- Nandi, A., Beard, J. R., & Galea, S. (2009). Epidemiologic heterogeneity of common mood and anxiety disorders over the lifecourse in the general population: A systematic review. *BMC Psychiatry*, 9(1), 31. doi:10.1186/1471-244X-9-31
- Nath, A., Venkatesh, S., Balan, S., Metgud, C. S., Krishna, M., & Murthy, G. V. S. (2019). The prevalence and determinants of pregnancy-related anxiety amongst pregnant women at less than 24 weeks of pregnancy in Bangalore, Southern India. *International Journal of Women's Health*, 11, 241-249. doi:10.2147/IJWH.S193306
- National Collaborating Centre for Mental Health. (2014). *Antenatal and postnatal mental health: Clinical management and service guidance: Updated edition*. Leicester, UK: National Institute for Health and Clinical Excellence.
- National Institutes of Health. (2011). *National Institutes of Health Sleep Disorders Research Plan*. Retrieved from <https://www.nhlbi.nih.gov/files/docs/ncsdr/201101011NationalSleepDisordersResearchPlanDHHSPublication11-7820.pdf>
- Nazik, E., & Eryilmaz, G. (2014). Incidence of pregnancy-related discomforts and management approaches to relieve them among pregnant women. *Journal of Clinical Nursing*, 23, 1736-1750. doi:10.1111/jocn.12323
- New Zealand Ministry of Health. (2006). *The New Zealand Health Survey: Content guide 2006-2007*. Wellington, NZ: New Zealand Ministry of Health.
- New Zealand Ministry of Health. (2008). *Te Puāwaiwhero: The Second Māori Mental Health and Addiction National Strategic Framework 2008–2015*. Wellington, NZ: New Zealand Ministry of Health.
- New Zealand Ministry of Health. (2012). *Healthy Beginnings: Developing perinatal and infant mental health services in New Zealand*. Wellington, NZ: New Zealand Ministry of Health.
- New Zealand Ministry of Health. (2016). *Health Loss in New Zealand 1990–2013: A report from the New Zealand Burden of Diseases, Injuries and Risk Factors Study*. Wellington, NZ: New Zealand Ministry of Health.
- New Zealand Ministry of Health. (2017a). An overview of suicide statistics. Retrieved 08/07/2019 from <https://www.health.govt.nz/system/files/documents/pages/data-story-overview-suicide-prevention-strategy-april2017newmap.pdf>

- New Zealand Ministry of Health. (2017b). Sit less, move more, sleep well: Physical activity guidelines for children and young people. Retrieved from <https://www.health.govt.nz/system/files/documents/pages/physical-activity-guidelines-for-children-and-young-people-may17.pdf>
- New Zealand Ministry of Health. (2018a). *Advice regarding perinatal and maternal mental health*. Wellington, NZ: New Zealand Ministry of Health.
- New Zealand Ministry of Health. (2018b). Tatau Kahukura: Māori health statistics: Mental health. Retrieved 08/07/2019 from <https://www.health.govt.nz/our-work/populations/maori-health/tatau-kahukura-maori-health-statistics/nga-mana-hauora-totohu-health-status-indicators/mental-health>
- New Zealand Ministry of Health. (2019a). Pregnancy. Retrieved 04/12/2019 from <https://www.health.govt.nz/your-health/pregnancy-and-kids/pregnancy>
- New Zealand Ministry of Health. (2019b). *Report on maternity 2017*. Wellington: New Zealand Ministry of Health.
- New Zealand Ministry of Health and New Zealand College of Midwives. (2017). *Community Midwifery Pricing Model Report and Recommendations of the Community Midwifery Funding Co-design Project*. Wellington, NZ: New Zealand Ministry of Health.
- Newland, R. P., Parade, S. H., Dickstein, S., & Seifer, R. (2016). Goodness of fit between prenatal maternal sleep and infant sleep: Associations with maternal depression and attachment security. *Infant Behavior and Development*, *44*, 179-188. doi:10.1016/j.infbeh.2016.06.010
- Newport, D. J., Ji, S., Long, Q., Knight, B. T., Zach, E. B., Smith, E. N., . . . Stowe, Z. N. (2012). Maternal depression and anxiety differentially impact fetal exposures during pregnancy. *Journal of Clinical Psychiatry*, *73*(2), 247-251. doi:10.4088/JCP.10m06783
- Nichols, A. L., & Maner, J. K. (2008). The good-subject effect: Investigating participant demand characteristics. *Journal of General Psychology*, *135*(2), 151-165. doi:10.3200/GENP.135.2.151-166
- Nicholson, W. K., Setse, R., Hill-Briggs, F., Cooper, L. A., Strobino, D., & Powe, N. R. (2006). Depressive symptoms and health-related quality of life in early pregnancy. *Obstetrics & Gynecology*, *107*(4), 798-806. doi:10.1097/01.AOG.0000204190.96352.05
- Nishioka, E., Haruna, M., Ota, E., Matsuzaki, M., Murayama, R., Yoshimura, K., & Murashima, S. (2011). A prospective study of the relationship between breastfeeding and postpartum depressive symptoms appearing at 1–5 months after delivery. *Journal of Affective Disorders*, *133*(3), 553-559. doi:10.1016/j.jad.2011.04.027

- Nutt, D., Wilson, S., & Paterson, L. (2008). Sleep disorders as core symptoms of depression. *Dialogues in Clinical Neuroscience, 10*(3), 329-336.
- Nylen, K., Williamson, J., O'Hara, M., Watson, D., & Engeldinger, J. (2013). Validity of somatic symptoms as indicators of depression in pregnancy. *Archives of Women's Mental Health, 16*(3), 203-210. doi:10.1007/s00737-013-0334-2
- O'Brien, L. M., Bullough, A. S., Owusu, J. T., Tremblay, K. A., Brincat, C. A., Chames, M. C., . . . Chervin, R. D. (2012). Pregnancy-onset habitual snoring, gestational hypertension, and preeclampsia: Prospective cohort study. *American Journal of Obstetrics and Gynecology*(6), 487e481. doi:10.1016/j.ajog.2012.08.034
- O'Brien, L. M., Warland, J., Stacey, T., Heazell, A. E. P., & Mitchell, E. A. (2019). Maternal sleep practices and stillbirth: Findings from an international case-control study. *Birth, 46*(2), 344-354. doi:10.1111/birt.12416
- O'Connor, T. G., Monk, C., & Fitelson, E. M. (2014). Practitioner Review: Maternal mood in pregnancy and child development: Implications for child psychology and psychiatry. *Journal of Child Psychology & Psychiatry, 55*(2), 99-111. doi:10.1111/jcpp.12153
- O'Hara, M. W., & McCabe, J. E. (2013). Postpartum depression: Current status and future directions. *Annual Review of Clinical Psychology, 9*, 379-407. doi:10.1146/annurev-clinpsy-050212-185612
- O'Hara, M. W., & Swain, A. M. (1996). Rates and risk of postpartum depression: A meta-analysis. *International Review of Psychiatry, 8*(1), 37-54. doi:10.3109/09540269609037816
- O'Keane, V., & Marsh, M. S. (2007). Depression during pregnancy. *BMJ, 334*(7601), 1003-1005. doi:10.1136/bmj.39189.662581.55
- O'Connor, E., Senger, C. A., Henninger, M. L., Coppola, E., & Gaynes, B. N. (2019). Interventions to prevent perinatal depression evidence report and systematic review for the US Preventive Services Task Force. *JAMA: Journal of the American Medical Association, 321*(6), 588-601. doi:10.1097/01.aoa.0000603640.60393.40
- Oakley Browne, M. A., Wells, J. E., & Scott, K. M. (2006). *Te Rau Hinengaro: The New Zealand Mental Health Survey*. Wellington, NZ: NZ Ministry of Health.
- Oakley Browne, M. A., Wells, J. E., Scott, K. M., & McGee, M. A. (2010). The Kessler Psychological Distress Scale in Te Rau Hinengaro: the New Zealand Mental Health Survey. *Australian & New Zealand Journal of Psychiatry, 44*(4), 314-322. doi:10.3109/00048670903279820
- Oates, M. (2003). Suicide: The leading cause of maternal death. *The British Journal of Psychiatry, 183*(4), 279-281. doi:10.1192/bjp.183.4.279

- Ocampo-Garcés, A., Molina, E., Rodríguez, A., & Vivaldi, E. A. (2000). Homeostasis of REM sleep after total and selective sleep deprivation in the rat. *Journal of Neurophysiology*, *84*(5), 2699-2702. doi:10.1152/jn.2000.84.5.2699
- Ogbo, F. A., Eastwood, J., Hendry, A., Jalaludin, B., Agho, K., E., Barnett, B., & Page, A. (2018). Determinants of antenatal depression and postnatal depression in Australia. *BMC Psychiatry*, *18*(49) doi:10.1186/s12888-018-1598-x
- Ohayon, M., Wickwire, E. M., Hirshkowitz, M., Albert, S. M., Avidan, A., Daly, F. J., . . . Vitiello, M. V. (2017). National Sleep Foundation's sleep quality recommendations: First report. *Sleep Health: Journal of the National Sleep Foundation*, *3*, 6-19. doi:10.1016/j.sleh.2016.11.006
- Okun, M. L. (2019). Sleep disturbances and modulations in inflammation: Implications for pregnancy health. *Social and Personality Psychology Compass*, *13*(5), e12451. doi:10.1111/spc3.12451
- Okun, M. L., Buysse, D. J., & Hall, M. H. (2015). Identifying insomnia in early pregnancy: Validation of the Insomnia Symptoms Questionnaire (ISQ) in pregnant women. *Journal of Clinical Sleep Medicine*, *11*(6), 645-654. doi:10.5664/jcsm.4776
- Okun, M. L., Kiewra, K., Luther, J. F., Wisniewski, S. R., & Wisner, K. L. (2011). Sleep disturbances in depressed and nondepressed pregnant women. *Depression & Anxiety*, *28*(8), 676-685. doi:10.1002/da.20828
- Okun, M. L., Kline, C. E., Roberts, J. M., Wettlaufer, B., Glover, K., & Hall, M. (2013). Prevalence of sleep deficiency in early gestation and its associations with stress and depressive symptoms. *Journal of Women's Health*, *22*(12), 1028-1037. doi:10.1089/jwh.2013.4331
- Okun, M. L., Luther, J. F., Wisniewski, S. R., Sit, D., Prairie, B. A., & Wisner, K. L. (2012). Disturbed sleep, a novel risk factor for preterm birth? *Journal of Women's Health*, *21*(1), 54-60. doi:10.1089/jwh.2010.2670
- Okun, M. L., Roberts, J. M., Hall, M., & Marsland, A. L. (2009). How disturbed sleep may be a risk factor for adverse pregnancy outcomes: A hypothesis. *Obstetrical and Gynecological Survey*, *64*(4), 273-280. doi:10.1097/OGX.0b013e318195160e
- Okun, M. L., Schetter, C. D., & Glynn, L. M. (2011). Poor sleep quality is associated with preterm birth. *Sleep*, *34*(11), 1493-1498. doi:10.5665/sleep.1384
- Owais, S., Chow, C. H. T., Furtado, M., Frey, B. N., & Van Lieshout, R. J. (2018). Non-pharmacological interventions for improving postpartum maternal sleep: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *41*, 87-100. doi:10.1016/j.smr.2018.01.005

- Paine, S.-J., & Gander, P. H. (2013). Sleep, sleepiness, and sleep disorders: Principles for examining differences by ethnicity. In *Encyclopedia of Sleep* (pp. 691-698): Elsevier Inc. doi:10.1016/B978-0-12-378610-4.00526-X
- Paine, S.-J., & Gander, P. H. (2016). Explaining ethnic inequities in sleep duration: A cross-sectional survey of Māori and non-Māori adults in New Zealand. *Sleep Health, 2*(2), 109-115. doi:10.1016/j.sleh.2016.01.005
- Pajulo, M., Savonlahti, E., Sourander, A., Helenius, H., & Piha, J. (2001). Antenatal depression, substance dependency and social support. *Journal of Affective Disorders, 65*(1), 9-17. doi:10.1016/S0165-0327(00)00265-2
- Pamidi, S., Pinto, L. M., Marc, I., Benedetti, A., Swartzman, K., & Kimoff, J. R. (2014). Maternal sleep-disordered breathing and adverse pregnancy outcomes: A systematic review and metaanalysis. *American Journal of Obstetrics and Gynecology, 210*(1), 52-65. doi:10.1016/j.ajog.2013.07.033
- Parikh, S. V., Segal, Z. V., Grigoriadis, S., Ravindran, A. V., Kennedy, S. H., Lam, R. W., & Patten, S. B. (2009). Canadian Network for Mood and Anxiety Treatments (CANMAT) Clinical guidelines for the management of major depressive disorder in adults. II. Psychotherapy alone or in combination with antidepressant medication. *Journal of Affective Disorders, 117*, S15-S25. doi:10.1016/j.jad.2009.06.042
- Park, E. M., Meltzer-Brody, S., & Stickgold, R. (2013). Poor sleep maintenance and subjective sleep quality are associated with postpartum maternal depression symptom severity. *Archives of Women's Mental Health, 16*(6), 539-547. doi:10.1007/s00737-013-0356-9
- Parsons, C. E., Young, K. S., Rochat, T. J., Kringelbach, M. L., & Stein, A. (2012). Postnatal depression and its effects on child development: A review of evidence from low- and middle-income countries. *British Medical Bulletin, 101*, 57-79. doi:10.1093/bmb/ldr047
- Patel, S. I., Miller, B. W., Kosiorek, H. E., Parish, J. M., Lyng, P. J., & Krahn, L. E. (2017). The effect of dogs on human sleep in the home sleep environment. *Mayo Clinic Proceedings, 92*(9), 1368-1372. doi:10.1016/j.mayocp.2017.06.014
- Paulson, J. F., & Bazemore, S. D. (2010). Prenatal and postpartum depression in fathers and its association with maternal depression: A meta-analysis. *JAMA: Journal of the American Medical Association, 303*(19), 1961-1969. doi:10.1001/jama.2010.605
- Paulson, J. L., & Miller-Graff, L. (2019). Prenatal sleep quality and mental health symptoms across the perinatal period: A longitudinal study of high-risk women. *Journal of Psychosomatic Research, 116*, 31-36. doi:10.1016/j.jpsychores.2018.11.011
- Paunio, T., Korhonen, T., Hublin, C., Partinen, M., Koskenvuo, K., Koskenvuo, M., & Kaprio, J. (2015). Poor sleep predicts symptoms of depression and disability retirement due to depression. *Journal of Affective Disorders, 172*, 381-389. doi:10.1016/j.jad.2014.10.002

- Pearson, R. M., Evans, J., Kounali, D., Lewis, G., Heron, J., Ramchandani, P. G., . . . Stein, A. (2013). Maternal depression during pregnancy and the postnatal period: Risks and possible mechanisms for offspring depression at age 18 years. *JAMA Psychiatry*, *70*(12), 1312-1319. doi:10.1001/jamapsychiatry.2013.2163
- Peer, M., Levitan, R. D., Soares, C. N., Steiner, M., & Streiner, D. L. (2013). Antenatal depression in a multi-ethnic, community sample of Canadian immigrants: Psychosocial correlates and hypothalamic-pituitary-adrenal axis function. *Canadian Journal of Psychiatry*, *58*(10), 579-587. doi:10.1177/070674371305801007
- Perinatal and Maternal Mortality Review Committee. (2012). *Sixth annual report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2010*. Wellington, NZ: Health Quality & Safety Commission New Zealand.
- Perinatal and Maternal Mortality Review Committee. (2015). *Ninth annual review of the Perinatal and Maternal Mortality Review Committee. Reporting mortality 2013*. . Wellington, NZ: Health Quality & Safety Commission New Zealand.
- Perinatal and Maternal Mortality Review Committee. (2018). *Twelfth annual report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2016*. Wellington, NZ: Health Quality & Safety Commission New Zealand.
- Perlis, M. L., Giles, D. E., Mendelson, W. B., Bootzin, R. R., & Wyatt, J. K. (1997). Psychophysiological insomnia: the behavioural model and a neurocognitive perspective. *Journal of Sleep Research*, *6*, 179-188. doi:10.1046/j.1365-2869.1997.00045.x
- Peterson, M. J., & Benca, R. M. (2008). Sleep in mood disorders. *Sleep Medicine Clinics*, *3*(2), 231-249. doi:10.1016/j.jsmc.2008.01.009
- Phelan, S., Hart, C., Phipps, M., Abrams, B., Schaffner, A., Adams, A., & Wing, R. (2011). Maternal behaviors during pregnancy impact offspring obesity risk. *Experimental Diabetes Research*, *2011*, 985139. doi:10.1155/2011/985139
- Phillips, J., Charles, M., Sharpe, L., & Matthey, S. (2009). Validation of the subscales of the Edinburgh Postnatal Depression Scale in a sample of women with unsettled infants. *Journal of Affective Disorders*, *118*(1-3), 101-112. doi:10.1016/j.jad.2009.02.004
- Phillips, J., Sharpe, L., & Nemeth, D. (2010). Maternal psychopathology and outcomes of a residential mother-infant intervention for unsettled infant behaviour. *Australian & New Zealand Journal of Psychiatry*, *44*(3), 280-289. doi:10.3109/00048670903487225
- Picchiatti, D. L., Hensley, J. G., Bainbridge, J. L., Lee, K. A., Manconi, M., McGregor, J. A., . . . Walters, A. S. (2015). Consensus clinical practice guidelines for the diagnosis and treatment of restless legs syndrome/Willis-Ekbom disease during pregnancy and lactation. *Sleep Medicine Reviews*, *22*, 64-77. doi:10.1016/j.smr.2014.10.009

- Pien, G. W., & Schwab, R. J. (2004). Sleep disorders during pregnancy. *Sleep, 27*(7), 1405-1417. doi:10.1093/sleep/27.7.1405
- Pietikäinen, J. T., Paunio, T., Paavonen, E. J., Polo-Kantola, P., Pölkki, P., & Saarenpää-Heikkilä, O. (2018). Sleeping problems during pregnancy: A risk factor for postnatal depressiveness. *Archives of Women's Mental Health, 22*(3), 327-337. doi:10.1007/s00737-018-0903-5
- Pilcher, J. J., Ginter, D. R., & Sadowsky, B. (1997). Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well-being and sleepiness in college students. *Journal of Psychosomatic Research, 42*(6), 583-596. doi:10.1016/S0022-3999(97)00004-4
- Pinquart, M., & Teubert, D. (2010). Effects of parenting education with expectant and new parents: A meta-analysis. *Journal of Family Psychology, 24*(3), 316-327. doi:10.1037/a0019691
- Pitt, B. (1973). 'Maternity blues'. *British Journal of Psychiatry, 122*(569), 431-433.
- Polo-Kantola, P., Aukia, L., Karlsson, H., Karlsson, L., & Paavonen, E. J. (2016). Sleep quality during pregnancy: Associations with depressive and anxiety symptoms. *Acta Obstetrica Et Gynecologica Scandinavica, 96*, 198-206. doi:10.1111/aogs.13056
- Poon, L. C., McIntyre, H. D., Hyett, J. A., da Fonseca, E. B., & Hod, M. (2018). The first-trimester of pregnancy: A window of opportunity for prediction and prevention of pregnancy complications and future life. *Diabetes Research and Clinical Practice, 145*, 20-30. doi:10.1016/j.diabres.2018.05.002
- PricewaterhouseCoopers Australia. (2012). *Valuing perinatal health: The consequences of not treating perinatal depression and anxiety*. Hawthorn, Victoria: Beyond Blue.
- Putnam, K., Robertson-Blackmore, E., Sharkey, K., Payne, J., Bergink, V., Munk-Olsen, T., . . . Brock, R. (2015). Heterogeneity of postpartum depression: A latent class analysis. *The Lancet Psychiatry, 2*(1), 59-67. doi:10.1016/S2215-0366(14)00055-8
- Qiu, C., Enquobahrie, D. A., Frederick, I. O., Abetew, D., & Williams, M. A. (2010). Glucose intolerance and gestational diabetes risk in relation to sleep duration and snoring during pregnancy: A pilot study. *BMC Women's Health, 10*(17) doi:10.1186/1472-6874-10-17
- Qiu, C., Enquobahrie, D. A., Frederick, I. O., Gelaye, B., Zhong, Q. Y., & Williams, M. A. (2016). Construct validity and factor structure of the Pittsburgh Sleep Quality Index among pregnant women in a Pacific-Northwest cohort. *Sleep and Breathing, 20*(1), 293-301. doi:10.1007/s11325-016-1313-4

- Qiu, C., Frederick, I. O., Sorensen, T. K., Enquobahrie, D. A., & Williams, M. A. (2014). Sleep duration and plasma leptin concentrations in early pregnancy among lean and overweight/obese women: A cross sectional study. *BMC Research Notes*, *7*(1), 20-27. doi:10.1186/1756-0500-7-20
- Qiu, C., Gelaye, B., Fida, N., & Williams, M. A. (2012). Short sleep duration, complaints of vital exhaustion and perceived stress are prevalent among pregnant women with mood and anxiety disorders. *BMC Pregnancy & Childbirth*, *12*, 104-112. doi:10.1186/1471-2393-12-104
- Rahman, N. A., & Rao, C. V. (2009). Recent progress in luteinizing hormone/human chorionic gonadotrophin hormone research. *Molecular Human Reproduction*, *15*(11), 703-711. doi:10.1093/molehr/gap067
- Raines, D. A., & Cooper, D. B. (2019). *Braxton Hicks Contractions*. Treasure Island, Florida: StatPearls Publishing.
- Räisänen, S., Kramer, M. R., Heinonen, S., Lehto, S. M., Nielsen, H. S., & Gissler, M. (2013). Fear of childbirth predicts postpartum depression: A population-based analysis of 511 422 singleton births in Finland. *BMJ Open*, *3*(11), 1-7. doi:10.1136/bmjopen-2013-004047
- Raisanen, S., Lehto, S. M., Nielsen, H. S., Gissler, M., Kramer, M. R., & Heinonen, S. (2014). Risk factors for and perinatal outcomes of major depression during pregnancy: A population-based analysis during 2002-2010 in Finland. *BMJ Open*, *4*(11), e004883. doi:10.1136/bmjopen-2014-004883
- Raising Children Network. (2019). Pregnancy and birth. Retrieved 04/12/2019 from <https://raisingchildren.net.au/pregnancy>
- Rasch, B., & Born, J. (2013). About sleep's role in memory. *Physiological Reviews*, *93*(2), 681-766. doi:10.1152/physrev.00032.2012
- Rasmussen, K. M., Abrams, B., Bodnar, L. M., Butte, N. F., Catalano, P. M., & Maria Siega-Riz, A. (2010). Recommendations for weight gain during pregnancy in the context of the obesity epidemic. *Obstetrics & Gynecology*, *116*(5), 1191-1195. doi:10.1097/AOG.0b013e3181f60da7
- Ray-Griffith, S. L., Wendel, M. P., Stowe, Z. N., & Magann, E. F. (2018). Chronic pain during pregnancy: A review of the literature. *International Journal of Women's Health*, *10*, 153-164. doi:10.2147/IJWH.S151845
- Rechtschaffen, A. (1998). Current perspectives on the function of sleep. *Perspectives in Biology and Medicine*, *41*(3), 359-390. doi:10.1353/pbm.1998.0051

- Redhead, K., Walsh, J., Galbally, M., Newnham, J. P., Watson, S. J., & Eastwood, P. (2020). Obstructive sleep apnea is associated with depressive symptoms in pregnancy. *Sleep*, 43(5). <https://doi.org/10.1093/sleep/zsz270>
- Reid, K. J., Herbas, M., Zee, P. C., Facco, F. L., Simhan, H. N., Grobman, W. A., . . . Parry, S. (2017). Sleep during pregnancy: The nuMoM2b pregnancy and sleep duration and continuity study. *Sleep*, 40(5) doi:10.1093/sleep/zsx045
- Reiter, R. J., Tan, D. X., Korkmaz, A., & Rosales-Corral, S. A. (2014). Melatonin and stable circadian rhythms optimize maternal, placental and fetal physiology. *Human Reproduction Update*, 20(2), 293-307. doi:10.1093/humupd/dmt054
- Rezaei, E., Moghadam, Z. B., & Hagani, H. (2015). The effect of sleep health behavioral education on the depression of pregnant women with sleep disorders: A randomized control trial. *Iranian Red Crescent Medical Journal*, 17(1), e11420. doi:10.5812/ircmj.11420
- Rich-Edwards, J. W., Kleinman, K., Abrams, A., Harlow, B., L., McLaughlin, T., J., Joffe, H., & Gillman, W. (2006). Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. *Journal of Epidemiology and Community Health*, 60(3), 221-227. doi:10.1136/jech.2005.039370
- Rich, J. L., Byrne, J. M., Curryer, C., Byles, J. E., & Loxton, D. (2013). Prevalence and correlates of depression among Australian women: A systematic literature review, January 1999-January 2010. *BMC Research Notes*, 6(1), 424-439. doi:10.1186/1756-0500-6-424
- Richter, D., Krämer, M. D., Tang, N. K. Y., Lemola, S., & Montgomery-Downs, H. E. (2019). Long-term effects of pregnancy and childbirth on sleep satisfaction and duration of first-time and experienced mothers and fathers. *Sleep*, 42(4), 1-10. doi:10.1093/sleep/zsz015
- Robertson, E., Grace, S., Wallington, T., & Stewart, D. E. (2004). Antenatal risk factors for postpartum depression: A synthesis of recent literature. *General Hospital Psychiatry*, 26(4), 289-295. doi:10.1016/j.genhosppsych.2004.02.006
- Rod, N. H., Lange, T., Vahtera, J., Westerlund, H., Kivimaki, M., Zins, M., & Goldberg, M. (2011). Sleep disturbances and cause-specific mortality: Results from the GAZEL cohort study. *American Journal of Epidemiology*, 173(3), 300-309. doi:10.1093/aje/kwq371
- Roeder, K., Lynch, K., G., & Nagin, D., S. (1999). Modeling uncertainty in latent class membership: A case study in criminology. *Journal of the American Statistical Association*, 94(447), 766-776. doi:10.2307/2669989
- Roenneberg, T., Allebrandt, K. V., Mellow, M., & Vetter, C. (2012). Social jetlag and obesity. *Current biology*, 22(10), 939-943. doi:10.1016/j.cub.2012.03.038

- Roenneberg, T., Pilz, L. K., Zerbini, G., & Winnebeck, E. C. (2019). Chronotype and social jetlag: A (self-) critical review. *Biology, 8*(3), 54-74. doi:10.3390/biology8030054
- Roenneberg, T., Wirz-Justice, A., & Mellow, M. (2003). Life between clocks: Daily temporal patterns of human chronotypes. *Journal of Biological Rhythms, 18*(1), 80-90. doi:10.1177/0748730402239679
- Ross, L. E., Murray, B. J., & Steiner, M. (2005). Sleep and perinatal mood disorders: A critical review. *Journal of Psychiatry and Neuroscience, 30*(4), 247-256.
- Rotenberg, V. S., Indursky, P., Kayumov, L., Sirota, P., & Melamed, Y. (2000). The relationship between subjective sleep estimation and objective sleep variables in depressed patients. *International Journal of Psychophysiology, 37*, 291-297. doi:10.1016/s0167-8760(00)00110-0
- Royal Australian and New Zealand College of Obstetricians and Gynaecologists. (2018). *Mental Health Care in the Perinatal Period (C-Obs 48)*. Melbourne, Australia: The Royal Australian and New Zealand College of Obstetricians and Gynaecologists.
- Rull, K., & Laan, M. (2005). Expression of β -subunit of HCG genes during normal and failed pregnancy. *Human Reproduction, 20*(12), 3360-3368. doi:10.1093/humrep/dei261
- Russell, L. (2018). *Te Oranga Hinengaro: Report on Māori Mental Wellbeing Results from the New Zealand Mental Health Monitor & Health and Lifestyles Survey*. Wellington, NZ: Health Promotion Agency.
- Ryan, D., Milis, L., & Misri, N. (2005). Depression during pregnancy. *Canadian Family Physician, 51*, 1087-1093.
- Sabino, J., & Grauer, J. N. (2008). Pregnancy and low back pain. *Current Reviews in Musculoskeletal Medicine, 1*(2), 137-141. doi:10.1007/s12178-008-9021-8
- Sack, R. L., Brandes, R. W., Kendall, A. R., & Lewy, A. J. (2000). Entrainment of free-running circadian rhythms by melatonin in blind people. *The New England Journal of Medicine, 343*(15), 1070-1077. doi:10.1056/NEJM200010123431503
- Sanaati, F., Charandabi, S. M.-A., Eslamlo, H. F., Mirghafourvand, M., & Sharajabad, F. A. (2017). The effect of lifestyle-based education to women and their husbands on the anxiety and depression during pregnancy: A randomized controlled trial. *The Journal of Maternal-Fetal & Neonatal Medicine, 30*(7), 870-876. doi:10.1080/14767058.2016.1190821
- Sandall, J., Soltani, H., Gates, S., Shennan, A., & Devane, D. (2016). Midwife-led continuity models versus other models of care for childbearing women. *Cochrane Database of Systematic Reviews, 4*, CD004667. doi:10.1002/14651858.CD004667.pub5

- Sandman, C. A., Glynn, L., Schetter, C. D., Wadhwa, P., Garite, T., Chicz-DeMet, A., & Hobel, C. (2006). Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): Priming the placental clock. *Peptides*, 27, 1457-1463. doi:10.1016/j.peptides.2005.10.002
- Saper, C. B., Cano, G., & Scammell, T. E. (2005). Homeostatic, circadian, and emotional regulation of sleep. *The Journal of Comparative Neurology*, 493(1), 92-98. doi:10.1002/cne.20770
- Sattler, M., C., Jelsma, J., G. M. , Bogaerts, A., Simmons, D., Desoye, G., Corcoy, R., . . . van Poppel, M., N. M. (2017). Correlates of poor mental health in early pregnancy in obese European women. *BMC Pregnancy & Childbirth*, 17(1), 404-414. doi:10.1186/s12884-017-1595-y
- Sayakhot, P., & Carolan-Olah, M. (2016). Internet use by pregnant women seeking pregnancy-related information: A systematic review. *BMC Pregnancy & Childbirth*, 16, 65-74. doi:10.1186/s12884-016-0856-5
- Scheer, F. A. J. L., Hilton, M. F., Mantzoros, C. S., Shea, S. A., & Takahashi, J. S. (2009). Adverse metabolic and cardiovascular consequences of circadian misalignment. *Proceedings of the National Academy of Sciences of the United States of America*, 106(11), 4453-4458. doi:10.1073/pnas.0808180106
- Scime, N. (2016). Antidepressant use during pregnancy. *University of Western Ontario Medical Journal*, 85(1), 11-13. doi:10.5206/uwomj.v85i1.4206
- Sedov, I. D., Cameron, E. E., Madigan, S., & Tomfohr-Madsen, L. M. (2018). Sleep quality during pregnancy: A meta-analysis. *Sleep Medicine Reviews*, 38, 168-176. doi:10.1016/j.smrv.2017.06.005
- Semler, C. N., & Harvey, A. G. (2005). Misperception of sleep can adversely affect daytime functioning in insomnia. *Behaviour Research and Therapy*, 43(7), 843-856. doi:10.1016/j.brat.2004.06.016
- Setse, R., Grogan, R., Pham, L., Cooper, L. A., Strobino, D., Powe, N. R., & Nicholson, W. (2009). Longitudinal study of depressive symptoms and health-related quality of life during pregnancy and after delivery: The Health Status in Pregnancy (HIP) study. *Maternal & Child Health Journal*, 13(5), 577-587. doi:10.1007/s10995-008-0392-7
- Sharp, L. K., & Lipsky, M. S. (2002). Screening for depression across the lifespan: A review of measures for use in primary care settings. *American Family Physician*, 66(6), 1001-1008.
- Shea, J. L., Mochizuki, T., Sagvaag, V., Aspevik, T., Bjorkum, A. A., & Datta, S. (2008). Rapid eye movement (REM) sleep homeostatic regulatory processes in the rat: Changes in the

- sleep-wake stages and electroencephalographic power spectra. *Brain Research*, 1213, 48-56. doi:10.1016/j.brainres.2008.03.062
- Shulman, H. B., D'Angelo, D. V., Harrison, L., Smith, R. A., & Warner, L. (2018). The Pregnancy Risk Assessment Monitoring System (PRAMS): Overview of design and methodology. *American Journal of Public Health*, 108(10), 1305-1313. doi:10.2105/AJPH.2018.304563
- Signal, T. L. (2019, October). Sleep in late pregnancy and the relationship to depressive symptoms. In Y. Bin (Chair), *Sleep and mental health in perinatal women*. Symposium conducted at the meeting of the Australian Sleep Association, Sydney, Australia.
- Signal, T. L., Gander, P. H., Sangalli, M. R., Travier, N., Firestone, R. T., & Tuohy, J. F. (2007). Sleep duration and quality in healthy nulliparous and multiparous women across pregnancy and post-partum. *Australian & New Zealand Journal of Obstetrics & Gynaecology*, 47(1), 16-22. doi:10.1111/j.1479-828X.2006.00672.x
- Signal, T. L., Paine, S.-J., Sweeney, B., Muller, D., Priston, M., Lee, K., . . . Huthwaite, M. (2016). The prevalence of symptoms of depression and anxiety, and the level of life stress and worry in New Zealand Māori and non-Māori women in late pregnancy. *The Australian And New Zealand Journal Of Psychiatry*, 51(2), 168-176. doi:10.1177/0004867415622406
- Signal, T. L., Paine, S.-J., Sweeney, B., Priston, M., Muller, D., Smith, A., . . . Gander, P. (2014). Prevalence of abnormal sleep duration and excessive daytime sleepiness in pregnancy and the role of socio-demographic factors: Comparing pregnant women with women in the general population. *Sleep Medicine*, 15(12), 1477-1483. doi:10.1016/j.sleep.2014.07.007
- Sills, M. R., Shetterly, S., Xu, S., Magid, D., & Kempe, A. (2007). Association between parental depression and children's health care use. *Pediatrics*, 119(4), E829-E836. doi:10.1542/peds.2006-2399
- Simmonds, S., Robson, B., Cram, F., & Purdie, G. (2008). Kaupapa Māori epidemiology. *Australian Epidemiologist*, 15(1), 2-6.
- Sit, D. K. Y., & Wisner, K. L. (2009). Identification of postpartum depression. *Clinical Obstetrics and Gynecology*, 52(3), 456-468. doi:10.1097/GRF.0b013e3181b5a57c.
- Skouteris, H., Germano, C., Wertheim, E. H., Paxton, S. J., & Milgrom, J. (2008). Sleep quality and depression during pregnancy: A prospective study. *Journal of Sleep Research*, 17(2), 217-220. doi:10.1111/j.1365-2869.2008.00655.x
- Skouteris, H., Wertheim, E. H., Germano, C., Paxton, S. J., & Milgrom, J. (2009). Assessing sleep during pregnancy a study across two time points examining the Pittsburgh Sleep

- Quality Index and associations with depressive symptoms. *Women's Health Issues*, 19(1), 45-51. doi:10.1016/j.whi.2008.10.004
- Skouteris, H., Wertheim, E. H., Rallis, S., Milgrom, J., & Paxton, S. J. (2009). Depression and anxiety through pregnancy and the early postpartum: An examination of prospective relationships. *Journal of Affective Disorders*, 113(3), 303-308. doi:10.1016/j.jad.2008.06.002
- Slomian, J., Honvo, G., Reginster, J. Y., Bruyère, O., & Emonts, P. (2019). Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes. *Women's Health*, 15, 1-55. doi:10.1177/1745506519844044
- Smart, J., & Hiscock, H. (2007). Early infant crying and sleeping problems: A pilot study of impact on parental well-being and parent-endorsed strategies for management. *Journal of Paediatrics and Child Health*, 43, 284-290.
- Smetacek, V. (2010). Recalibrating sleep: Is recalibration and readjustment of sense organs and brain-body connections the core function of sleep? *Medical Hypotheses*, 75(4), 401-404. doi:10.1016/j.mehy.2010.04.008
- Smith-Nielsen, J., Matthey, S., Lange, T., & Væver, M. S. (2018). Validation of the Edinburgh Postnatal Depression Scale against both DSM-5 and ICD-10 diagnostic criteria for depression. *BMC Psychiatry*, 18(1), 393. doi:10.1186/s12888-018-1965-7
- Smith, B., Thompson, K., Clarkson, L., & Dawson, D. (2014). The prevalence and implications of human-animal co-sleeping in an Australian sample. *Anthrozoos*, 27(4), 543-551. doi:10.2752/089279314X14072268687880
- Smith, B. P., Hazelton, P. C., Thompson, K. R., Trigg, J. L., Etherton, H. C., & Blunden, S. L. (2017). A multispecies approach to co-sleeping: Integrating human-animal co-sleeping practices into our understanding of human sleep. *Human Nature*, 28(3), 255-273. doi:10.1007/s12110-017-9290-2
- Smorti, M., Ponti, L., & Pancetti, F. (2019). A comprehensive analysis of post-partum depression risk factors: The role of socio-demographic, individual, relational, and delivery characteristics. *Frontiers in Public Health*, 7(295) doi:10.3389/fpubh.2019.00295
- Sockol, L. E., Epperson, C. N., & Barber, J. P. (2011). A meta-analysis of treatments for perinatal depression. *Clinical Psychology Review*, 31(5), 839-849. doi:10.1016/j.cpr.2011.03.009
- Soderquist, J., Wijma, B., Thorbert, G., & Wijma, K. (2009). Risk factors in pregnancy for post-traumatic stress and depression after childbirth. *BJOG: An International Journal of Obstetrics & Gynaecology*, 116(5), 672-680. doi:10.1111/j.1471-0528.2008.02083.x

- Sönmez, A., & Aksoy Derya, Y. (2018). Effects of sleep hygiene training given to pregnant women with restless leg syndrome on their sleep quality. *Sleep and Breathing, 22*(2), 527-535. doi:10.1007/s11325-018-1619-5
- Spiegel, K., Luthringer, R., Follenius, M., Schaltenbrand, N., Macher, J. P., Muzet, A., & Brandenberger, G. (1995). Temporal relationship between prolactin secretion and slow-wave electroencephalic activity during sleep. *Sleep, 18*(7), 543-548.
- Spong, C. Y. (2013). Defining "term" pregnancy: Recommendations from the defining "term" pregnancy workgroup. *JAMA: Journal of the American Medical Association, 309*(23), 2445-2446. doi:10.1001/jama.2013.6235
- Sprinkle, S. D., Lurie, D., Insko, S. L., Atkinson, G., Jones, G. L., Logan, A. R., & Bissada, N. N. (2002). Criterion validity, severity cut scores, and test-retest reliability of the Beck Depression Inventory-II in a university counseling center sample. *Journal of Counseling Psychology, 49*(3), 381-385. doi:10.1037/0022-0167.49.3.381
- Srivanitchapoom, P., Pandey, S., & Hallett, M. (2014). Restless legs syndrome and pregnancy: A review. *Parkinsonism and Related Disorders, 20*(7), 716-722. doi:10.1016/j.parkreldis.2014.03.027
- Stacey, T., Thompson, J., M. D., Mitchell, E., A., Ekeroma, A., J., Zuccollo, J., M., & McGowan, L., M. E. (2011). Association between maternal sleep practices and risk of late stillbirth: A case-control study. *BMJ, 342*(7811), 1350-1355. doi:10.1136/bmj.d3403
- Stanisiere, J., Mousset, P. Y., & Lafay, S. (2018). How safe is ginger rhizome for decreasing nausea and vomiting in women during early pregnancy? *Foods, 7*(4), 50-78. doi:10.3390/foods7040050
- Statistics New Zealand. (2006). *New Zealand Census of Population and Dwelling*. Wellington, NZ: Statistics New Zealand.
- Statistics New Zealand. (2017). *Statistical standard for ethnicity*. Retrieved from <http://archive.stats.govt.nz/methods/classifications-and-standards/classification-related-stats-standards/ethnicity.aspx>
- Stein, A., Pearson, R. M., Goodman, S. H., Rapa, E., Rahman, A., McCallum, M., . . . Pariante, C. M. (2014). Effects of perinatal mental disorders on the fetus and child. *The Lancet, 384*(9956), 1800-1819. doi:10.1016/S0140-6736(14)61277-0
- Stepanski, E. J., & Wyatt, J. K. (2003). Use of sleep hygiene in the treatment of insomnia. *Sleep Medicine Reviews, 7*(3), 215-225. doi:10.1053/smr.2001.0246
- Stephoe, A., Peacey, V., & Wardle, J. (2006). Sleep duration and health in young adults. *Archives of Internal Medicine, 166*(16), 1689-1692. doi:10.1001/archinte.166.16.1689

- Stiles, J., & Jernigan, T. L. (2010). The basics of brain development. *Neuropsychology Review*, 20(4), 327-348. doi:10.1007/s11065-010-9148-4
- Stone, K. C., Salisbury, A. L., Miller-Loncar, C. L., Battle, C. L., Mattera, J. A., Johnsen, D. M., & O'Grady, K. E. (2017). Pregnancy and postpartum antidepressant use moderates the effects of sleep on depression. *Archives of Women's Mental Health*, 20, 621-632. doi:10.1007/s00737-017-0726-9
- Storksén, H. T., Eberhard-Gran, M., Garthus-Niegel, S., & Eskild, A. (2012). Fear of childbirth; the relation to anxiety and depression. *Acta Obstetrica Et Gynecologica Scandinavica*, 91, 237-242. doi:10.1111/j.1600-0412.2011.01323.x
- Strange, L. B., Parker, K. P., Moore, M. L., Strickland, O. L., & Bliwise, D. L. (2009). Disturbed sleep and preterm birth: A potential relationship? *Clinical and Experimental Obstetrics and Gynecology*, 36(3), 166-168.
- Stranges, S., Dorn, J. M., Shipley, M. J., Kandala, N., Trevisan, M., Miller, M. A., . . . Cappuccio, F. P. (2008). Correlates of short and long sleep duration: A cross-cultural comparison between the United Kingdom and the United States: The Whitehall II Study and the Western New York Health Study. *American Journal of Epidemiology*, 168(12), 1353-1364. doi:10.1093/aje/kwn337
- Stremler, R., Hodnett, E., Kenton, L., Lee, K., Weiss, S., Weston, J., & Willan, A. (2013). Effect of behavioural-educational intervention on sleep for primiparous women and their infants in early postpartum: Multisite randomised controlled trial. *BMJ*, 346, 349-359. doi:10.1136/bmj.f1164
- Stremler, R., Hodnett, E., Lee, K., MacMillan, S., Mill, C., Ongcangco, L., & Willan, A. (2006). A behavioral-educational intervention to promote maternal and infant sleep: A pilot randomized, controlled trial. *Sleep*, 29(12), 1609-1615. doi:10.1093/sleep/29.12.1609
- Stremler, R., McMurray, J., & Brennenstuhl, S. (2019). Self-reported sleep quality and actigraphic measures of sleep in new mothers and the relationship to postpartum depressive symptoms. *Behavioral Sleep Medicine*, 21, 1-10. doi:10.1080/15402002.2019.1601629
- Stuart, S., Couser, G., Schilder, K., O'Hara, M., & Gorman, L. (1998). Postpartum anxiety and depression: Onset and comorbidity in a community sample. *Journal of Nervous and Mental Disease*, 186(7), 420-424. doi:10.1097/00005053-199807000-00006
- Suzuki, S., Dennerstein, L., Dennerstein, L., Armstrong, S. M., & Satohisa, E. (1994). Sleeping patterns during pregnancy in Japanese women. *Journal of Psychosomatic Obstetrics & Gynecology*, 15(1), 19-26. doi:10.3109/01674829409025625

- Suzuki, S., Dennerstein, L., Greenwood, K. M., Armstrong, S. M., Sano, T., & Satohisa, E. (1993). Melatonin and hormonal changes in disturbed sleep during late pregnancy. *Journal of Pineal Research, 15*(4), 191-198.
- Swallow, B. L., Lindow, S. W., Masson, E. A., & Hay, D. M. (2004). Psychological health in early pregnancy: Relationship with nausea and vomiting. *Journal of Obstetrics & Gynaecology, 24*(1), 28-32. doi:10.1080/01443610310001620251
- Swanson, L. M., Flynn, H., Wilburn, K., Marcus, S., & Armitage, R. (2010). Maternal mood and sleep in children of women at risk for perinatal depression. *Archives of Women's Mental Health, 13*(6), 531-534. doi:10.1007/s00737-010-0177-z
- Swanson, L. M., Pickett, S. M., Flynn, H., & Armitage, R. (2011). Relationships among depression, anxiety, and insomnia symptoms in perinatal women seeking mental health treatment. *Journal of Women's Health, 20*(4), 553-558. doi:10.1089/jwh.2010.2371
- Sword, W., Heaman, M. I., Brooks, S., Tough, S., Janssen, P. A., Young, D., . . . Hutton, E. (2012). Women's and care providers' perspectives of quality prenatal care: A qualitative descriptive study. *BMC Pregnancy & Childbirth, 12*, 29. doi:10.1186/1471-2393-12-29
- Szegda, K., Markenson, G., Bertone-Johnson, E. R., & Chasan-Taber, L. (2014). Depression during pregnancy: A risk factor for adverse neonatal outcomes? A critical review of the literature. *The Journal of Maternal-Fetal & Neonatal Medicine, 27*(9), 960-967. doi:10.3109/14767058.2013.845157
- Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson Education.
- Takahashi, M., Tahara, Y., Tsubosaka, M., Fukazawa, M., Ozaki, M., Iwakami, T., . . . Shibata, S. (2018). Chronotype and social jetlag influence human circadian clock gene expression. *Scientific Reports, 8*(1), 10152. doi:10.1038/s41598-018-28616-2
- Tan, X., van Egmond, L., Partinen, M., Lange, T., & Benedict, C. (2019). A narrative review of interventions for improving sleep and reducing circadian disruption in medical inpatients. *Sleep Medicine, 59*, 42-50. doi:10.1016/j.sleep.2018.08.007
- Tanner Stapleton, L. R., Dunkel Schetter, C., Westling, E., Rini, C., Glynn, L. M., Hobel, C. J., & Sandman, C. A. (2012). Perceived partner support in pregnancy predicts lower maternal and infant distress. *Journal of Family Psychology, 26*(3), 453-463. doi:10.1037/a0028332
- Teixeira, C., Figueiredo, B., Conde, A., Pacheco, A., & Costa, R. (2009). Anxiety and depression during pregnancy in women and men. *Journal of Affective Disorders, 119*(1-3), 142-148. doi:10.1016/j.jad.2009.03.005

- Thase, M. E. (2006). Depression and sleep: Pathophysiology and treatment. *Dialogues in Clinical Neuroscience, 8*(2), 217-226.
- Thurston, R. C., Luther, J. F., Wisniewski, S. R., Eng, H., & Wisner, K. L. (2013). Prospective evaluation of nighttime hot flashes during pregnancy and postpartum. *Fertility and Sterility, 100*(6), 1667-1672. doi:10.1016/j.fertnstert.2013.08.020
- Tikotzky, L. (2016). Postpartum maternal sleep, maternal depressive symptoms and self-perceived mother–infant emotional relationship. *Behavioral Sleep Medicine, 14*(1), 5-22. doi:10.1080/15402002.2014.940111
- Toffol, E., Lahti-Pulkkinen, M., Lahti, J., Lipsanen, J., Heinonen, K., Pesonen, A.-K., . . . Rääkkönen, K. (2018). Maternal depressive symptoms during and after pregnancy are associated with poorer sleep quantity and quality and sleep disorders in 3.5-year-old offspring. *Sleep Medicine, 56*, 201-210. doi:10.1016/j.sleep.2018.10.042
- Tomfohr-Madsen, L. M., Campbell, T. S., Giesbrecht, G. F., Letourneau, N. L., Carlson, L. E., Madsen, J. W., & Dimidjian, S. (2016). Mindfulness-based cognitive therapy for psychological distress in pregnancy: Study protocol for a randomized controlled trial. *Trials, 17*(1), 498-509. doi:10.1186/s13063-016-1601-0
- Tomfohr-Madsen, L. M., Clayborne, Z. M., Rouleau, C. R., & Campbell, T. S. (2016). Sleeping for two: An open-pilot study of cognitive behavioral therapy for insomnia in pregnancy. *Behavioral Sleep Medicine, 15*(5), 377-393. doi:10.1080/15402002.2016.1141769
- Tomfohr, L. M., Buliga, E., Campbell, T. S., Giesbrecht, G. F., & Letourneau, N. L. (2015). Trajectories of sleep quality and associations with mood during the perinatal period. *Sleep, 38*(8), 1237-1245. doi:10.5665/sleep.4900
- Toohill, J., Fenwick, J., Gamble, J., Creedy, D. K., Buist, A., Turkstra, E., & Ryding, E.-L. (2014). A randomized controlled trial of a psycho-education intervention by midwives in reducing childbirth fear in pregnant women. *Birth, 41*(4), 384-394. doi:10.1111/birt.12136
- Toth, P., Lukacs, H., Hiatt, E. S., Reid, K. H., Iyer, V., & Rao, C. V. (1994). Administration of human chorionic gonadotropin affects sleep-wake phases and other associated behaviors in cycling female rats. *Brain Research, 654*(2), 181-190. doi:10.1016/0006-8993(94)90478-2
- Trotter, K. (2017). Breast pain: An evidence-based case report *Women's Healthcare, 5*(3)
- Truijens, S. E. M., Spek, V., van Son, M. J. M., Oei, S. G., & Pop, V. J. M. (2017). Different patterns of depressive symptoms during pregnancy. *Archives of Women's Mental Health, 20*, 539-546. doi:10.1007/s00737-017-0738-5

- Tsai, S.-Y., Kuo, L.-T., Lai, Y.-H., & Lee, C.-N. (2011). Factors associated with sleep quality in pregnant women: A prospective observational study. *Nursing Research, 60*(6), 405-412. doi:10.1097/NNR.0b013e3182346249
- Tsai, S.-Y., Kuo, L.-T., Lee, C.-N., Lee, Y.-L., & Landis, C. A. (2013). Reduced sleep duration and daytime naps in pregnant women in Taiwan. *Nursing Research, 62*(2), 99-105. doi:10.1097/NNR.0b013e3182830d87
- Tsai, S.-Y., Lee, C.-N., Wu, W.-W., & Landis, C. A. (2016). Sleep hygiene and sleep quality of third-trimester pregnant women. *Research in Nursing & Health, 39*(1), 57-65. doi:10.1002/nur.21705
- Tsai, S.-Y., Lee, P.-L., Lin, J.-W., & Lee, C.-N. (2016a). Cross-sectional and longitudinal associations between sleep and health-related quality of life in pregnant women: A prospective observational study. *International Journal of Nursing Studies, 56*, 45-53. doi:10.1016/j.ijnurstu.2016.01.001
- Tsai, S.-Y., Lee, P.-L., Lin, J.-W., & Lee, C.-N. (2016b). Persistent and new-onset daytime sleepiness in pregnant women: A prospective observational cohort study. *International Journal of Nursing Studies, 66*, 1-6. doi:10.1016/j.ijnurstu.2016.11.003
- Tsai, S.-Y., Lin, J.-W., Kuo, L.-T., Lee, C.-N., & Landis, C. A. (2013). Nighttime sleep, daytime napping, and labor outcomes in healthy pregnant women in Taiwan. *Research in Nursing & Health, 36*(6), 612-622. doi:10.1002/nur.21568
- Tsai, S.-Y., Lin, J.-W., Kuo, L.-T., & Thomas, K. A. (2012). Daily sleep and fatigue characteristics in nulliparous women during the third trimester of pregnancy. *Sleep, 35*(2), 257-262. doi:10.5665/sleep.1634
- Tsai, S.-Y., Lin, J. W., Wu, W. W., Lee, C. N., & Lee, P. L. (2016). Sleep disturbances and symptoms of depression and daytime sleepiness in pregnant women. *Birth, 43*(2), 176-183. doi:10.1111/birt.12215
- Tsuno, N., Besset, A., & Ritchie, K. (2005). Sleep and depression. *The Journal of Clinical Psychiatry, 66*(10), 1254-1269. doi:10.4088/JCP.v66n1008
- Tuovinen, S., Lahti-Pulkkinen, M., Girchenko, P., Lipsanen, J., Lahti, J., Heinonen, K., . . . Raikkonen, K. (2018). Maternal depressive symptoms during and after pregnancy and child developmental milestones. *Depression & Anxiety, 35*(8), 732-741. doi:10.1002/da.22756
- Tzeng, Y.-L., Chen, S.-L., Chen, C.-F., Wang, F.-C., & Kuo, S.-Y. (2015). Sleep trajectories of women undergoing elective cesarean section: Effects on body weight and psychological well-being. *PLoS ONE, 10*(6), e0129094. doi:10.1371/journal.pone.0129094

- Ursavas, A. (2009). Sleep breathing disorders in pregnancy. *Tuberkuloz ve toraks*, *57*(2), 237-243.
- Van Cauter, E., & Plat, L. (1996). Physiology of growth hormone secretion during sleep. *The Journal of Pediatrics*, *128*(5), S32-37. doi:10.1016/s0022-3476(96)70008-2
- Van Der Waerden, J., Melchior, M., Larroque, B., Saurel-Cubizolles, M. J., Galéra, C., & Sutter-Dallay, A. L. (2015). Maternal depression trajectories and children's behavior at age 5 years. *Journal of Pediatrics*, *166*(6), 1440-1448. doi:10.1016/j.jpeds.2015.03.002
- van Mill, J. G., Hoogendijk, W. J. G., Vogelzangs, N., van Dyck, R., & Penninx, B. W. J. H. (2010). Insomnia and sleep duration in a large cohort of patients with major depressive disorder and anxiety disorders. *The Journal of Clinical Psychiatry*, *71*(3), 239-246. doi:10.4088/JCP.09m05218gry
- Vandeputte, M., & de Weerd, A. (2003). Sleep disorders and depressive feelings: A global survey with the Beck depression scale. *Sleep Medicine*, *4*(4), 343-345. doi:10.1016/S1389-9457(03)00059-5
- Vazquez, J. C. (2015). Heartburn in pregnancy. *BMJ Clinical Evidence*, *9*, 1411-1419.
- Verbiest, S., Tully, K., Simpson, M., & Stuebe, A. (2018). Elevating mothers' voices: Recommendations for improved patient-centered postpartum. *Journal of Behavioral Medicine*, *41*(5), 577-590. doi:10.1007/s10865-018-9961-4
- Viljoen, E., Visser, J., Koen, N., & Musekiwa, A. (2014). A systematic review and meta-analysis of the effect and safety of ginger in the treatment of pregnancy-associated nausea and vomiting. *Nutrition Journal*, *13*(20), 1-28. doi:10.1186/1475-2891-13-20
- Viola-Saltzman, M. (2006). Gestational restless legs syndrome. In H. Attarian & M. Viola-Saltzman (Eds.), *Sleep disorders in women: A guide to practical management*. London, England: Human Press.
- Vliegen, N., Casalin, S., & Luyten, P. (2014). The course of postpartum depression: A review of longitudinal studies. *Harvard Review of Psychiatry*, *22*(1), 1-22. doi:10.1097/HRP.0000000000000013
- Voegtline, K. M., Costigan, K. A., Kivlighan, K. T., Laudenslager, M. L., Henderson, J. L., & DiPietro, J. A. (2013). Concurrent levels of maternal salivary cortisol are unrelated to self-reported psychological measures in low-risk pregnant women. *Archives of Women's Mental Health*, *16*(2), 101-108. doi:10.1007/s00737-012-0321-z
- Voiculescu, S. E., Zygouropoulos, N., Zahiu, C. D., & Zagrean, A. M. (2014). Role of melatonin in embryo fetal development. *Journal of Medicine and Life*, *7*(4), 488-492.

- Volkovich, E., Tikotzky, L., & Manber, R. (2016). Objective and subjective sleep during pregnancy: Links with depressive and anxiety symptoms. *Archives of Women's Mental Health, 19*(1), 173-181. doi:10.1007/s00737-015-0554-8
- Wagner, D. R. (1996). Disorders of the circadian sleep-wake cycle. *Neurologic Clinics, 14*(3), 651-670. doi:10.1016/s0733-8619(05)70278-4
- Waldie, K. E., Peterson, E. R., D'Souza, S., Underwood, L., Pryor, J. E., Carr, P. A., . . . Morton, S. M. B. (2015). Depression symptoms during pregnancy: Evidence from Growing Up in New Zealand. *Journal of Affective Disorders, 186*, 66-73. doi:10.1016/j.jad.2015.06.009
- Walker, M. P. (2011). The role of sleep in neurocognitive function. In C. M. Morin & C. A. Espie (Eds.), *The Oxford handbook of sleep and sleep disorders*. USA: Oxford University Press.
- Wang, G., Deng, Y., Jiang, Y., Lin, Q., Dong, S., Song, Y., . . . Jiang, F. (2018). Trajectories of sleep quality from late pregnancy to 36 months postpartum and association with maternal mood disturbances: A longitudinal and prospective cohort study. *Sleep, 41*(12), 1-10. doi:10.1093/sleep/zsy179
- Wang, W., Wei, S., Zhong, C., Zhang, Y., Huang, L., Chen, X., . . . Xiao, M. (2017). Shorter sleep duration in early pregnancy is associated with birth length: A prospective cohort study in Wuhan, China. *Sleep Medicine, 34*, 99-104. doi:10.1016/j.sleep.2017.03.013
- Warland, J., Dorrian, J., Morrison, J. L., & O'Brien, L. M. (2018). Maternal sleep during pregnancy and poor fetal outcomes: A scoping review of the literature with meta-analysis. *Sleep Medicine Reviews, 41*, 197-219. doi:10.1016/j.smr.2018.03.004
- Waters, M. A., & Lee, K. A. (1996). Differences between primigravidae and multigravidae mothers in sleep disturbances, fatigue, and functional status. *Journal of Nurse-Midwifery, 41*(5), 364-367. doi:10.1016/s0091-2182(96)00049-3
- Watson, H., Harrop, D., Walton, E., Young, A., & Soltani, H. (2019). A systematic review of ethnic minority women's experiences of perinatal mental health conditions and services in Europe. *PLoS ONE, 14*(1), 1-19. doi:10.1371/journal.pone.0210587
- Watson, N. F., Badr, M. S., Belenky, G., Bliwise, D. L., Buxton, O. M., Buysse, D., . . . Tasali, E. (2015). Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Journal of Clinical Sleep Medicine, 38*(6), 843-844. doi:10.5664/jcsm.4758
- Weaver, A. L., Stutzman, S. E., Supnet, C., & Olson, D. M. (2016). Sleep quality, but not quantity, is associated with self-perceived minor error rates among emergency department nurses. *International Emergency Nursing, 25*, 48-52. doi:10.1016/j.ienj.2015.08.003

- Weissman, M. M., Wickramaratne, P., Nomura, Y., Warner, V., Pilowsky, D., & Verdeli, H. (2006). Offspring of depressed parents: 20 years later. *The American Journal of Psychiatry*, *163*(6), 1001-1008. doi:10.1176/ajp.2006.163.6.1001
- Weissman, M. M., Wickramaratne, P., Nomura, Y., Warner, V., Verdeli, H., Pilowsky, D. J., . . . Bruder, G. (2005). Families at high and low risk for depression: A 3-generation study. *Archives of General Psychiatry*, *62*(1), 29-36. doi:10.1001/archpsyc.62.1.29
- Wells, D. L. (2009). Associations between pet ownership and self-reported health status in people suffering from chronic fatigue syndrome. *Journal of Alternative and Complementary Medicine*, *15*(4), 407-413. doi:10.1089/acm.2008.0496
- Wesström, J., Skalkidou, A., Manconi, M., Fulda, S., & Sundström-Poromaa, I. (2014). Pre-pregnancy Restless Legs Syndrome (Willis-Ekbom Disease) is associated with perinatal depression. *Journal of Clinical Sleep Medicine*, *10*(5), 527-533. doi:10.5664/jcsm.3704
- Whitton, A., Warner, R., & Appleby, L. (1996). The pathway to care in post-natal depression: Women's attitudes to post-natal depression and its treatment. *British Journal of General Practice*, *46*(408), 427-428.
- Whitton, S. W., & Whisman, M. A. (2010). Relationship satisfaction instability and depression. *Journal of Family Psychology*, *24*(6), 791-794. doi:10.1037/a0021734
- Wikman, A., Axfors, C., Iliadis, S. I., Cox, J., Fransson, E., & Skalkidou, A. (2019). Characteristics of women with different perinatal depression trajectories. *Journal of Neuroscience Research*, 1-15. doi:10.1002/jnr.24390
- Williams, M. A., Miller, R. S., Qiu, C., Cripe, S. M., Gelaye, B., & Enquobahrie, D. (2010). Associations of early pregnancy sleep duration with trimester-specific blood pressures and hypertensive disorders in pregnancy. *Sleep*, *33*(10), 1363-1371. doi:10.1093/sleep/33.10.1363
- Williamson, D. L., & Carr, J. (2009). Health as a resource for everyday life: Advancing the conceptualization. *Critical Public Health*, *19*(1), 107-122. doi:10.1080/09581590802376234
- Wilson, D. L., Barnes, M., Ellett, L., Permezel, M., Jackson, M., & Crowe, S. F. (2011). Decreased sleep efficiency, increased wake after sleep onset and increased cortical arousals in late pregnancy. *Australian & New Zealand Journal of Obstetrics & Gynaecology*, *51*(1), 38-46. doi:10.1111/j.1479-828X.2010.01252.x
- Wilson, D. L., Fung, A., Walker, S. P., & Barnes, M. (2013). Subjective reports versus objective measurement of sleep latency and sleep duration in pregnancy. *Behavioral Sleep Medicine*, *11*(3), 207-221. doi:10.1080/15402002.2012.670674

- Wittmann, M., Dinich, J., Merrow, M., & Roenneberg, T. (2006). Social jetlag: Misalignment of biological and social time. *Chronobiology International*, 23(1-2), 497-509. doi:10.1080/07420520500545979
- Wolfson, A. R., Crowley, S. J., Anwer, U., & Bassett, J. L. (2003). Changes in sleep patterns and depressive symptoms in first-time mothers: Last trimester to 1-year postpartum. *Behavioral Sleep Medicine*, 1(1), 54-67. doi:10.1207/ S15402010BSM0101_6
- Wolfson, A. R., & Lee, K. A. (2005). Pregnancy and the postpartum period. In *Principles and Practice of Sleep Medicine* (4th ed.). Philadelphia, PA: Elsevier Saunders.
- World Health Organization. (2005a). *Maternal and Newborn Health in the WHO European Region: The challenges and the way forward: Fact sheet EURO/03/05*. Copenhagen: World Health Organization.
- World Health Organization. (2005b). *Preventing chronic diseases: A vital investment: WHO global report*. Geneva, Switzerland: World Health Organization.
- World Health Organization. (2009). Global health risks: Mortality and burden of disease attributable to selected major risks. Retrieved from http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf
- World Health Organization. (2016). *WHO recommendation on interventions for the relief of leg cramps during pregnancy*. Geneva, Switzerland: WHO Reproductive Health Library.
- World Health Organization. (2019). World Health Organization Constitution. Retrieved from <https://www.who.int/about/who-we-are/constitution>
- Xu, Y.-H., Shi, L., Bao, Y.-P., Chen, S.-J., Shi, J., Zhang, R.-L., & Lu, L. (2018). Association between sleep duration during pregnancy and gestational diabetes mellitus: A meta-analysis. *Sleep Medicine*, 52, 67-74. doi:10.1016/j.sleep.2018.07.021
- Yang, Y., Mao, J., Ye, Z., Zeng, X., Zhao, H., Liu, Y., & Li, J. (2017). Determinants of sleep quality among pregnant women in China: A cross-sectional survey. *The Journal of Maternal-Fetal & Neonatal Medicine*, 31(22), 2980-2985. doi:10.1080/14767058.2017.1359831
- Yazici, E., Kirkan, T. S., Aslan, P. A., Aydin, N., & Yazici, A. B. (2015). Untreated depression in the first trimester of pregnancy leads to postpartum depression: High rates from a natural follow-up study. *Neuropsychiatric Disease and Treatment*, 11, 405-411. doi:10.2147/NDT.S77194
- Yildirim, E., & Demir, E. (2019). The relationship of hyperemesis gravidarum with sleep disorders, anxiety and depression. *Journal of Obstetrics & Gynaecology*, 39(6), 793-798. doi:10.1080/01443615.2019.1572725

- Yin, J., Jin, X., Shan, Z., Li, S., Huang, H., Li, P., . . . Bao, W. (2017). Relationship of sleep duration with all-cause mortality and cardiovascular events: A systematic review and dose-response meta-analysis of prospective cohort studies. *Journal of the American Heart Association, 6*(9), 1-9. doi:10.1161/JAHA.117.005947
- Yonkers, K. A., Smith, M. V., Gotman, N., & Belanger, K. (2009). Typical somatic symptoms of pregnancy and their impact on a diagnosis of major depressive disorder. *General Hospital Psychiatry, 31*(4), 327-333. doi:10.1016/j.genhosppsych.2009.03.005
- Yonkers, K. A., Vigod, S., & Ross, L. E. (2011). Diagnosis, pathophysiology, and management of mood disorders in pregnant and postpartum women. *Obstetrics & Gynecology, 117*(4), 961-977. doi:10.1097/AOG.0b013e31821187a7.
- Yonkers, K. A., Wisner, K. L., Stewart, D. E., Oberlander, T. F., Dell, D. L., Stotland, N., . . . Lockwood, C. (2009). The management of depression during pregnancy: A report from the American Psychiatric Association and the American College of Obstetricians and Gynecologists. *General Hospital Psychiatry, 114*(3), 703-713. doi:10.1097/AOG.0b013e3181ba0632
- Yosefy, C., Shenhav, S., Feldman, V., Sagi, Y., Katz, A., & Anteby, E. (2012). Left atrial function during pregnancy: A three-dimensional echocardiographic study. *Echocardiography, 29*(9), 1096-1101. doi:10.1111/j.1540-8175.2012.01745.x
- Young, T. B. (2004). Epidemiology of daytime sleepiness: Definitions, symptomatology, and prevalence. *Journal of Clinical Psychiatry, 65*(S16), 12-16.
- Yu, Y., Li, M., Pu, L., Wang, S., Wu, J., Ruan, L., . . . Jiang, W. (2017). Sleep was associated with depression and anxiety status during pregnancy: A prospective longitudinal study. *Archives of Women's Mental Health, 20*(5), 695-701. doi:10.1007/s00737-017-0754-5
- Zayas, L. H., Cunningham, M., McKee, M. D., & Jankowski, K. R. B. (2002). Depression and negative life events among pregnant African-American and Hispanic women. *Women's Health Issues, 12*(1), 16-22. doi:10.1016/S1049-3867(01)00138-4
- Zee, P. C., & Turek, F. W. (2013). Respect the clock. *Sleep Medicine Reviews, 17*(6), 395-397. doi:10.1016/j.smr.2013.08.001
- Zhong, C., Chen, R., Zhou, X., Xu, S., Li, Q., Cui, W., . . . Sun, G. (2018). Poor sleep during early pregnancy increases subsequent risk of gestational diabetes mellitus. *Sleep Medicine, 46*, 20-25. doi:10.1016/j.sleep.2018.02.014
- Zhou, H., Li, W., & Ren, Y. (2018). Poor sleep quality of third trimester exacerbates the risk of experiencing postnatal depression. *Psychology, Health & Medicine, 1*-10. doi:10.1080/13548506.2018.1549738

- Zhou, K., West, H. M., Zhang, J., Xu, L., & Li, W. (2015). Interventions for leg cramps in pregnancy. *Cochrane Database of Systematic Reviews*, 8, CD010655. doi:10.1002/14651858.CD010655.pub2
- Zhou, M., Thayer, W. M., & Bridges, J. F. P. (2017). Using latent class analysis to model preference heterogeneity in health: A systematic review. *PharmacoEconomics*, 36(2), 175-187. doi:10.1007/s40273-017-0575-4
- Zhu, B., Calvo, R. S., Wu, L., Simon, L., Shah, K., Piano, M., . . . Izci-Balsarak, B. (2018). Objective sleep in pregnant women: A comparison of actigraphy and polysomnography. *Sleep Health*, 4(5), 390-396. doi:10.1016/j.sleh.2018.07.011
- Zohar, D., Tzischinsky, O., Epstein, R., & Lavie, P. (2005). The effects of sleep loss on medical residents' emotional reactions to work events: A cognitive-energy model. *Sleep*, 28(1), 47-54. doi:10.1093/sleep/28.1.47
- Zsomboky, M. L. (2017). Sleep and pregnancy: Understanding the importance. *International Journal of Childbirth Education*, 32(1), 22.
- Zuckerman, B., Bauchner, H., Parker, S., & Cabral, H. (1990). Maternal depressive symptoms during pregnancy, and newborn irritability. *Journal of Developmental and Behavioral Pediatrics*, 11(4), 190-194. doi:10.1097/00004703-199008000-00006

PUBLICATIONS, PRESENTATIONS AND AWARDS ARISING FROM THESIS

Publications

Ladyman, C. I. (2020). *Sleeping better in pregnancy: A guide to sleep health for pregnant women*. Wellington, New Zealand: Massey University Press.

Ladyman, C., Gander, P., Huthwaite, M., Sweeney, B., Signal, T. L. (2020). Sleep HAPi: A feasibility and descriptive analysis of an early and longitudinal sleep education intervention for pregnant women. *Behavioral Sleep Medicine*. doi:10.1080/15402002.2020.1772265

Ladyman, C., Signal, T. L., Sweeney, B., Gander, P., Paine, S-J., Huthwaite, M. (2020) A pilot longitudinal sleep education intervention from early pregnancy and its effect on optimizing sleep and minimizing depressive symptoms. *Sleep Health*. doi:10.1016/j.sleh.2020.05.001

Ladyman, C. I., & Signal, T. L. (2018). Sleep health in pregnancy: A scoping review. *Sleep Medicine Clinics*, 13(3), 307-333. doi:10.1016/j.jsmc.2018.04.004

Presentations

Ladyman C. I., Signal T. L., Sweeney B. S., Gander P. H., Paine S-J., Huthwaite M. (2019). Impact of a sleep education intervention on depression. Symposia presentation at the *31st Annual Scientific Meeting of the Australasian Sleep Association*, Sydney, Australia, 19 October

Ladyman, C. I., Signal T. L., Sweeney B. S., Gander P. H., Paine S-J., Huthwaite M. (2019). A longitudinal sleep education intervention for pregnant women with a history of depression: analysis of sleep and depressive symptoms from 12 weeks gestation to 12 weeks postnatal. Shortlisted for New Investigator Award at *Sleep in Aotearoa*, Christchurch, New Zealand, 2-3 May 2019

Ladyman, C. I., & Signal, T. L. (2018). Sleep health in pregnancy: A scoping review. Shortlisted for New Investigator Award at *Sleep in Aotearoa*, Wellington, New Zealand, 11-12 May 2018

Awards

Finalist, Asia Pacific 3 Minute Thesis Competition, University of Queensland, Brisbane, 4 October 2019

Winner, Massey University 3 Minute Thesis Competition, Palmerston North Campus, 14 August 2019

Doctoral Scholarship, College of Health, Massey University, June 2016

APPENDIX 1 ETHICAL APPROVAL, E MOE MĀMĀ STUDY



Central Regional Ethics Committee

Ministry of Health
Level 2, 1-3 The Terrace
PO Box 5013
Wellington
Phone: (04) 496 2405
Fax: (04) 496 2191
Email: central_ethicscommittee@moh.govt.nz

2 November 2009

[Amendment to letter dated 20 October 2009]

Dr Leigh Signal
Sleep/Wake research Centre
Massey University
102 Adelaide Road
Newtown
Wellington

Dear Dr Leigh Signal

CEN/09/09/070 - SLEEP DURING PREGNANCY AND POSTPARTUM: THE RELATIONSHIP WITH MATERNAL HEALTH

The above study has been given ethical approval by the Central Regional Ethics Committee pending receipt of locality assessments for Capital and Coast District Health Board, and for Parent Centre and local public health organisations

Approved Documents

- Information Sheet : Maternal Sleep and Health in Aotearoa/New Zealand, version 6, 06/10/2009.
- Consent Form Maternal Sleep and Health in Aotearoa/New Zealand, version 3, 06/10/2009.
- Information Sheet: PIPIS Project: Sleep and Health in New Mothers and their Babies in Aotearoa/New Zealand, version 3, 05/10/2009.
- Consent Form: PIPIS Project: Sleep and Health in New Mothers and their Babies in Aotearoa/New Zealand, version 3, dated 05/10/2009.
- Postal Sleep Questionnaire : Sleep and Health During Pregnancy, version 5, dated 05/10/2009.
- Cover letter to Maori participants. E Moe, Māmā : Moe Kahurangi Me te Haurora | Aotearoa, version 2, dated 06/10/2009.
- Information sheet. E Moe, Māmā : Moe Kahurangi Me te Haurora | Aotearoa, version 2, dated 19/08/2009.
- Amendment to postal sleep questionnaire: questions B8 and E3.
- Cover letter for non- Maori participants, version 1, 19/08/09
- Consent form: Puka Whakaae (consent form for Maori participants), version 2, 06/01/09
- Cover letter PIPIS Project, version 1, 24/08/09
- Questionnaire 1 for Behavioural-Education Intervention (all women), version 1, 23/08/09
- Questionnaire 2 for Behavioural-Education Intervention (intervention and control group versions), version 1, 23/08/09.
- Questionnaire 3 for Behavioural-Education Intervention (intervention and control group versions), version 1, 23/08/09.
- Sleep diary for Behavioural-Education Intervention (mother and infant versions), version 1, 23/08/09.
- Sleep diary and actiwatch information sheet for Behavioural Education Intervention, version 1, 24/08/09
- Feedback form for Behavioural-Education Intervention (intervention and control group versions), version 1, 24/08/09

Accreditation

The Committee involved in the approval of this study is accredited by the Health Research Council and is constituted and operates in accordance with the Operational Standard for Ethics Committees, April 2006.

Progress Reports

The study is approved until **1 October 2012**. The Committee will review the approved application annually and notify the Principal Investigator if it withdraws approval. It is the Principal Investigator's responsibility to forward

Administered by the Ministry of Health

Approved by the Health Research Council

<http://www.ethicscommittees.health.govt.nz>

a progress report covering all sites prior to ethical review of the project in **14 October 2010**. The report form is available on <http://www.ethicscommittees.health.govt.nz>. Please note that failure to provide a progress report may result in the withdrawal of ethical approval. A final report is also required at the conclusion of the study.

Amendments


It is also a condition of approval that the Committee is advised if the study does not commence or is altered in any way, including documentation eg advertisements, letters to prospective participants.

Please quote the above ethics committee reference number in all correspondence.

The Principal Investigator is responsible for advising any other study sites of approvals and all other correspondence with the Ethics Committee.

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider within whose facility the research is to be carried out. Where applicable, authority for this must be obtained separately from the appropriate manager within the organisation.

Yours sincerely



Sonia Scott
Central Regional Ethics Committee Administrator

Email: sonia_scott@moh.govt.nz

APPENDIX 2 ETHICAL APPROVAL, MOE KURA STUDY



Health and Disability Ethics Committees
1 The Terrace
PO Box 5013
Wellington
6011

0800 4 ETHICS
hdec@mh.govt.nz

16 November 2012

Dr Tracey Leigh Signal
Sleep/Wake Research Centre
Massey University
PO Box 756
Wellington 6140

Dear Dr Signal

Re:	Ethics ref:	CEN/09/09/070
	Study title:	Sleep during pregnancy and postpartum: the relationship with maternal health

I am pleased to advise that this amendment has been *approved* by the Central Health and Disability Ethics Committee. This decision was made through the HDEC Expedited Review pathway.

Non-standard conditions:

1. The Chair notes 'I do like the Code of Practice' idea, include it when applicable.
2. Yes – consent for the child in the consent form would be wise.

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

Mrs Helen Walker
Chairperson
Central Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix A
Documents submitted

Document	Version	Date
Survey/questionnaire: Maternal questionnaire	V1	01 November 2012
Cover letter for Maori women	V1	01 November 2012
Cover letter non-Maori women	V1	01 November 2012
PIS/CF: Participant Information Sheet	V1	01 November 2012
PIS/CF: Participant Consent Form	V1	01 November 2012
Covering letter: Cover letter	V1	01 November 2012
PIS/CF: Information sheet	V1	01 November 2012
PIS/CF: Consent form	V1	01 November 2012
Survey/questionnaire: Maternal questionnaire Age 3	V1	01 November 2012
Survey/questionnaire: Child questionnaire Age 3	V1	01 November 2012
Cover letter for Maori women	V1	01 November 2012
Cover letter non-Maori women	V1	01 November 2012
Post Approval Form		

Appendix B
Statement of compliance and list of members

Statement of compliance

The Central Health and Disability Ethics Committee:

- is constituted in accordance with its Terms of Reference
- operates in accordance with the *Standard Operating Procedures for Health and Disability Ethics Committees*, and with the principles of international good clinical practice (GCP)
- is approved by the Health Research Council of New Zealand's Ethics Committee for the purposes of section 25(1)(c) of the Health Research Council Act 1990
- is registered (number 00008712) with the US Department of Health and Human Services' Office for Human Research Protection (OHRP).

List of members

<i>Name</i>	<i>Category</i>	<i>Appointed</i>	<i>Term Expires</i>
Mrs Helen Walker	Lay (consumer/community perspectives)	01/07/2012	01/07/2015
Dr Angela Ballantyne	Lay (ethical/moral reasoning)	01/07/2012	01/07/2015
Mr Paul Barnett	Lay (the law)	01/07/2012	01/07/2014
Mrs Gael Donoghue	Non-lay (health/disability service provision)	01/07/2012	01/07/2014
Mrs Sandy Gill	Lay (consumer/community perspectives)	01/07/2012	01/07/2014
Dr Ptries Herst	Non-lay (intervention studies)	01/07/2012	01/07/2015
Dr Dean Quinn	Non-lay (intervention studies)	01/07/2012	01/07/2015
Dr Lynne Russell	Non-lay (observational studies)	01/07/2012	01/07/2014

<http://www.ethics.health.govt.nz>

APPENDIX 3 SLEEP AND HEALTH DURING PREGNANCY

QUESTIONNAIRE, E MOE MĀMĀ STUDY

ID: _____

Sleep and Health during Pregnancy

THIS QUESTIONNAIRE SHOULD BE COMPLETED WHEN YOU ARE 35-37 WEEKS PREGNANT

1. What is your date of birth? / /
(day) (month) (year)

2. When is your baby due? / /
(day) (month) (year)

3. How many weeks pregnant are you now? weeks

4. Write your NHI number here if you know it:
(This is your National Health Index number – your midwife or doctor will have this).
[] []

5. Which ethnic group do you belong to? *Mark the space or spaces which apply to you.*
 New Zealand European
 Cook Island Māori
 Chinese
 Māori
 Tongan
 Indian
 Samoan
 Niuean
 Other such as DUTCH, JAPANESE, TOKELAUN. Please state:

6. Where do you usually live?
 Street number Flat number
 Street name
 Suburb or rural locality Post Code
 City, town or district
 Telephone number Cell phone number

7. In the last 12 months what was your households total income, before tax or anything else was taken out of it?
 1. Loss
 2. Zero income
 3. \$1 - \$5,000
 4. \$5,001 - \$10,000
 5. \$10,001 - \$15,000
 6. \$15,001 - \$20,000
 7. \$20,001 - \$25,000
 8. \$25,001 - \$30,000
 9. \$30,001 - \$35,000
 10. \$35,001 - \$40,000
 11. \$40,001 - \$45,000
 12. \$45,001 - \$50,000
 13. \$50,001 - \$70,000
 14. \$70,001 - \$100,000
 15. \$100,001 - \$150,000
 16. \$150,001 or more
 17. don't know

Please go to next page 1

Sleep and Health during Pregnancy V5 05/10/09

Paid Work (These questions refer to your work in the last month)

8. Do you currently work for pay, profit or income?
 1. Yes, one paid job
 2. Yes, more than one paid job
 0. No
 Comments welcome →

If you answered 'No' please go to question 12. If 'Yes' go to question 9.

9. On average, how many HOURS A WEEK did you work for pay, profit or income? Just think about the LAST MONTH.
 Please write how many hours a week here → hours a week

10. In the LAST MONTH did you work for pay, profit or income for at least 3 hours between midnight and 5am?
 1. Yes
 0. No (please go to question 12)

11. In the LAST MONTH what is the total number of nights that you worked for at least 3 hours between midnight and 5am? Please write how many nights here → nights

12. Return to work
 1. I have no plans to return to work
 2. I plan to return to work but have no date in mind
 3. I expect to be back at work when my baby is (write baby's age)

Support & dependents

13. How many people normally live in your home?
 1. Yes
 0. No

14. How many of these people need looking after by you (not counting you)?
 What are their ages?

15. Support for you at home
 Do you live with anyone you can count on to help you with:
 Financial support
 IF YES, who? (e.g. partner, friend, parent)
 Emotional support (e.g. someone who listens or is 'there' for you)
 IF YES, who? (e.g. partner, friend, parent)
 Advice (e.g. can give information or guidance about pregnancy, birth and parenting)
 IF YES, who? (e.g. partner, friend, parent)
 Concrete/Practical support (e.g. baby care, housework, cooking)
 IF YES, who? (e.g. partner, friend, parent)

Please go to next page 2

Sleep and Health during Pregnancy V5 05/10/09

16. Support for you – outside of home
Are there other people, not living with you, who you can count on to help with:

Financial support 1 Yes 0 No

IF YES, who? (e.g. partner, friend, parent).....

Emotional support (e.g. someone who listens or is 'there' for you) 1 Yes 0 No

IF YES, who? (e.g. partner, friend, parent).....

Advice (e.g. can give information or guidance about pregnancy, birth and parenting) 1 Yes 0 No

IF YES, who? (e.g. partner, friend, parent).....

Concrete/Practical support (e.g. baby care, housework, cooking) 1 Yes 0 No

IF YES, who? (e.g. partner, friend, parent).....

17. If you have a partner, how is your relationship with them at the moment?
Please circle one number

Perfectly	Extremely	OR	Not applicable
Happy	Unhappy		
0	1 2 3 4 5 6 7		

18. How supportive of this pregnancy is your partner?: Please circle one number

Completely supportive	Not at all supportive	OR	Not applicable
0	1 2 3 4 5 6 7		

19. How often is a private motor vehicle (not counting motorbikes) available for your use?

	NO	DAYS	EVERY DAY
Circle the number of days a week	0	1 2 3 4 5 6 7	

Sleep – before this pregnancy

20. Before this pregnancy, how many hours sleep did you usually get in 24 hours, including naps?
Please write the number of hours here hours

21. Before this pregnancy, how often did you get a good night's sleep?

	NO	NIGHTS	EVERY NIGHT
Circle the number of nights	0	1 2 3 4 5 6 7	

22. Before this pregnancy, has anyone told you that during sleep you do any of the following things? Please circle how often

	NO	NIGHTS	EVERY NIGHT
Loud snoring.....	0	1 2 3 4 5 6 7	
Long pauses between breaths while asleep.....	0	1 2 3 4 5 6 7	
Legs twitching or jerking while you sleep.....	0	1 2 3 4 5 6 7	

Sleep – during this pregnancy

23. How many hours sleep do you usually get in 24 hours, including naps?
(Just think about the last week.)

Please write the number of hours here hours

24. In the last week, how often did you get a good night's sleep?
(Just think about the last week.)

	NO	NIGHTS	EVERY NIGHT
Circle the number of days	0	1 2 3 4 5 6 7	

25. On how many days in the last week did you have a daytime nap?

	NO	NIGHTS	EVERY NIGHT
Circle the number of days	0	1 2 3 4 5 6 7	

26. How long on average, per day, do you spend outside (really outside) exposed to daylight?

..... hours minutes

27. On how many nights in the last week did the following things disturb your sleep?
Please circle one number in every row.

	NO	NIGHTS	EVERY NIGHT
Circle the number of nights	0	1 2 3 4 5 6 7	
Going to the bathroom.....	0	1 2 3 4 5 6 7	
Pain in back/neck/joints.....	0	1 2 3 4 5 6 7	
Dreams.....	0	1 2 3 4 5 6 7	
Nightmares.....	0	1 2 3 4 5 6 7	
Heartburn.....	0	1 2 3 4 5 6 7	
Nasal congestion (blocked nose).....	0	1 2 3 4 5 6 7	
Leg cramps.....	0	1 2 3 4 5 6 7	
Contractions.....	0	1 2 3 4 5 6 7	
Feeling too hot or cold.....	0	1 2 3 4 5 6 7	
Thinking or worrying about things.....	0	1 2 3 4 5 6 7	
Baby moving around (baby kicking).....	0	1 2 3 4 5 6 7	
Other children.....	0	1 2 3 4 5 6 7	

Circle the number of nights

	NO NIGHTS	1	2	3	4	5	6	7
Just can't get comfortable	0	1	2	3	4	5	6	7
Just can't get to sleep	0	1	2	3	4	5	6	7
Disturbed by partner (e.g. snoring)	0	1	2	3	4	5	6	7
Other	0	1	2	3	4	5	6	7

If you circled 'Other', what were the other things that disturbed your sleep?

28. During sleep in the **LAST WEEK**, has anyone told you that you did any of the following?

Please circle how often.

	NO NIGHTS	1	2	3	4	5	6	7
Loud snoring	0	1	2	3	4	5	6	7
Long pauses between breaths while asleep	0	1	2	3	4	5	6	7
Legs twitching or jerking while you sleep	0	1	2	3	4	5	6	7

29. Do you ever experience an urge to move your legs (usually accompanied by unpleasant sensations)?

1 Yes 0 No – If "No" please go to question 31.

30. If you answered "Yes" in question 29, is this: Tick all that apply to you.

1 Worse at night?
 2 More noticeable when you rest?
 3 Relieved by movement?

31. How often in the last week did you:

Please circle one number in every row

	NO NIGHTS	1	2	3	4	5	6	7
Have difficulty getting to sleep	0	1	2	3	4	5	6	7
Wake up during your sleep period	0	1	2	3	4	5	6	7
Wake up too early at the end of a sleep period	0	1	2	3	4	5	6	7
Feel rested upon awakening at the end of a sleep period	0	1	2	3	4	5	6	7
Sleep poorly	0	1	2	3	4	5	6	7
Feel sleepy during the day	0	1	2	3	4	5	6	7
Struggle to stay awake during the day	0	1	2	3	4	5	6	7
Feel irritable during the day	0	1	2	3	4	5	6	7
Feel tired or fatigued during the day	0	1	2	3	4	5	6	7
Feel satisfied with the quality of your sleep	0	1	2	3	4	5	6	7

Please circle one number in every row

	NO NIGHTS	1	2	3	4	5	6	7
Feel alert and energetic during the day	0	1	2	3	4	5	6	7
Get too much sleep	0	1	2	3	4	5	6	7
Get too little sleep	0	1	2	3	4	5	6	7
Take a nap at a scheduled time	0	1	2	3	4	5	6	7
Fall asleep at an unscheduled time	0	1	2	3	4	5	6	7
Use a prescription sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
Use any pain medication to help you get to sleep (e.g. Paracetamol)	0	1	2	3	4	5	6	7
Take or use anything else to help you sleep	0	1	2	3	4	5	6	7

If so, what did you take or use:

32. How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times.

PLEASE TICK ONE CIRCLE ON EACH LINE

	would never doze	slight chance	moderate chance	high chance
Sitting and reading	0	1	2	3
Watching TV	0	1	2	3
Sitting inactive in a public place (e.g. movies, meeting)	0	1	2	3
As a passenger in a car for an hour without a break	0	1	2	3
Lying down in the afternoon when circumstances permit	0	1	2	3
Sitting and talking to someone	0	1	2	3
Sitting quietly after a lunch without alcohol	0	1	2	3
In a car, while stopped for a few minutes in traffic	0	1	2	3

PLEASE MAKE SURE YOU HAVE TICKED ONE BOX ON EACH LINE

Feelings in pregnancy

33. Please tick the answer which comes closest to how you have felt **IN THE LAST 7 DAYS**, not just how you feel today.

I have been able to laugh and see the funny side of things.

0 As much as I always could
 1 Not quite so much now
 2 Definitely not so much now
 3 Not at all

I have looked forward with enjoyment to things.

0 As much as I ever did
 1 Rather less than I used to
 2 Definitely less than I used to
 3 Hardly at all

34. The following are statements about worrying. Please read each statement and indicate how true each one is in describing your general/usual experience of worrying.
Please tick the one option that most likely applies to you for each statement

When I worry, it interferes with my day-to-day functioning (e.g. stops me getting my work done, organising myself or my activities).
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

When I think I should be finished worrying about something, I find myself worrying about the same thing, over and over.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

My worrying leads me to feel down and depressed.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

When I worry, it interferes with my ability to make decisions or solve problems.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

I feel tense and anxious when I worry.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

I worry that bad things or events are certain to happen.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

I often worry about not being able to stop myself from worrying.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

As a consequence of my worrying, I tend to feel emotional unease or discomfort.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

This pregnancy and birth

35. Who is providing professional health care for you in this pregnancy?

Independent (self-employed) midwife/team Hospital based midwife/team
 Hospital high risk team Specialist Obstetrician
 Shared care (e.g. midwife & obstetrician, midwife & GP) No one
 Other (who) _____

36. What was your weight before this pregnancy? kgs **OR** stones lbs

37. What is your height?cms **OR**feetinches

38. When you got pregnant, were you trying to get pregnant?
 1 Yes 0 No

39. Did you require the assistance of reproductive technology to become pregnant this time?
 (e.g. IVF, GIFT, ICSI) 1 Yes 0 No

I have blamed myself unnecessarily when things went wrong.
 3 Yes, most of the time
 2 Yes, some of the time
 1 Not very often
 0 No, never

I have been anxious or worried for no good reason.
 0 No, not at all
 1 Hardly ever
 2 Yes, sometimes
 3 Yes, very often

I have felt scared or panicky for no very good reason.
 3 Yes, quite a lot
 2 Yes, sometimes
 1 No, not much
 0 No, not at all

Things have been getting on top of me.
 3 Yes, most of the time I haven't been able to cope at all
 2 Yes, sometimes I haven't been coping as well as usual
 1 No, most of the time I have coped quite well
 0 No, I have been coping as well as ever

I have been so unhappy that I have had difficulty sleeping.
 3 Yes, most of the time
 2 Yes, sometimes
 1 Not very often
 0 No, not at all

I have felt sad or miserable.
 3 Yes, most of the time
 2 Yes, quite often
 1 Not very often
 0 No, not at all

I have been so unhappy that I have been crying.
 3 Yes, most of the time
 2 Yes, quite often
 1 Only occasionally
 0 No, never

The thought of harming myself has occurred to me.
 3 Yes, quite often
 2 Sometimes
 1 Hardly ever
 0 Never

Mood

40. **Before this pregnancy did you ever have a period of 2 weeks or more when you felt particularly miserable or depressed?**
 Yes No – go to question 41

If so, did being depressed:

a) Interfere with your ability to get things done or your relationships with family and friends?
 Circle one number: Not at all Somewhat Very much
 0 1 2 3 4 5

b) Lead you to seek professional help?
 Yes No

41. **Have you ever been told by a health professional you were depressed or needed antidepressants?**
 Yes No

42. **During this pregnancy have you been distressed by feelings of anxiety or depression for 2 weeks or more?**
 Yes No – go to question 43

If so, did this distress:

a) Interfere with your ability to get things done or your relationships with family and friends?
 Circle one number: Not at all Somewhat Very much
 0 1 2 3 4 5

b) Lead you to seek professional help?
 Yes No

43. **Before this pregnancy, have you ever had depression during pregnancy (antenatal depression) or after having a baby (postnatal depression)?**
 Yes No

44. **Has anyone in your family ever been told by a health professional that they have depression or another mental health problem?**
 Yes No
 If 'Yes' who was that:

45. **Has anyone in your family ever had antenatal or postnatal depression?**
 Yes No
 If 'Yes' who was that:

Pregnancy history

46. **How many times have you ever been pregnant, including this one?** times
 Comments welcome →

If this is your first pregnancy, please go to Question 50. If you have been pregnant more than once please answer the following:

47. **How many times have you given birth to a baby, alive or not, after at least 20 weeks of pregnancy?**
 Comments welcome →

48. **Have any of your previous babies had significant health problems which were identified in pregnancy or at birth?**
 Yes No Comments welcome →

49. **Have you had a caesarean section in the past?**
 Yes No

50. **Are you currently having any treatment or monitoring for any of these conditions?**
 Please tick one circle on every line.

High blood pressure (including hypertension, pre-eclampsia, toxemia, chronic hypertension)	Yes <input type="radio"/>	No <input type="radio"/>	Don't know/ can't remember <input type="radio"/>
Pregnancy or pre-existing diabetes (gestational diabetes managed using dietary control, with or without insulin)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low iron or anaemia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Abnormal vaginal bleeding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Placenta/whitena low down near the cervix (placenta praevia/low lying placenta)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

51. Are you currently having any treatment or monitoring for any other conditions such as:
If 'No' please go to question 52

Other medical problem(s) – please specify (e.g. thyroid problem, severe back problem, severe carpal tunnel syndrome, any other medical condition):

Mental health problem(s) – please specify (e.g. depression, bipolar disorder, schizophrenia, or other mental health condition):

A diagnosed sleep disorder – please specify:

52. Please list any medicines you are currently taking.

Life events

53. This question is about things that may have happened during the last 12 months.
Tick all that apply to you - if none of these apply please go to question 54

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

54. Do you describe yourself as: *Please tick the circle that applies to you*

- regular smoker (I smoke one or more cigarettes per day)
- occasional smoker (I do not smoke every day)
- ex-smoker (I used to smoke but not any more)
- non-smoker (I have never smoked regularly)

55. During this pregnancy how often do you drink alcohol? *Please tick the circle that applies to you*

- Never
- 1. Less than once a week
- 2. Once every 3-7 days
- 3. Once every 2 days
- 4. Daily

56. On a typical drinking occasion (in this pregnancy), how many drinks do you have? (One drink equals a glass of beer or a glass of wine or a nip of spirits)? *Please tick the circle that applies to you*

- 0. None
- 1. Less than 2 drinks
- 2. 2 to 4 drinks
- 3. 5 to 6 drinks
- 4. More than 6 drinks

57. During this pregnancy how often do you use street or recreational drugs, including party pills?
Please tick the circle that applies to you

- 0. Never
- 1. Less than once a week
- 2. Once every 3 to 7 days
- 3. Once every 2 day
- 4. Daily

58. Date questionnaire completed / /
 (day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

A \$20 voucher, from the choice of three options, below will be posted to you when we receive this completed questionnaire. Please ensure you advise us if your address changes.

Please indicate the type of voucher you would prefer (tick one):

Petrol Supermarket Department Store
 (MTR) (New World) (Farmers)

Return questionnaire to Sleep/Make Research Centre, Massey University, PO Box 756, Wellington 6140.

Important note

If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Lead Maternity Carer, doctor or other health professional.

APPENDIX 4 POSTNATAL SLEEP AND HEALTH QUESTIONNAIRE, E MOE MĀMĀ STUDY

ID: _____

Postnatal Sleep and Health

PLEASE COMPLETE THIS QUESTIONNAIRE WHEN YOUR BABY IS 12 WEEKS OLD

- What is your date of birth? / /
(day) (month) (year)
- When was your baby born? / /
(day) (month) (year)
- Please write your NHI number here:
(This is your National Health Index number – your midwife or doctor will have this).
[] []
- Which ethnic group do you belong to? Mark the space or spaces which apply to you.
 New Zealand European Cook Island Māori Chinese
 Māori Tongan Indian
 Samoan Niuean Other such as DUTCH, JAPANESE, TOKELAUAN. Please state:
- Which ethnic group does your baby belong to? Mark the space or spaces which apply to you.
 New Zealand European Cook Island Māori Chinese
 Māori Tongan Indian
 Samoan Niuean Other such as DUTCH, JAPANESE, TOKELAUAN. Please state:
- Where do you usually live?
 Street number..... Flat Number.....
 Street name.....
 Suburb or rural locality..... Post Code.....
 City, town or district.....
 Telephone number..... Cellphone number.....
- In the last 12 months what was your households total income, before tax or anything else was taken out of it?
 1 Loss
 2 Zero income
 3 \$1 - \$5,000
 4 \$5,001 - \$10,000
 5 \$10,001 - \$15,000
 6 \$15,001 - \$20,000
 7 \$20,001 - \$25,000
 8 \$25,001 - \$30,000
 9 \$30,001 - \$35,000
 10 \$35,001 - \$40,000
 11 \$40,001 - \$45,000
 12 \$45,001 - \$50,000
 13 \$50,001 - \$70,000
 14 \$70,001 - \$100,000
 15 \$100,001 - \$150,000
 16 \$150,001 or more
 17 I don't know

Please go to next page 1

Postnatal Sleep Questionnaire V6 18/10/09

Paid Work (These questions refer to your work in the last month)

8. Do you currently work for pay, profit or income?
 1 Yes, one paid job 2 Yes, more than one paid job
 0 No *Comments welcome →*

If you answered 'No' please go to question 12, if 'Yes' go to question 9.

9. On average, how many HOURS A WEEK did you work for pay, profit or income? Just think about the LAST MONTH.
 Please write how many hours a week here → hours a week

10. In the LAST MONTH did you work for pay, profit or income for at least 3 hours between midnight and 5am?
 1 Yes 0 No (please go to question 12)

11. In the LAST MONTH what is the total number of nights that you worked for at least 3 hours between midnight and 5am? Please write how many nights here →

12. If you are NOT currently working for pay, profit or income, are you taking paid parental leave?
 1 Yes 0 No

13. Return to work
 1 I have no plans to return to work
 2 I plan to return to work but have no date in mind
 3 I expect to be back at work when my baby is (write baby's age)

Please go to next page 2

Postnatal Sleep Questionnaire V6 18/10/09

Support & dependents

14. How many people normally live in your home?.....

15. How many of these people need looking after by you (not counting you)?
 What are their ages?

16. **Support for you at home**
 Do you live with anyone you can count on to help you with:
 Financial support
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No
 Emotional support (e.g. someone who listens or is 'there' for you)
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No
 Advice (e.g. can give information or guidance about baby care and parenting)
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No
 Concrete/Practical support (e.g. baby care, housework, cooking)
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No

17. **Support for you – outside of home**
 Are there other people, not living with you, who you can count on to help with;
 Financial support
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No
 Emotional support (e.g. someone who listens or is 'there' for you)
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No
 Advice (e.g. can give information or guidance about baby care and parenting)
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No
 Concrete/Practical support (e.g. baby care, housework, cooking)
 If YES, who? (e.g. partner, friend, parent) 1 Yes 0 No

18. **If you have a partner do they currently work for pay, profit or income?**
 1 Yes 0 No **OR** 2 Not applicable
If "Yes", have they been able to take time off work to be with you and the baby?
 1 Yes - how much time?
 0 No

Having a baby can affect how we feel about relationships. We are interested to know how you feel about your relationships with your partner right now. We understand that this may not be how you usually feel. If you do not have a partner please go to Question 20.

19. If you have a partner, how is your relationship with them at the moment?
 Please circle one number

Perfectly Happy	0	1	2	3	4	5	6	7
Extremely Unhappy								

OR 8 Not applicable

20. How often is a motor vehicle (not counting motorbikes) available for your use?
 Circle the number of days a week

NO DAYS	0	1	2	3	4	5	6	7
EVERY DAY								

Birth

21. How old is your baby now?weeks

22. How many weeks pregnant were you when your baby was born?weeks

23. At what time was your baby born?pm / am (please write the time and circle pm or am)

24. What was your baby's birth weight?grams orpounds/ounces

25. What was your baby's length at birth?cm

26. What was your weight when your baby was born?
kgs **OR**stoneslbs Don't know

27. If you experienced labour, how long was it for – from the time you started to experience regular contractions?hours

28. Where was your baby born? (e.g. at home, or name of maternity unit/hospital)

Is this where you planned to give birth? 1 Yes 0 No
 If 'No', where did you plan to give birth? (e.g. at home, or name of maternity unit/hospital)

29. How was your baby born? Tick all that apply

Induced (you had an "induction")

Vaginally

With the help of forceps or ventouse (vacuum)

A planned caesarean (you were expecting to have a caesarean that day)

An emergency, but pre-planned caesarean (you were expecting to have a caesarean on another day)

An unexpected or emergency caesarean (you weren't expecting to have a caesarean)

30. Overall, how was your experience of labour and birth? Please circle one number

0	1	2	3	4	5
	Great	Challenging		Terrible, never again	
	Better than I thought	but manageable		Much worse than I thought	

Comments welcome:

Anaesthesia

31. Did you have an epidural (injection in the back) during labour?

No Yes *Comments welcome:*

32. Did you have a general anaesthetic for the birth? (You were given medicine to make you go to sleep for the birth – sometimes this happens for a caesarean section).

No Yes *Comments welcome:*

If "yes" – was this planned: No Yes

33. Were there any complications during the birth?

No Yes *Comments welcome:*

34. Did you bleed excessively at, or after birth?

No Yes

35. Did you require a blood transfusion during or after birth?

No Yes

36. If you gave birth in hospital, how long did you stay there after your baby was born?

.....hours **OR**nights

37. Did your baby have any illness in the first week of life that required assessment by a paediatrician or admission to the neonatal or special care baby unit?

No Yes *Comments welcome:*

38. Was your baby born with any congenital abnormalities that required assessment by a paediatrician or admission to the neonatal or special care baby unit?

No Yes *Comments welcome:*

39. Did you feel you knew enough about what was going on during your birth experience?

0	1	2	3	4	5
Not at all					Very much

40. Did you feel listened to during your labour and birth experience?

0	1	2	3	4	5
Not at all					Very much

Feeding your baby

41. How would you describe feeding your baby to start with?
 Please circle one number
 0 Easy - no problems
 1
 2
 3
 4 Very difficult - lots of problems
 5
 Comments welcome:

42. If feeding was difficult at the start, how long was it difficult for? weeks

43. What was your baby's source of milk in the last 48 hours?
 1 Baby has received breast milk only, in the last 48 hours
 2 Baby has received some breast milk and some formula in the last 48 hours
 3 Baby has received only infant formula in the last 48 hours
 4 Other, in the last 48 hours - please describe →

44. Has your baby only ever received breast milk (no water, formula or other foods)?
 1 Yes
 0 No

45. Is this how you hoped to be feeding your baby?
 1 Yes
 0 No
 2 Don't know
 Comments welcome:

46. How is feeding going now? Please circle
 0 Easy - no problems
 1
 2
 3
 4 Very difficult - lots of problems
 5
 Comments welcome:

47. Are you the only one who feeds your baby? 1 Yes 0 No
 If "No", on how many days a week does someone else feed your baby?
 Circle the number of days a week
 1 2 3 4 5 6 7
 Once a week Daily

48. How many times has your baby fed in the last 24 hours?
 Please circle one number
 1 2 3 4 5 6 7 8 9 10
 or more

49. How many times did you wake up last night to feed your baby?
 Please circle one number
 0 1 2 3 4 5
 or more

50. How many times did you wake up for your baby last night for another reason?
 Please circle one number
 0 1 2 3 4 5
 or more

51. How often do you have help at night with baby care, if you want it?
 Please circle one number
 NO NIGHTS 0 1 2 3 4 5 6 7
 EVERY NIGHT

OR I could have help at night but I don't need it 8 0

Sleep – since you have had your baby

52. How many hours sleep, including naps, do you usually get in 24 hours?
 (Just think about the last week)
 Please write the number of hours here hours

53. In the last week, how often did you get a good night's sleep?
 Circle the number of days
 NO NIGHTS 0 1 2 3 4 5 6 7
 EVERY NIGHT

54. How long on average, per day, do you spend outside (really outside) exposed to daylight?
 hours minutes

55. On how many nights in the last week did the following things disturb your sleep?
Please circle one number in every row.

	NO NIGHTS	1	2	3	4	5	6	7
Going to the bathroom.....	0	1	2	3	4	5	6	7
Pain in back/neck/joints.....	0	1	2	3	4	5	6	7
Dreams.....	0	1	2	3	4	5	6	7
Nightmares.....	0	1	2	3	4	5	6	7
Heartburn.....	0	1	2	3	4	5	6	7
Nasal congestion (blocked nose).....	0	1	2	3	4	5	6	7
Leg cramps.....	0	1	2	3	4	5	6	7
Feeling too hot or cold.....	0	1	2	3	4	5	6	7
Thinking or worrying about things.....	0	1	2	3	4	5	6	7
Just can't get comfortable.....	0	1	2	3	4	5	6	7
Feeding baby.....	0	1	2	3	4	5	6	7
Breast leaking or uncomfortable.....	0	1	2	3	4	5	6	7
Other baby care.....	0	1	2	3	4	5	6	7
Other children.....	0	1	2	3	4	5	6	7
Disturbed by partner (e.g. snoring).....	0	1	2	3	4	5	6	7
Other.....	0	1	2	3	4	5	6	7

56. During sleep in the LAST WEEK, has anyone told you that you did any of the following? Please circle how often.

	NO NIGHTS	1	2	3	4	5	6	7
Loud snoring.....	0	1	2	3	4	5	6	7
Long pauses between breaths while asleep.....	0	1	2	3	4	5	6	7
Legs twitching or jerking while you sleep.....	0	1	2	3	4	5	6	7

57. Do you ever experience an urge to move your legs (usually accompanied by unpleasant sensations)?
 1 Yes 0 No – If "No" please go to question 59

58. If you answered "Yes" in Question 57, is this: Tick all that apply to you

<input type="radio"/> 1 worse at night?	
<input type="radio"/> 2 more noticeable when you rest?	
<input type="radio"/> 3 relieved by movement?	

59. How often in the last week did you:
Please circle one number in every row.

	NO NIGHTS	1	2	3	4	5	6	7
Have difficulty getting to sleep.....	0	1	2	3	4	5	6	7
Wake up during your sleep period.....	0	1	2	3	4	5	6	7
Wake up too early at the end of a sleep period.....	0	1	2	3	4	5	6	7
Feel rested upon awakening at the end of a sleep period.....	0	1	2	3	4	5	6	7
Sleep poorly.....	0	1	2	3	4	5	6	7
Feel sleepy during the day.....	0	1	2	3	4	5	6	7
Struggle to stay awake during the day.....	0	1	2	3	4	5	6	7
Feel irritable during the day.....	0	1	2	3	4	5	6	7
Feel tired or fatigued during the day.....	0	1	2	3	4	5	6	7
Feel satisfied with the quality of your sleep.....	0	1	2	3	4	5	6	7
Feel alert and energetic during the day.....	0	1	2	3	4	5	6	7
Get too much sleep.....	0	1	2	3	4	5	6	7
Get too little sleep.....	0	1	2	3	4	5	6	7
Take a nap at a scheduled time.....	0	1	2	3	4	5	6	7
Fall asleep at an unscheduled time.....	0	1	2	3	4	5	6	7
Use a prescription sleeping pill to help you get to sleep.....	0	1	2	3	4	5	6	7
Use any pain medication to help you get to sleep (e.g. Paracetamol).....	0	1	2	3	4	5	6	7
Take anything else to help you sleep.....	0	1	2	3	4	5	6	7
If so, what did you take to help you sleep.....								

60. How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times.

PLEASE TICK ONE CIRCLE ON EACH LINE

	would never doze	slight chance	moderate chance	high chance
Sitting and reading.....	0	1	2	3
Watching TV.....	0	1	2	3
Sitting inactive in a public place (e.g. movies, meeting).....	0	1	2	3
As a passenger in a car for an hour without a break.....	0	1	2	3
Lying down in the afternoon when circumstances permit.....	0	1	2	3
Sitting and talking to someone.....	0	1	2	3
Sitting quietly after a lunch without alcohol.....	0	1	2	3
In a car, while stopped for a few minutes in traffic.....	0	1	2	3

PLEASE MAKE SURE YOU HAVE TICKED ONE BOX ON EACH LINE

General health and well-being

61. Are you currently having any treatment or monitoring for any of these conditions?
Please tick one circle on every line.

	Yes	No	Don't know/ can't remember
High blood pressure (hypertension)	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2
Pain as a result of the birth	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2
Breast infection (mastitis)	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2
Low iron or anaemia	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2
Birth related infection	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2
Urinary incontinence	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2
Faecal incontinence	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2

62. Are you currently having any treatment or monitoring for any other conditions such as:
if No, please go to question 63

Other medical problem(s) – please specify (e.g. diabetes, severe back problem, another medical condition):

Mental health problem(s) – please specify (e.g. depression or other mental health condition):

Diagnosed sleep disorder – please specify:

63. Please list any medicines you are currently taking.

64. During this most recent pregnancy were you distressed by feelings of anxiety or depression for 2 weeks or more?

1 Yes 0 No – go to question 65

If so, did this distress:

a) Interfere with your ability to get things done or your relationships with family and friends?
Please circle one number

0	1	2	3	4	5
Not at all		somewhat		very much	

b) Lead you to seek professional help?
 1 Yes 0 No

Please go to next page **11**

65. In the first week after your baby was born did you experience times of unexplained tears, feeling very up and then very down or feeling like you were on an emotional roller-coaster – sometimes called the “baby blues”?

1 Yes 0 No – go to question 66

If “Yes”, how long did these feelings last? Please circle one number

0	1	2	3
Less than than a day	One to two days	Three days to a week	More than a week

Life events

66. This question is about things that may have happened during the last 12 months.
Tick all that apply to you - If none of these apply, please go to question 67

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

Feelings since you have had your baby

67. Please tick the answer which comes closest to how you have felt IN THE LAST 7 DAYS, not just how you feel today.

I have been able to laugh and see the funny side of things:

- 0 As much as I always could
- 1 Not quite so much now
- 2 Definitely not so much now
- 3 Not at all

I have looked forward with enjoyment to things:

- 0 As much as I ever did
- 1 Rather less than I used to
- 2 Definitely less than I used to
- 3 Hardly at all

Please go to next page **12**

68. The following are statements about worrying. Please read each statement and indicate how true each one is in describing your general/usual experience of worrying.
Please tick the one option that most likely applies to you for each statement

When I worry, it interferes with my day-to-day functioning (e.g. stops me getting my work done, organising myself or my activities).
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

When I think I should be finished worrying about something, I find myself worrying about the same thing, over and over.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

My worrying leads me to feel down and depressed.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true


When I worry, it interferes with my ability to make decisions or solve problems.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

I feel tense and anxious when I worry.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

I worry that bad things or events are certain to happen.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

I often worry about not being able to stop myself from worrying.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

As a consequence of my worrying, I tend to feel emotional unease or discomfort.
 0 Not true at all 1 Somewhat true 2 Moderately true 3 Definitely true

Please go to next page  **14**

Postnatal Sleep Questionnaire V6 18/10/09

I have blamed myself unnecessarily when things went wrong.
 3 Yes, most of the time
 2 Yes, some of the time
 1 Not very often
 0 No, never

I have been anxious or worried for no good reason.
 0 No, not at all
 1 Hardly ever
 2 Yes, sometimes
 3 Yes, very often

I have felt scared or panicky for no very good reason.
 3 Yes, quite a lot
 2 Yes, sometimes
 1 No, not much
 0 No, not at all

Things have been getting on top of me.
 3 Yes, most of the time I haven't been able to cope at all
 2 Yes, sometimes I haven't been coping as well as usual
 1 No, most of the time I have coped quite well
 0 No, I have been coping as well as ever

I have been so unhappy that I have had difficulty sleeping.
 3 Yes, most of the time
 2 Yes, sometimes
 1 Not very often
 0 No, not at all

I have felt sad or miserable.
 3 Yes, most of the time
 2 Yes, quite often
 1 Not very often
 0 No, not at all

I have been so unhappy that I have been crying.
 3 Yes, most of the time
 2 Yes, quite often
 1 Only occasionally
 0 No, never

The thought of harming myself has occurred to me.
 3 Yes, quite often
 2 Sometimes
 1 Hardly ever
 0 Never

Please go to next page  **13**

Postnatal Sleep Questionnaire V6 18/10/09

Baby's health

74. Which of the following has your baby had during the LAST WEEK?
Tick all that apply (or go to question 75 if none apply)

Fever (high temperature) Runny nose or cold
 Diarrhoea Cough or wheeze
 Vomiting Chest infection
 Ear infection Asthma
 Colic Food allergy
 Fussy or irritable Eczema (atopic dermatitis)
 Reflux None of these

75. Did your baby receive any of the following medicines in the last 2 weeks?
(Please do not include vitamins or minerals).

Antibiotics Yes No

Other prescription medicine Yes No

If "Yes", please write the name of the medicine(s) here:

Non-prescription medicine Yes No

If "Yes", please write the name of the medicine(s) here:

76. Has your baby received immunisation injections in the last 48-hours?

Yes No

Baby's sleep in the last week

77. Where does your baby sleep most of the time during the DAY?

In his/her own room
 In parents' room
 In sibling or other's room
 In another room of the house
 With you or another person e.g. being held or in a sling
 Moving around with you e.g. in a pram or basket
 Other – please state where:

Your baby

69. In general how often does your baby cry?

0 Never 1 2 3 4 5 Very often

70. When your baby has been upset and you do things to try and calm him/her down (like rocking, walking, showing toys), how often does he/she take more than 10 minutes to calm down?

Please circle one number

Never	Very rarely	Less than half the time	About half the time	More than half the time	Always
1	2	3	4	5	6
					7

71. When being held, how often does your baby:

Pull away or kick?

Please circle one number

Never	Very rarely	Less than half the time	About half the time	More than half the time	Always
1	2	3	4	5	6
					7

Seem to enjoy him/herself?

Please circle one number

Never	Very rarely	Less than half the time	About half the time	More than half the time	Always
1	2	3	4	5	6
					7

72. When going to bed, how often does your baby settle within 10 minutes?

Please circle one number

Never	Very rarely	Less than half the time	About half the time	More than half the time	Always
1	2	3	4	5	6
					7

73. When your baby is upset about something, how often does s/he stay upset for 20 minutes or longer?

Please circle one number

Never	Very rarely	Less than half the time	About half the time	More than half the time	Always
1	2	3	4	5	6
					7

82. If you answered "Yes" to question 81, why did your baby move sleep location during the night? (Feel free to list more than one reason).

1 In his/her own room
 2 In parents' room
 3 In sibling or other's room
 4 In another room of the house
 5 Other – please state where:

83. How often does your baby go off to sleep with help from others? (e.g. being fed, rocked or cuddled)

Circle one number: 0 Never 1 Rarely 2 Often 3 Always

84. In general do you consider your child's sleep as a problem?

2 A very serious problem
 1 A small problem
 0 Not a problem at all

78. Where does your baby sleep most of the time at NIGHT?

1 In his/her own room
 2 In parents' room
 3 In sibling or other's room
 4 In another room of the house
 5 Other – please state where:

79. What does your baby sleep in most of the time during the DAY?

1 Bassinet
 2 Cot
 3 Parents' bed
 4 Infant seat
 5 Being held or in a sling/front pack
 6 In a pram or buggy
 7 Other – please state what:

80. What does your baby sleep in most of the time at NIGHT?

1 Bassinet
 2 Cot
 3 Parents' bed
 4 Infant seat
 5 In a pram or buggy
 6 Other – please state what:

85. How many times does your baby usually wake up between 10pm and 6am?

0 Not at all 1 2 3 4 or more times

86. What is the longest stretch of time that your baby is asleep during the night without waking up?

0 Less than 30 minutes 1 30 mins to 1 hour 2 1 to 2 hours 3 2 to 3 hours 4 3 to 4 hours 5 More than 4 hours

87. What is the longest stretch of time that your baby usually sleeps during the day?

0 Less than 30 minutes 1 30 mins to 1 hour 2 1 to 2 hours 3 2 to 3 hours 4 3 to 4 hours 5 More than 4 hours

88. How often do your baby's sleep patterns allow you to get a reasonable, total amount of sleep in 24 hours?

Circle the number of days

	NO DAYS	1	2	3	4	5	6	7
EVERY DAY	0	1	2	3	4	5	6	7

81. In the last week did your baby start their night sleep in one location, and then move to another location during the night? (For example, baby went to sleep in own cot, then moved to your bed and went to sleep again).

1 Yes 0 No – go to question 83

If "Yes", on how many nights did they change their sleep location?

Circle the number of nights: 1 2 3 4 5 6 7

89. How often do your baby's daytime sleep patterns allow you to have a break?

	NO	1	2	3	4	5	6	7
	DAYS							
		EVERY						
		DAY						

Circle the number of days

90. How much do your baby's sleep patterns change from day to day?

0	1	2	3
Always the same	Change occasionally	Change often	Everyday is different

91. Date questionnaire completed / /
 (day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

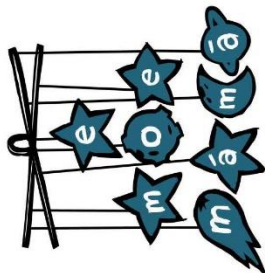
A \$20 voucher, from the choice of three options, below will be posted to you when we receive this completed questionnaire. Please ensure you advise us if your address has changed.

Please indicate the type of voucher you would prefer (tick one):

Petrol Supermarket Department store
 (MVA) (New World) (Farmers)

Important note

If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Lead Maternity Carer, doctor or other health professional.



E Moe, Māmā, Maternal Sleep and Health in Aotearoa/New Zealand

APPENDIX 5 SLEEP AND HEALTH QUESTIONNAIRE, MOE KURA STUDY

E Moa, Māori

Your Sleep and Health



5. *cont'd.*

Please fill this in between the following dates:

Please **tick one** option for questions with circles like this:

Please **tick as many options as apply** for questions with boxes like this:

1. What is your date of birth?

DD MM YY Y Y

About your sleep

2. How many hours sleep, including naps, do you usually get in 24 hours? (last think about the last week)

HOURS

3. In the last week, how often did you get a good night's sleep? (Please tick one option)

No nights: 0 1 2 3 4 5 6 7

Every night: 0 1 2 3 4 5 6 7

4. On how many days in the last week did you have a daytime nap? (Please tick one option)

No days: 0 1 2 3 4 5 6 7

Every day: 0 1 2 3 4 5 6 7

5. On days when you are scheduled to work, study, care for others or have other regular commitments:

a. I have to get up at: HH:MM AM/PM

b. To wake up I need: MINUTES

c. I regularly wake up: Before the alarm, With the alarm, Don't use an alarm

d. I am fully awake from: HH:MM AM/PM

e. I have an energy dip at: HH:MM AM/PM

f. On nights before scheduled (e.g. work) days, I go to bed at: HH:MM AM/PM

6. *cont'd.*

g. To fall asleep when I go to bed takes me: MINUTES

h. If I get the chance, I like to take a nap: Yes No

i. If yes, I like to nap at: HH:MM AM/PM

for: MINUTES

Imagine having free days (days when you are not scheduled to work, study, care for others or have no other regular commitments). On free days:

a. Ideally, I would sleep in until: HH:MM AM/PM

b. I normally wake up at: HH:MM AM/PM

c. If I wake up at around the normal (scheduled/work day) alarm time, I try to get back to sleep: Yes No

d. If I get back to sleep, I sleep for another: MINUTES

e. I am fully awake from: HH:MM AM/PM

6. *cont'd.*

f. I have an energy dip at around: HH:MM AM/PM

g. On nights before free days, I go to bed at: HH:MM AM/PM

h. To fall asleep when I go to bed takes me: MINUTES

i. If I get the chance, I like to take a nap: Yes No

j. If yes, I like to nap at: HH:MM AM/PM

for: MINUTES

7. Do you usually watch TV or read in bed before falling asleep? Yes No

If you answered 'No' please continue to question 8.

If 'Yes', once I am in bed, I would like to watch TV or read for: MINUTES

but I normally fall asleep after a maximum of: MINUTES

E-Note, M-Print

Your Sleep and Health



8. Do you prefer to sleep in a completely dark room?
 Yes No
9. Do you wake up more easily when morning light shines into your room?
 Yes No

10. How long on average per day do you spend outside (really outside) exposed to daylight?
 a: On scheduled days
 HOURS & MINUTES
- b: On free days:
 HOURS & MINUTES

11. Are you an early type (morning) person or a late type (evening) person?

Early type people like getting up early in the morning but have trouble staying up late. Late type people like staying up late but find it hard to get up in the morning.

(Please tick one option on each line)

	Extreme early type	Moderate early type	Slight early type	Neither type	Slight late type	Moderate late type	Extreme late type
At present, I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As a child, I was	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As a teenager, I was	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My mother is/was	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My father is/was	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My partner* is/was	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(* boyfriend, girlfriend, spouse, significant other)

E-Note, M-Print

Your Sleep and Health



12. Are you satisfied with the amount, quality, and timing of your sleep?
 Yes No
- Please go to question 13 if 'No', would you like to: (Please tick any that apply)
- sleep more go to sleep later
 sleep less get up earlier
 have more refreshing sleep get up later
 go to sleep earlier

13. Thinking about your sleep and sleep habits within the past month, how often have you done the following in the hour before you went to bed?

	Every night or almost every night	A few nights a week	A few nights a month	Rarely	Never	Not applicable
Did work relating to your job or study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watched TV/movie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listened to the radio or music	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Were on the computer or internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read a book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Had sex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exercised	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did activities with children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did activities with family/friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drank a caffeinated beverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drank an alcoholic beverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Took a hot bath or shower	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Completed household chores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

E Moa, Māmiā

Your Sleep and Health



14. Do you have the following technology in your bedroom?
(Please tick as many boxes as apply)

- TV/computer/laptop/ DVD player
- Smartphone
- Cellphone (not a smartphone)/pager/Blackberry
- Gaming console
- Radio or other music **only** player (e.g. MP3 player)
- e-reader **with** a bright screen (e.g. Kobo, iPad, other tablets)
- e-reader **without** a bright screen (e.g. non-backlit Kindle)
- Other technology (Please specify)

PLEASE SPECIFY

None

15. How frequently do you do the following in the **hour before** going to sleep?

	Every night or almost every night	A few nights a week	A few nights a month	Rarely	Never
Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listen to radio or music (e.g. using radio, CD or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surf internet or use social media (e.g. Facebook/Texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other activities using technology (Please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

PLEASE SPECIFY

E Moa, Māmiā

Your Sleep and Health



16. How frequently do you do the following to help **fall asleep**?

	Every night or almost every night	A few nights a week	A few nights a month	Rarely	Never
Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listen to radio or music (e.g. using radio, CD or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surf internet or use social media (e.g. Facebook/Texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other activities using technology (Please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

PLEASE SPECIFY

17.

Most nights, do you sleep...
(Please tick as many options as you like)

- Alone
- With your partner/significant other
- With an infant (child under 1 year)
- With your "E Moa, Māmiā" child
- With other children
- With a pet
- Or with someone or something else? (Please specify)

PLEASE SPECIFY

E Moes, Māhina

Your Sleep and Health



18.

How often in the **last week** did you:
(Please circle one number in every row)

	No days/ no nights	1	2	3	4	5	6	7
Have difficulty getting to sleep	0	1	2	3	4	5	6	7
Wake up during your sleep period	0	1	2	3	4	5	6	7
Wake up too early at the end of a sleep period	0	1	2	3	4	5	6	7
Feel rested upon awakening at the end of a sleep period	0	1	2	3	4	5	6	7
Sleep poorly	0	1	2	3	4	5	6	7
Feel sleepy during the day	0	1	2	3	4	5	6	7
Struggle to stay awake during the day	0	1	2	3	4	5	6	7
Feel irritable during the day	0	1	2	3	4	5	6	7
Feel tired or fatigued during the day	0	1	2	3	4	5	6	7
Feel satisfied with the quality of your sleep	0	1	2	3	4	5	6	7
Feel alert and energetic during the day	0	1	2	3	4	5	6	7
Get too much sleep	0	1	2	3	4	5	6	7
Get too little sleep	0	1	2	3	4	5	6	7
Take a nap at a scheduled time	0	1	2	3	4	5	6	7
Fall asleep at an unscheduled time	0	1	2	3	4	5	6	7
Drink an alcoholic beverage to help you get to sleep	0	1	2	3	4	5	6	7
Use tobacco to help you get to sleep	0	1	2	3	4	5	6	7
Use a herbal product to help you get to sleep	0	1	2	3	4	5	6	7
Use an over-the-counter sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
Use a prescription sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
Use any pain medication to help you get to sleep (e.g. Panadol)	0	1	2	3	4	5	6	7
Take anything else to help you sleep (please specify)	0	1	2	3	4	5	6	7

PLEASE SPECIFY

7

E Moes, Māhina

Your Sleep and Health



19.

In the **last week** what, if anything, woke you up during the night?
(Please tick as many options as you like)

- Noise
- Light
- Stress
- Too hot or too cold
- Pain/discomfort
- Pain/discomfort associated with current pregnancy
- Nightmares
- The need to go to the bathroom
- Wake up for no apparent reason
- Heartburn
- Giving care to child
- Giving care to elderly parent
- Giving care to someone else
- Spouse/bed partner
- Hungry/thirsty
- Medication side effects
- Pets
- Text messages or alerts from phone or other electronic device (not pre-set alarms)
- Can't breathe comfortably
- Worrying or thinking about your "E Moes, Māhina" child's behaviour
- Worrying or thinking about another child's behaviour
- Worrying or thinking about a disabled or ill family member (adult or child)
- Worrying or thinking about current housing difficulties
- Worrying or thinking about money/finance problems
- Worrying or thinking about world or current events
- Worrying or thinking about balancing work and family
- Worrying or thinking about family members not getting on
- Worrying or thinking about who does household chores
- Something else (please specify)
- Nothing awakens me at night
- Don't know

8

Your Sleep and Health



20. During sleep in the **last week**, has anyone told you that you did any of the following? Please circle how often. (Please circle one number in every row)

	No	1	2	3	4	5	6	7
Loud snoring	0	1	2	3	4	5	6	7
Long pauses between breaths while asleep	0	1	2	3	4	5	6	7
Legs twitching or jerking while you sleep	0	1	2	3	4	5	6	7

21. In the **last week**, have you experienced an urge to move your legs (usually accompanied by unpleasant sensations)?

Yes No

If you answered 'No', please go to question 23.

22. If you answered 'Yes' in question 21, is this: (tick all that apply to you)

Worse at night?

More noticeable when you rest?

Relieved by movement?

23. Do you consider that you have a sleep problem?

No (Please go to question 30)

Yes, lasting less than 4 weeks

Yes, for 1-6 months

Yes, for more than 6 months

COMMENTS WELCOME

24. Please rate the **current (i.e. last 2 weeks) severity** of the following insomnia problem(s): (Please circle one number in every row)

	None	Mild	Moderate	Severe	Very severe
Difficulty falling asleep	0	1	2	3	4
Difficulty staying asleep	0	1	2	3	4
Problem waking too early	0	1	2	3	4

25. How **satisfied/dissatisfied** are you with your **current** sleep pattern? (Please circle one)

	Very satisfied	Satisfied	Moderately satisfied	Dissatisfied	Very dissatisfied
	0	1	2	3	4

E How, Mfmd



26. How **noticeable** to others do you think your sleeping problem is in terms of impairing your quality of life? (Please circle one)

	Not at all noticeable	A little	Somewhat	Much	Very much noticeable
	0	1	2	3	4

27. How **worried/distressed** are you about your current sleep problem? (Please circle one)

	Not at all worried	A little	Somewhat	Much	Very much worried
	0	1	2	3	4

28. To what extent do you consider your sleep problem to **interfere** with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc) **currently**? (Please circle one)

	Not at all interfering	A little	Somewhat	Much	Very much interfering
	0	1	2	3	4

29. Does your sleep problem interfere with...

	Yes	No	Don't know	Not applicable
Your relationship with your child or children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your relationship with your spouse or partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Caring for your family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your relationship with your extended family or friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

30. Have you ever been told by a doctor or other health professional that you have a sleep disorder?

No (Please go to question 33)

Yes (Please go to question 31)

Don't know (Please go to question 33)

31. What was the sleep disorder?

Obstructive Sleep Apnea

Insomnia

Restless legs

Other (Please specify)

PLEASE SPECIFY

Don't know

E Moes, Mämiid

Your Sleep and Health



32. What treatments do you now have for your sleep disorder(s)?
(Please tick as many boxes as apply)
- No treatment
 - Medicines, tablets or pills
 - Diet
 - Exercise
 - Other (please specify)
 - Don't know

33. How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? (This refers to your usual way of life, in recent times)
(Please tick one circle on each line)

	Would never doze	Slight chance	Moderate chance	High chance
Sitting and reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watching TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sitting inactive in a public place (e.g. movies, meeting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As a passenger in a car for an hour without a break	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lying down in the afternoon when circumstances permit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sitting and talking to someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sitting quietly after a lunch without alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In a car, while stopped for a few minutes in traffic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

34. Thinking about your typical day, what are you unable to do because you are too sleepy? Are you too sleepy to: (Please tick one circle on each line)

	Yes, too sleepy	No	Don't know
Do job-related work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spend time with family or friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have sex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

E Moes, Mämiid

Your Sleep and Health



34. *cont.* b. Thinking about your typical day, what are you unable to do because you run out of time? Do you wish you had more time to: (Please tick one circle on each line)

	Yes, run out of time	No	Don't know
Do job-related work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spend time with family or friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have sex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

35. How frequently does the sleep of your "E Moes, Mämiid" child affect...
(Please circle one number in every row)

	No nights/days							
	0	1	2	3	4	5	6	7
Your bed time?	0	1	2	3	4	5	6	7
Your get-up time?	0	1	2	3	4	5	6	7
The number of times you wake at night?	0	1	2	3	4	5	6	7
The amount of sleep you get at night?	0	1	2	3	4	5	6	7
How sleepy you are during the day?	0	1	2	3	4	5	6	7
Your ability to do things during the day?	0	1	2	3	4	5	6	7

36. If you have other children, how much does their sleep affect...
(Please circle one number in every row)

	No nights/days							
	0	1	2	3	4	5	6	7
Your bed time?	0	1	2	3	4	5	6	7
Your get-up time?	0	1	2	3	4	5	6	7
The number of times you wake at night?	0	1	2	3	4	5	6	7
The amount of sleep you get at night?	0	1	2	3	4	5	6	7
How sleepy you are during the day?	0	1	2	3	4	5	6	7
Your ability to do things during the day?	0	1	2	3	4	5	6	7

Your Sleep and Health



37. In the past year, how often have you driven a car or motor vehicle while feeling drowsy? Would you say you have driven drowsy...
- 3 or more times a week
 - 1 to 2 times a week
 - 1 to 2 times a month
 - Less than once a month
 - Never
 - Don't drive/Don't have a license/Don't have a car
 - Don't know

Where you live and who you live with:

38. Where do you usually live?

NUMBER & STREET NAME	
SUBURB OR RURAL DELIVERY NO.	
CITY, TOWN OR DISTRICT	
POSTCODE	
CODE	TELEPHONE NUMBER
CODE	CELLPHONE NUMBER

39. Thinking back over the past five years, how many times has your family moved house? (Please tick one option)
- Have not moved house in the past 5 years
 - Once
 - Twice
 - Three times
 - Four times
 - Five or more times
 - Don't know

Your Sleep and Health



40. Who normally lives in your household?

Person	Age (Years)	Sex (M/F)	Their relationship to you (e.g. partner, friend, flatmate, parent, grandparent, brother, sister, auntie, uncle, cousin, your child, step-child, another person's child)	Nights per week they normally live there (1-7)	Are you required to care for them? (Y/N)
Me		F	Not applicable		Not applicable
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Support

41. If you have a partner, how is your relationship with them at the moment?

(Please circle one number)

0	1	2	3	4	5	6	7	OR	not applicable
Perfectly happy							Extremely unhappy		

42. Do you have the following types of support?

(Please tick one circle in each line)

	I don't need any support	I would like some more support	I have enough support
Financial support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emotional support (e.g. someone who listens or is there for you)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advice (e.g. someone you can go to for information or guidance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concrete/Practical support (e.g. childcare, housework, cooking)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

E Heca, Māhira

Your Sleep and Health



Income

43. Are you, yourself currently receiving any of these types of income support?

(Mark the space or spaces which apply to you)

- Working for Families (Family Support, in Work Payment, Family Tax Credit)
- Unemployment benefit
- Domestic purposes benefit
- Sickness benefit
- Invalid's benefit
- Student allowance
- Disability allowance
- ACC (as income support, not reimbursement for health services)
- Other government benefits (independent youth benefit, war pension, etc)
- None of the above
- Don't know

44. What is the total income that you yourself got from all sources, before tax or anything was taken out of it, in the last 12 months?

- Loss
- Zero income
- \$1 - \$5,000
- \$5,001 - \$10,000
- \$10,001 - \$15,000
- \$15,001 - \$20,000
- \$20,001 - \$25,000
- \$25,001 - \$30,000
- \$30,001 - \$35,000
- \$35,001 - \$40,000
- \$40,001 - \$50,000

continues...

E Heca, Māhira

Your Sleep and Health



46. The following few questions are designed to identify people who have had special financial needs in the last 12 months. These questions may not apply directly to you, but for consistency we need to ask them of everyone. For each we just require a 'Yes' or 'No' response.

a. In the last 12 months, did you yourself get income from any of the following sources: Domestic Purposes Benefit, Independent Youth Benefit, Sickness Benefit, Invalids Benefit?

- Yes No

b. In the last 12 months have you personally been forced to buy cheaper food so that you could pay for other things you needed?

- Yes No

c. In the last 12 months, have you been out of paid work at any time for more than one month?

- Yes No

If you answered 'No' to question 46c, please go to question 46e.

d. If you answered 'Yes' in question 46c, was this due to being a full-time care-giver and/or home maker?

- Yes No

e. In the last 12 months have you personally put up with feeling cold to save heating costs?

- Yes No

f. In the last 12 months have you personally made use of special food grants or food banks because you did not have enough money for food?

- Yes No

g. In the last 12 months have you personally continued wearing shoes with holes because you could not afford replacement?

- Yes No

h. In the last 12 months have you personally gone without fresh fruit and vegetables, often, so that you could pay for other things you needed?

- Yes No

i. In the last 12 months have you personally received help in the form of clothes or money from a community organisation (like the Salvation Army)?

- Yes No

Education

47. What is your highest secondary school qualification?

- None
- NZ School Certificate in one or more subjects or National Certificate Level 1 or NCEA Level 1
- NZ Sixth Form Certificate in one or more subjects or National Certificate Level 2 or NZ UE before 1986 in one or more subjects or NCEA Level 2
- NZ Higher School Certificate or Higher Leaving Certificate or NZ University Entrance
- Bursary/Scholarship or National Certificate Level 3 or NCEA Level 3 or NZ Scholarship Level 4
- Other secondary school qualification gained in NZ (Please specify)

- Other secondary school qualification gained overseas

Your Sleep and Health



48. Apart from secondary school qualifications, do you have another completed qualification?
(Please do not count incomplete qualifications. Please do not include any part-time study or part-time study to get. Please tell us your highest qualification)
- No qualification beyond secondary school
 - Bachelors degree, for example, BA, BSc
 - Bachelors degree with honours
 - Masters degree, for example, MA, MSc
 - PhD
 - Diploma (not post-graduate)
 - Diploma – Postgraduate
 - Trade or technical certificate which took more than 3 months full-time study
 - Professional qualification, for example, ACA, teachers, nurses
 - Other *(Please specify)*
- PLEASE SPECIFY
49. Are you attending, studying or enrolled at school or anywhere else?
- Full-time (20 hours or more a week)
 - Part-time (less than 20 hours a week)
 - Neither of these

Your Sleep and Health



54. If you are **not** currently working for pay, profit or income, are you at home to care for a child?
- Yes, and I have no plans to return to work
 - Yes, and I plan to return to work but have no date in mind
 - Yes, I expect to be back at work by
- D D M M Y Y Y Y
- No (please go to question 55)
- Ethnicity**
55. Which ethnic group do you belong to?
(Mark the space or spaces which apply to you)
- New Zealand European
 - Māori
 - Samoan
 - Cook Island Māori
 - Tongan
 - Niuean
 - Chinese
 - Indian
 - Other such as DUTCH, JAPANESE, TOKELAUAN. Please state:
- PLEASE SPECIFY

56. Have you ever been a victim of an **ethnically motivated attack** (verbal or physical abuse to the person or property) in New Zealand?
(Mark the space or spaces which apply to you)
- Yes, verbal - within the past 12 months
 - Yes, verbal - more than 12 months ago
 - Yes, physical - within the past 12 months
 - Yes, physical - more than 12 months ago
 - No
 - Don't know/unsure
57. Have you ever been treated unfairly (for example, kept waiting or treated differently) by a health professional (that is, a doctor, nurse, dentist etc) **because of your ethnicity** in New Zealand?
(Mark the space or spaces which apply to you)
- Yes, within the past 12 months
 - Yes, more than 12 months ago
 - No
 - Don't know/unsure
58. Have you ever been treated unfairly at work or been refused a job **because of your ethnicity** in New Zealand?
(Mark the space or spaces which apply to you)
- Yes, within the past 12 months
 - Yes, more than 12 months ago
 - No
 - Don't know/unsure

E Moe, Māori

Your Sleep and Health



59. Have you ever been treated unfairly when renting or buying housing **because of your ethnicity** in New Zealand?
(Mark the space or spaces which apply to you)

Yes, within the past 12 months
 Yes, more than 12 months ago
 No
 Don't know/unsure

60. Over the past 12 months, how often have you felt emotionally upset (e.g. angry, sad or frustrated) as a result of **how people of your ethnicity were portrayed in the media** (e.g. newspapers, radio, television, movies)?

Never
 Once or twice in the past year
 Most months
 Most weeks
 Most days

General health and wellbeing

61. What is your weight?

WEIGHT IN KGS
 OR
 WEIGHT IN STONE/LBS
 OR
 Don't know

62. What is your height?

HEIGHT IN CENTIMETRES
 OR
 HEIGHT IN FEET/INCHES
 OR
 Don't know

63. What is your neck size?
(Please use the tape measure provided to measure around your neck and write the number of centimetres in the space provided)

NECK IN CENTIMETRES

64. Which of the following describes you, if any?
Are you currently pregnant?

Yes No

Have had another baby (or babies) since your "E Moe, Māori" baby?

Yes No

If 'Yes', please specify the dates of birth:

Baby 1
 Baby 2
 Baby 3
 Baby 4

E Moe, Māori

Your Sleep and Health



65. In general, would you say that your health is:

Excellent
 Fair
 Very good
 Poor
 Good
 Don't know

66. Are you currently having any **treatment or monitoring** for any of these conditions?
(Please tick one circle on every line)

	Yes	No	Don't know/ can't remember
Heart disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stroke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diabetes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Asthma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Arthritis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spinal disorder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Osteoporosis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anxiety (Please describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	PLEASE DESCRIBE		
Depression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other mental illness (Please state)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	PLEASE STATE		
Chronic pain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High blood pressure (hypertension)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High cholesterol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low iron or anaemia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Allergies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thyroid problem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Respiratory illness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Please state)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	PLEASE STATE		

E Mse, M4M4

Your Sleep and Health



67. Since your "E Mse, M4M4" baby was born have you been distressed by feelings of anxiety or depression for 2 weeks or more?

Yes No

If you answered 'No', please go to question 68.

If you answered 'Yes':

a. Were the feelings of anxiety or depression related to the pregnancy or birth of another baby?

Yes No

b. Did this distress interfere with your ability to get things done or your relationships with family and friends? (Please circle one number)

Not at all	Somewhat	Very much			
0	1	2	3	4	5

c. Did this distress lead you to seek professional help?

Yes No

Have you ever been told by a health professional that you had: Antenatal depression (depression during pregnancy)

No Yes

If 'Yes', when?

PLEASE SPECIFY WHEN

Postnatal depression (depression after having a baby)

No Yes

If 'Yes', when?

PLEASE SPECIFY WHEN

68. cont'd.

Postpartum psychosis:

No Yes

If 'Yes', when?

PLEASE SPECIFY WHEN

69.

This question is about things that may have happened during the last 12 months.

(Tick all that apply to you - If none of these apply please go to question 70)

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

E Mse, M4M4

Your Sleep and Health



70.

Considering the past 6 months, would you say that your menstrual cycles (periods) are:

- Regular (that is, predictable within 1-2 days)
- Somewhat irregular (that is, predictable between 2-7 days)
- Irregular (that is, more than 7 days)
- Unpredictable (that is, skipped a period)
- Very unpredictable (that is, skipped 2 or more periods in the past 6 months or no period in the past two months)
- You haven't had a period in the last 12 months
- Don't know

71.

Do you suffer from premenstrual syndrome or PMS?

- Yes, with symptoms that completely disrupt my life
- Yes, but with symptoms that have a minor impact on my life
- No
- Don't know

72.

Is your sleep disturbed during your period compared with other times of your menstrual cycle?

- Yes
- No
- Don't know

73.

Is your sleep disturbed during the week before your period compared with other times of your menstrual cycle?

- Yes
- No
- Don't know

74.

Do you or your doctor think that:

- You may be going through perimenopause, that is, you have changes in your periods but have not gone 12 months in a row without a period
- You are postmenopausal, or
- You are neither peri- nor postmenopausal? (Please go to question 75)
- Don't know (Please go to question 76)

75.

In the past month, how many nights did you have a hard time sleeping due to hot flushes or night sweats?

- Every night or almost every night
- A few nights a week
- A few nights a month
- Rarely
- Never
- Don't know

76.

In the last 12 months, has there been any time when you needed to see a GP about your own health, but didn't get to see any doctor at all?

- Yes
- No (Please go to question 80)
- Don't know (Please go to question 80)

77.

How many times has this happened in the past 12 months?

- One time
- Two times
- Three to five times
- More than five times

E NICE, MIND

Your Sleep and Health



78. The last time you were **not** able to see a GP when you needed to, what was the reason you weren't able to?
- Costs too much
 - Had no transport to get there
 - Lack of childcare
 - Couldn't get an appointment soon enough/at a suitable time
 - It was after hours
 - Couldn't get in touch with the doctor
 - Couldn't spare the time
 - Didn't want to make a fuss
 - Other (please specify)

PLEASE SPECIFY

79. The last time you were **not** able to see a GP, what did you do instead?
- Nothing
 - Went to see a GP at a later date
 - Phoned helpline or another phone number for advice
 - Phoned an ambulance
 - Went to Emergency Department at public hospital
 - Went to an after-hours or 24 hour Accident and Medical centre
 - Went to a pharmacy or chemist shop
 - Something else (please specify)

PLEASE SPECIFY

E NICE, MIND

Your Sleep and Health



80. *Count*
- In the past 30 days how often:
- e. Did you feel restless or fidgety?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time
- f. Did you feel so restless you could not sit still?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time

- g. Did you feel depressed?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time

- h. Did you feel that everything was an effort?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time

80. *Count*
- i. Did you feel so sad that nothing could cheer you up?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time
- j. Did you feel worthless?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time

E Hise, MEd
Your Sleep and Health



83. Do you describe yourself as a: *(Please tick the circle that applies to you)*

- regular smoker (I smoke one or more cigarettes per day)
- occasional smoker (I do not smoke every day)
- ex-smoker (I used to smoke but not any more)
- non-smoker (I have never smoked regularly)

84. Does anyone smoke inside your house? *(Please tick the circle that applies to you)*

- Yes
- Sometimes
- No
- Don't know

85. How many people who live in your household smoke cigarettes? Please count yourself as well

PLEASE SPECIFY

86. Thinking about the car that you usually travel in, does anyone smoke in that car?

Yes Sometimes No

87. How often do you drink alcohol? *(Please tick the circle that applies to you)*

Never Less than once a week Once every 3-7 days Once every 2 days Daily

88. On a typical drinking occasion, how many drinks do you have? *(One drink equals a glass of beer or a glass of wine or a nip of spirits)? (Please tick the circle that applies to you)*

None Less than 2 drinks 2 to 4 drinks 5 to 6 drinks More than 6 drinks

89. How often do you use street or recreational drugs, including party pills? *(Please tick the circle that applies to you)*

Never Less than once a week Once every 3-7 days Once every 2 days Daily

90. Date questionnaire completed

E Hise, MEd
Your Sleep and Health



81. Listed below are a few statements about your relationships with others. How much is each statement true or false for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
I am always courteous even to people who are disagreeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There have been occasions when I took advantage of someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes try to get even rather than forgive and forget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes feel resentful when I don't get my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter who I'm talking to, I'm always a good listener	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

82. Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt.

	Not at all true	Rarely true	Sometimes true	Often true	True nearly all the time
I am able to adapt when changes occur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can deal with whatever comes my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to see the humorous side of things when I am faced with problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having to cope with stress can make me stronger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to bounce back after illness, injury, or other hardships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I can achieve my goals, even if there are obstacles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Under pressure, I stay focused and think clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not easily discouraged by failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of myself as a strong person when dealing with life's challenges and difficulties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to handle unpleasant or painful feelings like sadness, fear and anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

All rights reserved. No part of this scale may be reproduced or transmitted in any form, or by any means, electronic or mechanical, including photocopying, or by any information storage or retrieval system, without permission in writing from Dr. Davidson at mail@of-risc.com. Copyright © 2004, 2003, 2002, 2001 by Kathryn K. Conner, M.D. and Jonathan R.T. Davidson, M.D.

E Hse, MfMind

Your Sleep and Health



You have now completed the questionnaire.

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

A \$40 voucher, from the choice of three options below, will be posted to you when we receive **both** completed questionnaires. Please ensure you advise us if your address has changed.

Please indicate the type of voucher you would prefer (tick one):

- Petrol (MTA)
- Supermarket (New World)
- The Warehouse

Important note

If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your doctor, WellChild/Tamariki Ora provider or other health professional. There is also information available on our website www.mumsleep.co.nz

Return to:

Sleep/Wake Research Centre, Massey University, PO Box 756, Wellington 6140 in the reply paid envelope.

If you have lost your envelope, or have any other problems returning the questionnaire, please ring 0800 MUMSLEEP (0800 686 7537) and a member of the research team will assist you.

Thank You!

APPENDIX 6 HIGH-SCORERS PROTOCOL



Protocol for High Scorers on Depression Screening Tools

Before calling the participant:

- Check any notes from previous high EPDS/BDI-II calls made. Also check their responses to other relevant questions to provide context;
- Ensure Dr Lora Wu and/or Dr Bronwyn Sweeney are present and available for advice and support.

Introduction

- *"Hi, my name is _____ from Massey University and I am ringing about the Sleep & Pregnancy questionnaire that you recently completed."*

Purpose of call

- *"Within the questionnaire/phone survey we have a series of questions about mental health, using a standardised screening tool. Your total score on these questions was high/elevated. This does not necessarily mean that you are depressed, sometimes it can be due to things going on around the time you are answering the questions or other recent stresses in your life. You are probably the best person to know how you have generally been feeling."*
- *"How does this high score fit with how you have been feeling lately?"*
- NOTE: as the conversation continues, can add more details i.e.
 - That the screening tool is called the Edinburgh Postnatal Depression Scale (EPDS) OR Becks Depression Inventory (BDI-II);
 - That scores can range from 0 – 30 and your score was ___;
 - Ask about the level of support the person has at home;
 - **Important to reiterate that this is a screening tool only and we are NOT saying you have depression.**

Contact with GP/Midwife

- *"We will also put that information in a letter for your LMC/midwife/GP so that they can follow-up with you. Would you also like me to send you a copy of that letter?"*

If they are concerned

- *"We (highly) recommend you call or visit your LMC/midwife/GP to let them know. They can provide further assessment and advice if required."*

**Edinburgh Postnatal Depression Scale (EPDS)
Becks Depression Inventory (BDI-II)
Phone Call Protocols for elevated scores.**

Antenatal EPDS Criteria	Action
EPDS Score \geq 13 & Q10= '0' or '1' OR BDI-II Score \geq 13 & Q9= '0' or '1'	<ol style="list-style-type: none"> 1. Call participant to inform of high/elevated score, which may indicate symptoms of depression. 2. Advise participant that they she should discuss this further with her Midwife/LMC/GP. 3. Send letter to participant if requested. 4. Phone Midwife/LMC/GP to advise of elevated scores and that they may want to re-administer the EPDS and consider a referral for further evaluation/treatment: <ul style="list-style-type: none"> ○ If EPDS \geq 18, discuss possible referral to Maternal Mental Health Service. If they are unsure on the process they can discuss with Mark Huthwaite. ○ If EPDS 13-17, consider referral to a PHO/NGO service, generally via their GP. 5. Send letter to Midwife/LMC/GP
EPDS Score \geq 13 & Q10= '2' or '3' OR BDI-II Score \geq 13 & Q9= '2' or '3' OR Any EPDS score and Q10='2' or '3' OR Any BDI score and Q9= '2' or '3'	<ol style="list-style-type: none"> 1. Discuss with Mark Huthwaite initially 2. Phone call to participant to inform of elevated score/risk on Q10 (EPDS0 or Q9 (BDI-II)). Advise that we highly recommend she should discuss this further with her Midwife/LMC/GP. 3. Phone Midwife/LMC/GP to inform of elevated scores and potential risk. Advise that they may want to re-administer the EPDS and further assess. Also, consider a referral for further evaluation/treatment. Discuss possible referral to Maternal Mental Health Service and in any emergency/urgent situation the first point of contact 111 and/or Crisis Assessment Treatment Team. If they are unsure they can consult further with Mark Huthwaite. 4. Send letter to participant if requested. 5. Send letter to Midwife/LMC/GP.
If the woman advises that she requires/may require acute assistance.	<ol style="list-style-type: none"> 1. Provide CATT team number/Mental Health Crisis Line number (see Appendix 1). Let them know they may have to leave a message. 2. Also inform Midwife
Emergency or urgent situation	<ol style="list-style-type: none"> 1. Call 111

Crisis Assessment Treatment Teams

They provide 24 hour emergency care and assessments for people in psychiatric crisis as well as providing information about the support services available. Women can phone directly

- **CCDHB MENTAL HEALTH CRISIS LINE** - 0800 745 477
- **CCDHB** – (04) 494 9169 - When you phone the service you may get an answer phone – leave your phone number and name and they will get back to you, usually within 15 minutes
http://www.ccdhb.org.nz/planning/Mental_Health/services/CATT.htm
- **HVDHB** - Ph (04) 566-6999 ask for the CAT Team -.
<http://www.huttvalleydhb.org.nz/Article.aspx?ID=808>
- **Wairarapa** - 0800 946 9800
- **Manawatu (Palmerston North)** – 0800 653-357
- **Hawkes Bay** – 0800 112 334
- **Waitemata (Waitakere, North Shore & Rodney)** – (09) 486 8900 or 0800 809 343
- **Central Auckland** – 0800 800 717
- **South Auckland** – (09) 270 4742
- **Christchurch** – 0800 920 092 or (03) 364 0482
- **Dunedin** – (03) 474 0999 – this is Dunedin Hospital number. Ask for the Emergency Psychiatric Service. They will contact the Central Otago on-call worker.

Telephone Support Services - 24 Hours

Sometimes it is easier to talk to an anonymous person, and/or you may feel the need for some immediate support, without having to go out to obtain it. There is a range of different telephone support services available, such as:

- Capital & Coast DHB Te Haika (Mental Health Contact Centre) - 0800 745 477
- Lifeline -Free Phone: 0800 543 354
- MAMTA (Asian women supporting Asian women) -Phone: 04 478 6213
- National Healthline - Free Phone: 0800 611 116
- Plunketline : 0800 933 922
- Pregnancy Counselling Services - 0800 633 328
- Samaritans - Phone: 04 473 9739
- SIDS (Sudden Infant Death Syndrome) offer a 24-hour phone support line for parents bereaved by cot death. Free Phone: 0800 164 455
- Parent Help - for parent help and family support - offer 24-hour telephone support, counselling, and an anger change group for women.
Phone: 04 499 9994

Useful Websites

- www.mothersmatter.co.nz
- www.outoftheblue.org.nz - Depression website, part of Mental Health Foundation
- www.mentalhealth.org.nz - Mental Health Foundation website
- www.parentscentre.org.nz - Good sections on mental health
- www.everybody.co.nz - Health information for New Zealanders. Only small section on PND
- www.webhealth.co.nz - Regional based health & social service organisations
- www.pnpsupport.org.nz - Auckland based postnatal psychosis support group
- www.matatini.co.nz - Maori mental health website
- www.psychiatry.net.nz - Summary of articles in psychiatric journals
- www.pnd.org.nz - Wellington based support group, excellent articles
- www.sfnat.org.nz - Supporting families in Mental Illness, regional supports
- www.postnataldistress.org.nz - Auckland based support website and groups
- www.tabs.org.nz - Trauma and birth stress-PTSD after childbirth
- www.everybody.co.nz/supportgroups.aspx - Listings of support groups in NZ
- www.justbreathe.org.nz - Christchurch based support website

MENTAL HEALTH SERVICES/RESOURCES

DHB Services

Maternal Mental Health Services - CCDHB

For women with a moderate-severe mood or psychotic disorder, living in the greater Wellington region (Kapiti, Porirua, Wellington, and Hutt Valley areas), this is likely to involve direct contact. For those with mild-moderate disorders, or living in the Lower Central North Island (Gisborne, Hawkes Bay, Wanganui, Manawatu, and Wairarapa), they provide a consultation/liaison service via other health providers involved in the care of the mother.

How to access the service: Referrals are accepted from GPs and midwives, and other mental health and hospital services. If further information is required about our service talk to your midwife, doctor or a local community mental health team.

Address: 21 Hania Street
Mt Victoria
Wellington
Phone: (04) 801 2960

Mental Health Access Centre – Wairarapa DHB

The Mental Health Access Centre provides a single point of contact for urgent and non-urgent new referrals, consultation, liaison and education regarding mental health. The service is available to all people and their whanau/family living in the Wairarapa region.

For crisis and non-urgent referrals, consultation, information and advice about mental health

Free Phone: 0508 432 432

Maternal Mental Health Specialist Service – Mid-Central Region

To provide clinical assessment, short-term intervention and co-ordination of services for women (their babies, partners and families/whanau and significant others) who are pregnant or up to 9 months postnatal at point of referral with an associated moderate to severe mental illness (psychosis or mood disorder).

Address: Ruahine Building
Palmerston North Hospital
Midcentral District Health Board
Phone: (06) 350 8184

Maternal Mental Health Service - Goodhealth Wanganui

A community-based service which includes: assessment and treatment. Referrals are accepted from primary practitioners, midwives, obstetricians, maternity staff, mental health services and in some cases Plunket.

Address: Community Mental Health Service
Wanganui Base Hospital
Private Bag 3003
Wanganui

Mark Huthwaite, Consultant Psychiatrist, Maternal Mental Health Service, CCDHB
Mobile: 021 300 182
Tel: (04) 8012960 or (04) 3855541 ext 5545

APPENDIX 7 PROTOCOL FOR MISCARRIAGE AND STILLBIRTH



Protocol for Miscarriage and Stillbirth

This protocol has been based on information provided by the NZ Ministry of Health, SANDS, and Miscarriage Support Auckland.

If the participant informs the study team about a miscarriage or stillbirth it is important to acknowledge the loss of the woman and recognise how difficult the situation is for them. (Note: If a woman notifies the research team by email, a research team member will phone them.)

If speaking to a woman over the phone the following may be used...

- "I'm so sorry for your loss."
- "That baby was real and a part of you."
- "You must be hurting terribly."
- "I wish I knew what to say right now, but I can't imagine how you must feel right now..."

It may be helpful to ask the following questions...

- Have you been able to talk about this with your family?
- Have you contacted your GP/Midwife?
- "Would it be helpful if I gave you a phone numbers of an organisation that may be able to help?"

*****Ask the woman if they would like their information to remain in the study or for it to be removed*****

SANDS – An organisation set up to support parents and families who have experienced the death of a baby at any stage during pregnancy, as a baby or infant.

- **Main contact number:** 05 0872 6372
- **Wellington:** Joan Curle (027 710 5130) or Vicki Culling (021 776 436)
- **Kapiti:** Renee (020 4003 1089)
- **Hutt Valley:** Vicki Culling (021 776 436)
- **Wairarapa:** Linda Penlington (021 297 4801)

If the woman advises that she requires/may require acute assistance.

Mental Health Crisis Assessment Teams - providers 24 hour emergency care and assessments for people in psychiatric crisis as well as providing information about the support services available. Women can phone directly.

- **CCDHB MENTAL HEALTH CRISIS LINE** - 0800 745 477
- **CCDHB** – (04) 494 9169 - When you phone the service you may get an answer phone – leave your phone number and name and they will get back to you, usually within 15 minutes
http://www.ccdhb.org.nz/planning/Mental_Health/services/CATT.htm
- **HVDHB** - (04) 566-6999 ask for CAT Team - <http://www.huttvalleydvhb.org.nz/Article.aspx?ID=808>
- **Wairarapa** - 0800 946 9800
- **Manawatu (Palmerston North)** – 0800 653-357
- **Hawkes Bay** – 0800 112 334
- **Waitemata (Waitakere, North Shore & Rodney)** – (09) 486 8900 or 0800 809 343
- **Central Auckland** – 0800 800 717
- **South Auckland** – (09) 270 4742
- **Christchurch** – 0800 920 092 or (03) 364 0482
- **Dunedin** – (03) 474 0999 – this is Dunedin Hospital number. Ask for the Emergency Psychiatric Service. They will contact the Central Otago on-call worker.

APPENDIX 8 RECRUITMENT POSTER, *SLEEP HAPI* STUDY



**Just
found
out
you're
pregnant?**

**The Sleep/Wake Research Centre at Massey University
is investigating how changes to sleep
during pregnancy affect women's
mental health and well-being.**



The study involves:

- Measuring your sleep for 6 weeks (2 weeks in each trimester), by wearing a specialised watch-like device and filling out sleep diaries.
- Answering a set of questions in each trimester and at 6 & 12 weeks after birth.
- Taking part in 3 personalised, one-on-one sleep health sessions with a Sleep Scientist (one in each trimester) either in the comfort of your own home or at Massey University.
- You will receive one \$50 voucher at the end of the third trimester and one further \$20 voucher after both the 6 & 12 week post-birth questionnaires are returned.



**Is this your first baby?
Are you less than 13 weeks
pregnant?
Have you had a previous history
of depression?
Do you want to be involved?**

Contact us:

FREE call: 0800 mumsleep
FREE text: Text SLEEP to 5222
Email: mumsleep@massey.ac.nz

**All data and information will
be kept strictly confidential**

APPENDIX 9 INITIAL SCREENING QUESTIONNAIRE, SLEEP HAPI STUDY



INITIAL SCREENING QUESTIONNAIRE

SLEEP HAPI

Sleep Health and Pregnancy Information



MASSEY UNIVERSITY

1. Are you over the age of 16? _____
 2. When is your baby due? _____
 3. How many weeks pregnant are you now? _____
 4. Do you have a GP or maternity health carer (LMC, Midwife, Obstetrician, or GP)? _____
 5. How many times have you been pregnant, including this one? _____
 6. Have you ever been pregnant past 24 weeks gestation?

 7. Are you comfortable answering questions in English? _____
 8. Do you have any children living in your home under the age of 3 years? _____
 9. Have you ever been diagnosed with a sleep disorder (i.e. OSA, restless leg syndrome)?

 10. Have you ever been diagnosed with chronic hypertension, heart disease, chronic lung disease, pre-gestational diabetes, chronic renal failure and autoimmune diseases (excluding treated hypothyroidism)?

 11. Before this pregnancy, did you ever have a period of 2 weeks or more when you felt particularly miserable or depressed? _____
 12. Have you ever been diagnosed with any psychological disorders (such as psychotic disorders, schizophrenia, depression, bipolar disorder)? _____
- If 'yes' to depression:**
- 12a. Who diagnosed the depression? _____
 - 12b. Are you currently on any depression medication? _____
 - 12c. When were you last on any depression medication? _____
 - 12d. Are you currently experiencing any depressive symptoms? _____
 - 12e. When did you last experience any depressive symptoms? _____

**Sleep/Wake
Research Centre**
Moe Tika, Moe Pai

**Massey University –
Wellington Campus**
Private Box 756
Wellington 6140
New Zealand

Administration
+64 (0)4 979 3997

Study enquiry line
0800 MUMSLEEP
(0800 6867 5337)

Courier Address
Massey University
Entrance B, Level D
Wallace Street
Mount Cook, Wellington
New Zealand

Email
mumsleep@massey.ac.nz

Internet
www.sleepwake.ac.nz

Clare Ladyman
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3024
C.Ladyman@massey.ac.nz

Assoc Professor T Leigh Signal
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3257
T.L.Signal@massey.ac.nz

Dr Bronwyn Sweeney
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3265
B.M.Sweeney@massey.ac.nz

Professor Philippa Gander
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3256
P.H.Gander@massey.ac.nz

Dr Mark Huthwaite
Department of Psychological
Medicine
University of Otago, Wellington
+64 (0)4 385 5541
Mark.Huthwaite@otago.ac.nz

APPENDIX 10 HDEC OUT OF SCOPE CONFIRMATION, *SLEEP HAPI* STUDY



Health and Disability Ethics Committees
 20 Aitken Street
 Freyberg Building
 PO Box 5013
 Wellington
 0800 4 ETHICS
 hdec@moh.govt.nz

Monday, 2 May 2016

Mrs Clare Ladyman
 Wallace Street, Mt Cook, Wellington, 6021
 Sleep/Wake Research Centre, Massey University

Dear Mrs Ladyman,

Study title:	Sleep Disruption During Pregnancy
--------------	-----------------------------------

Thank you for emailing HDEC a completed scope of review form on 2 May 2016. The Secretariat has assessed the information provided in your form and supporting documents against the Standard Operating Procedures.

Your study will not require submission to HDEC, as on the basis of the information you have submitted, it does not appear to be within the scope of HDEC review. This scope is described in section three of the Standard Operating Procedures for Health and Disability Ethics Committees.

An expert in the field has attested that this study will not involve vulnerable groups. An observational study requires HDEC review only if the study involves more than minimal risk (that is, potential participants could reasonably be expected to regard the probability and magnitude of possible harms resulting from their participation in the study to be greater than those encountered in those aspects of their everyday life that relate to the study).

If you consider that our advice on your project being out of scope is incorrect please contact us as soon as possible giving reasons for this.

This letter does not constitute ethical approval or endorsement for the activity described in your application, but may be used as evidence that HDEC review is not required for it.

Please note, your locality may have additional ethical review policies, please check with your locality. If your study involves a DHB, you must contact the DHB's research office before you begin. If your study involves a university or polytechnic, you must contact its institutional ethics committee before you begin.

Please don't hesitate to contact us for further information.

Yours sincerely,

Nic Aagaard
 Senior Advisor
 Health and Disability Ethics Committees
 hdec@moh.govt.nz

Encl: appendix A: documents submitted

Appendix A
Documents submitted

<i>Document</i>	<i>Version</i>	<i>Date</i>
Email to Nic Aagaard from Clare Ladyman – clarification of the study population's vulnerability, as described by Dr Mark Huthwaite, Perinatal Psychiatrist at the Wellington Specialist Maternal Mental Health Service.	1	2 May 2016

APPENDIX 11 ETHICAL APPROVAL, *SLEEP HAPI* STUDY



Date: 13 July 2016

Dear Clare Ladyman

Re: Ethics Notification - **SOA 16/29 - Can better sleep health during pregnancy regulate depressive symptoms in women with a previous history of depression?**

Thank you for the above application that was considered by the Massey University Human Ethics Committee: Human Ethics Southern A Committee at their meeting held on Wednesday, 13 July.

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely



Dr Brian Finch
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

APPENDIX 12 CONSENT FORM AT STUDY ENTRY, *SLEEP HAPI* STUDY



CONSENT FORM

SLEEP HAPI

Sleep Health and Pregnancy Information



MASSEY UNIVERSITY

**Sleep/Wake
Research Centre**
Moe Tika, Moe Pai

**Massey University –
Wellington Campus**
Private Box 756
Wellington 6140
New Zealand

Administration
+64 (0)4 979 3997

Study enquiry line
0800 MUMSLEEP
(0800 6867 5337)

Courier Address
Massey University
Entrance B, Level D
Wallace Street
Mount Cook, Wellington,
New Zealand

Email
mumsleep@massey.ac.nz

Internet
www.sleepwake.ac.nz

Clare Ladyman
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3024

C.Ladyman@massey.ac.nz

Assoc Professor T Leigh Signal
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3257
T.L.Signal@massey.ac.nz

Dr Bronwyn Sweeney
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3265
B.M.Sweeney@massey.ac.nz

Professor Philippa Gander
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3256
P.H.Gander@massey.ac.nz

Dr Mark Huthwaite
Department of Psychological
Medicine
University of Otago, Wellington
+64 (0)4 385 5541
Mark.Huthwaite@otago.ac.nz

- I have read and I understand the information sheet dated 1st May 2017 for volunteers taking part in the study designed to investigate the relationship between sleep and mental health in pregnant women. I have had the opportunity to discuss this study. I am satisfied with the answers I have been given.
 - I have had the opportunity to use family / whānau support or a friend to help me ask questions and understand the study.
 - I understand that taking part in this study is voluntary (my choice), and that I may withdraw from the study at any time and this will in no way affect my health care.
 - I understand that participation in this study is confidential and that no material that could identify me will be used in any reports on this study.
 - I have had time to consider whether to take part in the study.
 - I know whom to contact if I have any questions about the study.
 - I wish to receive a copy of the results: YES NO
- Please be aware that there will be a delay between data collection and the publication of the results. This study will take 18 months to complete and the results will be available by early 2019.
- If any of the questionnaires / screening tools suggest that I am at elevated risk for depression, a member of the research team will tell me and then contact my Lead Maternity Carer or GP/doctor.
 - I wish to go in the draw for a mattress package: YES NO

I (full name) _____
hereby consent to take part in this study.

Signature: _____ Date: _____

IMPORTANT: So that we can complete a follow up and evaluation of the study with you after your baby is born, please complete the following:

Baby's Due Date: _____ Address: _____

Home Phone: _____

Mobile Phone: _____ Post Code: _____

Email: _____

(Preferably not a work email unless you will be accessing those emails after your baby is born).

A photocopy of the completed consent form will be returned to you.

APPENDIX 13 CONSENT FORM TRIMESTER 2 & 3, SLEEP HAPI STUDY



TRIMESTER 2 - CONSENT & CHECKLIST

SLEEP HAPI
Sleep Health and Pregnancy Information



MASSEY UNIVERSITY

**Sleep/Wake
Research Centre**
Moe Tika, Moe Pai

1. Consent to Continue in Study

Participant Name: _____

Participant Signature: _____

Date: _____

2. Trimester 2 Questionnaire

Discussed Provided

3. Actiwatch & Sleep Diary Instructions

Discussed Provided

4. Sleep Diary

Discussed Provided

5. Actiwatch

Discussed Provided

6. Future Dates

Discussed Provided

7. Questions

Discussed

**Massey University –
Wellington Campus**
Private Box 756
Wellington 6140
New Zealand

Administration
+64 (0)4 979 3997

Study enquiry line
0800 MUMSLEEP
(0800 6867 5337)

Courier Address
Massey University
Entrance B, Level D
Wallace Street
Mount Cook, Wellington
New Zealand

Email
mumsleep@massey.ac.nz

Internet
www.sleepwake.ac.nz

Clare Ladyman
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3024
C.Ladyman@massey.ac.nz

Assoc Professor T Leigh Signal
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3257
T.L.Signal@massey.ac.nz

Dr Bronwyn Sweeney
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3265
B.M.Sweeney@massey.ac.nz

Professor Philippa Gander
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3256
P.H.Gander@massey.ac.nz

Dr Mark Huthwalte
Department of Psychological
Medicine
University of Otago, Wellington
+64 (0)4 385 5541
Mark.Huthwalte@otago.ac.nz

APPENDIX 14 CONSENT FORM 6- & 12-WEEKS POSTNATAL, SLEEP HAPI STUDY



6 WEEKS POSTNATAL CONSENT & CHECKLIST

SLEEP HAPI

Sleep Health and Pregnancy Information

1. Consent to Continue in Study

Participant Name: _____

Participant Signature: _____

Date: _____

2. 6 Weeks Postnatal Questionnaire

Discussed Provided

3. Questions

Discussed



MASSEY UNIVERSITY

Sleep/Wake
Research Centre
Moe Tika, Moe Pai

Massey University –
Wellington Campus
Private Box 756
Wellington 6140
New Zealand

Administration
+64 (0)4 979 3997

Study enquiry line
0800 MUMSLEEP
(0800 6867 5337)

Courier Address
Massey University
Entrance B, Level D
Wallace Street
Mount Cook, Wellington
New Zealand

Email
mumsleep@massey.ac.nz

Internet
www.sleepwake.ac.nz

Clare Ladyman
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3024
C.Ladyman@massey.ac.nz

Assoc Professor T Leigh Signal
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3257
T.L.Signal@massey.ac.nz

Dr Bronwyn Sweeney
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3265
B.M.Sweeney@massey.ac.nz

Professor Philippa Gander
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3256
P.H.Gander@massey.ac.nz

Dr Mark Huthwaite
Department of Psychological
Medicine
University of Otago, Wellington
+64 (0)4 385 5541
Mark.Huthwaite@otago.ac.nz

APPENDIX 15 INFORMATION SHEET, SLEEP HAPI STUDY



INFORMATION SHEET

SLEEP HAPI

Sleep Health and Pregnancy Information



Sleep/Wake Research Centre

Moe Tika, Moe Pai

Massey University –
Wellington Campus
Private Box 756
Wellington 6140
New Zealand

Administration
+64 (0)4 979 3997

Study enquiry line
0800 MUMSLEEP
(0800 6867 5337)

Courier Address
Massey University
Entrance B, Level D
Wallace Street
Mount Cook, Wellington
New Zealand

Email
mumsleep@massey.ac.nz

Internet
www.sleepwake.ac.nz

Clare Ladyman
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3024
C.Ladyman@massey.ac.nz

Assoc Professor T Leigh Signal
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3257
T.L.Signal@massey.ac.nz

Dr Bronwyn Sweeney
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3265
B.M.Sweeney@massey.ac.nz

Professor Philippa Gander
Sleep/Wake Research Centre
Massey University, Wellington
+64 (0)4 979 3256
P.H.Gander@massey.ac.nz

Dr Mark Huthwaite
Department of Psychological
Medicine
University of Otago, Wellington
+64 (0)4 385 5541
Mark.Huthwaite@otago.ac.nz

1st May 2017

About the study

You are invited to take part in a study investigating sleep and maternal mental health in pregnant and postpartum women. Scientists know that mental health is closely related to sleep and pregnancy is a time when sleep may be greatly disrupted. We would like to know more about how sleep, pregnancy and mental health are connected. This study will try and improve pregnant women's sleep to see if this affects their mental health. If you have ever suffered depression, your participation and input could help shape the direction of future research and treatment.

The aims of the study are to:

1. To investigate how sleep duration, timing and quality changes during pregnancy.
2. Determine if personalised sleep advice assists in achieving healthier sleep and better mental health during pregnancy.

Participants

Thirty women will be invited to participate in this study by their Lead Maternity Carer, GP, or antenatal care provider. Alternatively, women may contact the research team directly after seeing an advertisement for the study or after hearing about the study from someone else. To be included in the study:

- This must be your first baby;
- You must be less than 13 weeks gestation;
- You may have been pregnant before but your pregnancy did not go past 24 weeks gestation;
- You must be 16 years of age or older;
- You must be able to complete a questionnaire in English;
- You must have no children in your care under three years of age;
- You must have a prior history of diagnosed depression but not be taking any medication for depression for at least the last three months;
- You must not have a history of other severe mental illness (other than depression), such as psychotic disorders, bipolar disorders and schizophrenia;
- You must have no diagnosed sleep conditions, such as obstructive sleep apnea or restless leg syndrome;
- You must not have hypertension, heart disease, chronic lung disease, pre-gestational diabetes, chronic renal failure or autoimmune diseases (apart from treated hypothyroidism).
- You must have a primary health care provider and/or LMC (Midwife, Obstetrician) and agree to the research team forwarding information to them about your mental health if necessary.

Location and timing of the study

All study questions can be answered by you in your own time and in your own home, or you may prefer to complete them when visiting the Sleep Wake Research Centre. Your participation in the study will be over a 9 month period. The entire study will run for 18 months and be finished in mid 2018.

What is involved if you decide to participate?

- Your participation is entirely voluntary (your choice). You do not have to take part in this study and if you choose not to take part this will in no way affect your current or future care or treatment.
- If you do agree to take part in the study, you are free to withdraw from the study at any time, without having to give a reason, and this will in no way affect your current or future care or treatment.
- If you decide to be in the study you will be asked to:
 - Complete a questionnaire when you first join the study. This will take approximately 10 minutes.
 - Complete and return a questionnaire in each trimester of your pregnancy. The first questionnaire takes approximately 30-40 minutes to complete. The second and third questionnaires will take approximately 20-25 minutes to complete.
 - Complete six separate weeks of sleep measurements in weeks 11 and 13 (trimester 1), 23 and 25 (trimester 2), 34 and 36 (trimester 3) of pregnancy. These weeks are approximate and may move forward or back by one week. The measurements will involve you filling out sleep diaries and wearing an actigraph. An actigraph is watch-like device, worn on the wrist that measures movement and light. It is important to know that an actigraph only records how much / little you are moving and how much / little light there is. It cannot record any sound or video. The actigraph is worn continuously for 7 days at a time, except when you are in water (eg, showering/swimming). It is expected that filling out the sleep diaries will take no more than 10 minutes per day. The actigraph is returned to the University after being used.
 - Take part in a sleep health information session in weeks 12, 24, and 36. Again, these weeks are approximate and may move forward or back by one week. These sessions will be one-on-one with a member of the research team and will be tailored to you and your sleep based on the information we gain from your sleep measurement weeks. It is estimated these sessions will be approximately 30-60 minutes in length. The sessions can either take place in your own home or at the Sleep Wake Research Centre at Massey University, Mt Cook, Wellington.
 - Complete and return a final questionnaire approximately 6 weeks and 12 weeks after birth. This questionnaire takes approximately 25-30 minutes to complete.

The information you provide in the Consent Form may be used to contact you via text, email or telephone, to remind you about questionnaire completion.

Benefits, risks and safety

If you choose to receive the results of the study, you will have an opportunity to learn about your sleep and the changes to sleep that occur during pregnancy. The sleep health information sessions are aimed at giving you expert sleep advice that is intended to improve your sleep during your pregnancy.

There is a minor inconvenience associated with the time required to complete the questionnaires and take part in the information sessions. You will, however, be provided with one \$50 voucher of your choice (petrol, supermarket or department store) at the end of the third trimester. One further \$20 voucher will be provided after receiving both of 6 and 12 week post-birth questionnaires. These vouchers are reimbursements for travel and time or if you require a babysitter to provide you with enough time to complete the questionnaires after you have had your baby.

Once all data has been collected from all participants, you will also be eligible to go into a draw for one of two mattress packages. These packages have been donated by the Comfort Group and include a standard cot mattress, port-a-cot mattress and foam change mat.

Confidentiality

- No material that could personally identify you will be used in any reports on the study.
- Questionnaires will not have your name on them. Instead they will have a code number and all data will be stored in a secure cabinet or on password protected computers at Massey University's Sleep/Wake Research Centre.
- On completion of the project, data will be archived securely for ten years.

Results

You will receive a summary of the findings of the study and have access to a copy of any publications. Please be aware there will be a delay between data collection and the publication of the results. This study will take 18 months to complete and the results will be available in early 2019. Data from this study will be used by Mrs Clare Ladyman in her PhD thesis.

Ethics

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application 16/29. If you have any concerns about the conduct of this research, please contact Mr Jeremy Hubbard, Chair, Massey University Human Ethics Committee: Southern A, telephone 04 801 5799 x 63487, email humanethicsoutha@massey.ac.nz.

Australia New Zealand Clinical Trials Registry (ANZCTR)

This project has been reviewed and approved by the Australia New Zealand Clinical Trials Registry Application ACTRN12617000055303.

General Questions**1. Will my GP (doctor) and/or Lead Maternity Carer be told I am in the study?**

Included in each questionnaire and/or phone call are some questions to screen for depression. If the results suggest you may be at risk then we will tell you. We will then suggest where you can go for further evaluation and treatment. We will also notify your Lead Maternity Carer, GP or other health care provider.

2. Where can I get more information about the study?

You can contact a member of the research team using their details provided on this information sheet, or email them at mumsleep@massey.ac.nz, or phone them on 0800 MUMSLEEP.

3. If I need an interpreter, can one be provided?

No. Study questionnaires will be provided in English. It is a study requirement that you are able to complete the questions in English. You may have a friend or family support to help you understand the risks and/or benefits of this study and any other explanation you may require. You do not have to answer all the questions in the questionnaires, and you may stop the information sessions at any time.

If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact an independent health and disability advocate:

- a. Free phone: 0800 555 050
- b. Email: advocacy@hdc.org.nz

What do I do now?

If you choose to participate in the study after reading this information sheet, please complete the attached consent form as soon as possible. Please use the self-addressed envelope provided to return the consent form to the research team. A member of the research team will contact you when you are between 9 and 11 weeks pregnant to organise your first sleep measurement week.

Thank you for taking the time to consider being involved in the study.

Any of the members of the research team would be happy to answer questions you may have, or you can email them at mumsleep@massey.ac.nz, or phone them on 0800 MUMSLEEP (0800 686 7537).

APPENDIX 16 ACTIGRAPH AND SLEEP DIARY USER INFORMATION, SLEEP HAPI STUDY



Actiwatch and Sleep Diary

User Information

The Actiwatch contains a small activity monitor (accelerometer) and memory chip and it records movement. Data from the Actiwatch is analysed in conjunction with what you record in the sleep diary. This gives us information about the amount and quality of sleep you have. Please note the Actiwatches have been sterilised before being delivered to you.

The data from the Actiwatch is analysed along with the information from the sleep diaries to determine when and how well you have slept.

Actiwatch information:

1. Please wear the Actiwatch on your non-dominant wrist (the hand you **don't** write with).
2. Place the Actiwatch on your wrist with the event marker (small silver button on the side) closest to your thumb.
3. The Actiwatch is worn with the face on the outside of their wrist. It should be attached reasonably firmly so that it does not move about on your wrist. If it does move about, tighten the strap slightly.
4. The watch is water resistant, **not waterproof**. This means that it should be removed when bathing or showering or if washing any of the bands. Please remember to put it back on again after contact with water.
5. If you take the watch off for any reason (for example, showering) then please note this in the sleep log (write **OFF**).
6. If you forget to put the watch back on at any stage, please put it on as soon as you remember. Do not worry if you accidentally missed some time – we are interested in as much data as possible so simply note in the sleep log the time when you put the watch back on (write **ON**).
7. We cannot tell what you are doing from the Actiwatch data. We can only tell whether you are moving or not.

Information about filling out the sleep diary:


- a. The sleep log is set out so that each line represents 24 hours, from midnight to midnight on one day.
- b. Please write the date for each day in the space provided.
- c. We are interested in **any sleep that is 10 minutes or longer**. It does not matter whether this is during the day or during the night. This includes daytime naps and sleeps, as well as night time sleeps.
- d. It is also essential that we know the time you started trying to sleep and the time you woke up. Again, this is for any sleep that is 10 minutes or longer, including daytime naps and sleeps, as well as night time sleeps.
- e. Please place a mark on the line at each of these times and then write underneath what the line relates to (for example *start of sleep (S)*), with the time in hours and minutes next to it. There are abbreviations listed on the sleep diary for each of these events.
- f. It is at these start and finish times of sleeps that we would also like you to push the event marker on the Actiwatch. A green light will flash when the button is pressed.
- g. There is space for you to write any comments you have for the day. We are particularly interested in events which may affect your sleep, for example being in an unusual, stressful or exciting environment, or events which displaced routine sleep times or places.
- h. Also included on the Diary is a scale to record your feelings of sleepiness just prior to going to bed in the evening, and just after waking up in the morning. Please draw a circle around the number that corresponds to how sleepy you feel as close to your night bedtime as possible. In the morning please circle your sleepiness rating **15 minutes after you wake**. Explanations of the numeric ratings are shown on the sleep diary pages.

For an example of how to complete Sleep Diary please see the first page of your diary sheets.

APPENDIX 17 SLEEP DIARY, SLEEP HAPI STUDY

Please start with Day 1 on other side

Please mark the following on the timelines below: **S** Started a sleep **E** Ended a sleep **OFF** Anytime actiwatch was removed **ON** When actiwatch was put back on



DAY 5

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

DAY 6

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

DAY 7

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

DAY 8


Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

Sleepiness Ratings:	1	Feeling active, vital, alert or wide awake	2	Functioning at high levels, but not at peak; able to concentrate	3	Awake, but relaxed; responsive but not fully alert	4	Somewhat foggy, let down	5	Foggy; losing interest in remaining awake; slowed down	6	Sleepy, woozy, fighting sleep; prefer to lie down	7	No longer fighting sleep; sleep onset soon; having dream-like thoughts
----------------------------	----------	--	----------	--	----------	--	----------	--------------------------	----------	--	----------	---	----------	--

Pregnancy Sleep Diary Diary number: _____ Start Date: ____/____/____

Please mark the following on the timelines below: **S** Started a sleep **E** Ended a sleep **OFF** Anytime actiwatch was removed **ON** When actiwatch was put back on



DAY 1

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

DAY 2

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

DAY 3

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

DAY 4

Circle your sleepiness rating 15 minutes after you wake up: 1 2 3 4 5 6 7

Circle your sleepiness rating at bedtime: 1 2 3 4 5 6 7

Sleepiness Ratings:	1	Feeling active, vital, alert or wide awake	2	Functioning at high levels, but not at peak; able to concentrate	3	Awake, but relaxed; responsive but not fully alert	4	Somewhat foggy, let down	5	Foggy; losing interest in remaining awake; slowed down	6	Sleepy, woozy, fighting sleep; prefer to lie down	7	No longer fighting sleep; sleep onset soon; having dream-like thoughts
----------------------------	----------	--	----------	--	----------	--	----------	--------------------------	----------	--	----------	---	----------	--

Pregnancy Sleep Diary

Diary number: *Sample Diary*

Start Date: *20 / 1 / 2017*



For each day, please complete the row by mark the following times:

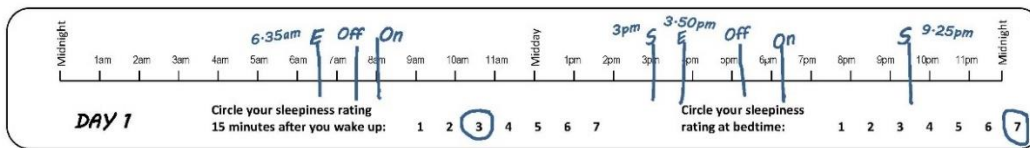
1. **'S'** for when you started a sleep, or trying to start a sleep, and **'E'** for ended the sleep for any sleep 10 minutes or longer
2. **'OFF'** for when the actiwatch was removed, for example, when showering
3. **'ON'** for when the actiwatch was re-fastened
4. Circle the sleepiness ratings just before going to bed every evening and 15 minutes after you wake up every morning – see ratings below

Please Note: Night sleeps start on one row and finish on the next row

EXAMPLE

A woman woke up at 6.35am and decided to get out of bed. 15 minutes after awaking, she rated her sleepiness scale as a '3'. She took her actiwatch off at 7.30am to have a shower and put it on again 30mins later. At 3pm she fell asleep on the couch for 50minutes. At 5.15pm she went to the local pool to swim so took her actiwatch off. She finished at the pool at 6.15pm and put her actiwatch back on. She went to bed for the night at 9pm and read until 9.25pm. Just before lights out she rated her sleepiness scale as a '7'.

Please mark the following on the timelines below: **S** Started a sleep **E** Ended a sleep **OFF** Anytime actiwatch was removed **ON** When actiwatch was put back on



- Sleepiness Ratings:**
- | | | | | | | |
|--|--|--|--------------------------|--|---|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Feeling active, vital, alert or wide awake | Functioning at high levels, but not at peak; able to concentrate | Awake, but relaxed; responsive but not fully alert | Somewhat foggy, let down | Foggy; losing interest in remaining awake; slowed down | Sleepy, woozy, fighting sleep; prefer to lie down | No longer fighting sleep; sleep onset soon; having dream-like thoughts |

Consensus Sleep Diary

Diary number: _____ Start Date: ____ / ____ / ____

	Sample	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
1. Today's Date	20/6/2016								
2. What time did you get into bed?	9pm								
3. What time did you try to go to sleep?	9:25pm								
4. How long did it take you to fall asleep?	30mins								
5. How many times did you wake up, not counting your final awakening?	3 times								
6. In total, how long did these awakenings last?	40mins								
7. What time was your final awakening (the next day)?	6:30am								
8. What time did you get out of bed (the next day)?	6:45am								
9. How would you rate the quality of your sleep?	▶ Very Poor <input checked="" type="radio"/> Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good	▶ Very Poor ▶ Poor ▶ Fair ▶ Good ▶ Very Good
10. Comments? (if applicable)	I have a cold								

APPENDIX 18 PRE-PREGNANCY QUESTIONNAIRE, SLEEP HAPI STUDY



Sleep and Health during Pregnancy ABOUT YOUR PRE-PREGNANCY SLEEP

The following questions relate to your usual sleep habits in the month prior to you getting pregnant.

Your answers should indicate the most accurate reply for the majority of days and nights that month.

Please answer all questions.

6. In the month prior to you getting pregnant, when did you usually get up in the morning?
Usual get up time: _____
7. In the month prior to you getting pregnant, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed)
Hours of sleep per night: _____

For each of the remaining questions, check the one best response.
Please answer all questions.

1. In the month prior to you getting pregnant, how many nights per week could you find a comfortable sleep position?

NO NIGHTS	EVERY NIGHT
0	7
1	6
2	5
3	4
4	3
5	2
6	1
2. In the month prior to you getting pregnant, what sleeping position did you find yourself being most comfortable?
 1 Lying on your left side
 2 Lying on your right side
 3 Lying on either side
 4 Lying on your back
 5 Lying on your stomach
 6 Sitting upright
 7 Other
3. In the month prior to you getting pregnant, did you use any sleeping aids (e.g. pillows, mattress toppers) to help you sleep in a comfortable position?

4. In the month prior to you getting pregnant, when did you usually go to bed?
Usual bed time: _____
5. In the month prior to you getting pregnant, how long (in minutes) did it usually take you to fall asleep each night?
Number of minutes: _____

8. In the month prior to you getting pregnant, how often did you have trouble sleeping because you:
- | | | | | |
|---|---|---|--|--|
| Cannot get to sleep within 30 minutes | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Wake up in the middle of the night or early morning | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Have to get up to use the bathroom | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Cannot breathe comfortably | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Cough or snore loudly | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Feel too cold | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Feel too hot | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Had bad dreams | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Have pain | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |
| Other: | <input type="radio"/> Not during that month | <input type="radio"/> Less than once a week | <input type="radio"/> Once or twice a week | <input type="radio"/> Three or more times a week |

9. In the month prior to you getting pregnant, how would you have rated your sleep quality overall?
- Very good
 Fairly good
 Fairly bad
 Very bad

10. In the month prior to you getting pregnant, how often did you take medicine (prescribed or “over the counter”) to help you sleep?

- Not during the past month
 Less than once a week
 Once or twice a week
 Three or more times a week

11. In the month prior to you getting pregnant, how often did you have trouble staying awake while driving, eating meals, or engaging in social activity?

- Not during the past month
 Less than once a week
 Once or twice a week
 Three or more times a week

12. In the month prior to you getting pregnant, how much of a problem was it for you to keep up enough enthusiasm to get things done?

- No problem at all
 Only a very slight problem
 Somewhat of a problem
 A very big problem

13. Did you have a bed partner or roommate in the month prior to you getting pregnant?

- No bed partner or roommate
 Partner/roommate in another room
 Partner/roommate in same room but not the same bed
 Partner/roommate in the same bed



If you have a bed partner or roommate, how often in the month prior to you getting pregnant, would they say you had:

Loud snoring	<input type="radio"/> Not during that month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Long pauses between breaths while asleep	<input type="radio"/> Not during that month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Legs twitching or jerking while you sleep	<input type="radio"/> Not during that month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Episodes of disorientation or confusion during sleep	<input type="radio"/> Not during that month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other restlessness while you sleep:	<input type="radio"/> Not during that month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

14. Date questionnaire completed / /
 (day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to. Thankyou.

APPENDIX 19 TRIMESTER 1 QUESTIONNAIRE, SLEEP HAPI STUDY

Sleep and Health during Pregnancy

THIS QUESTIONNAIRE SHOULD BE COMPLETED WHEN YOU ARE 10-12 WEEKS PREGNANT

This questionnaire is about your sleep and health.

Please **tick one** option for questions with **circles** like this:

Please **tick as many** options as apply for questions with **boxes** like this:

ABOUT YOUR SLEEP NOW

7. During the past month, how many nights per week could you find a comfortable sleep position? (please circle one number)
- | | |
|-----------|-------------|
| NO NIGHTS | EVERY NIGHT |
| 0 | 7 |
| 1 | 6 |
| 2 | 5 |
| 3 | 4 |
| 4 | 3 |
| 5 | 2 |
| 6 | 1 |
8. During the past month, what sleeping position did you find yourself being most comfortable? (please tick one circle)
- | | |
|--|---|
| 1 <input type="radio"/> Lying on your left side | 5 <input type="radio"/> Lying on your stomach |
| 2 <input type="radio"/> Lying on your right side | 6 <input type="radio"/> Sitting upright / recumbent |
| 3 <input type="radio"/> Lying on either side | 7 <input type="radio"/> Other (please specify): _____ |
| 4 <input type="radio"/> Lying on your back | |
9. During the past month, did you use any sleeping aids (e.g. pillows, mattress toppers) to help you sleep in a comfortable position?
10. During the past month, when have you usually gone to bed?
- Usual bed time: _____ AM or PM
11. During the past month, how long (in minutes) has it taken you to fall asleep each night?
- Number of minutes: _____
12. During the past month, when have you usually gotten up in the morning?
- Usual get up time: _____ AM or PM
13. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed)
- Actual sleep per night: _____ hours & _____ minutes

1. What is your date of birth? _____ / _____ / _____ (day) (month) (year)
2. When is your baby due? _____ / _____ / _____ (day) (month) (year)
3. How many weeks pregnant are you now? _____ weeks
4. Who is providing professional health care for you in this pregnancy?
- Independent (self-employed) midwife/team
 - Hospital based midwife/team
 - Hospital high risk team
 - Specialist Obstetrician
 - Shared care (e.g. midwife & obstetrician, midwife & GP)
 - No one
 - Other: _____

5. Who is your GP this pregnancy?

Name of GP: _____

Name of Medical Centre: _____

Phone: _____

6. If you currently have one, who is your Midwife / Lead Maternity Carer for this pregnancy?

Name of Midwife / LMC: _____

Phone: _____

18. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? *(please tick one circle)*

No problem at all Only a very slight problem Somewhat of a problem A very big problem

19. Do you have a bed partner or roommate? *(please tick one circle)*

No bed partner or roommate Partner/roommate in another room Partner/roommate in same room but not the same bed Partner/roommate in the same bed

20. If you have a bed partner or roommate, how often in the past month would they say you had: *(please tick one circle on every line)*

Loud snoring	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Long pauses between breaths while asleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Legs twitching or jerking while you sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Episodes of disorientation or confusion during sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other restlessness while you sleep <i>(please specify):</i>	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

21. In the last week, how often did you get a good night's sleep? *(please circle one number)*

NO NIGHTS: 0 1 2 3 4 5 6 7
EVERY NIGHT: 0 1 2 3 4 5 6 7

22. How many hours sleep do you usually get in 24 hours, including naps?

In the last week, please write the number of hours here: _____ hours

23. On how many days in the last week did you have a daytime nap? *(please circle one number)*

NO NIGHTS: 0 1 2 3 4 5 6 7
EVERY NIGHT: 0 1 2 3 4 5 6 7

IF YOU DID NOT NAP DURING THE LAST WEEK, PLEASE GO TO QUESTION 26. IF YOU HAVE HAD A NAP IN THE LAST WEEK, PLEASE GO TO THE NEXT QUESTION.

24. If you have had naps in the last week, how many hours or minutes would you sleep for?

Please write the number of hours and minutes here: _____ hours _____ minutes

25. If you have had naps in the last week, what time of the day do you like to start napping?

Please write the time here: _____ AM or _____ PM

14. During the past month, how often have you had trouble sleeping because you: *(please tick one circle on every line)*

Cannot get to sleep within 30 minutes	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Wake up in the middle of the night or early morning	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have to get up to use the bathroom	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cannot breathe comfortably	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cough or snore loudly	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too cold	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too hot	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Had bad dreams	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have pain	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other <i>(please specify):</i>	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

15. During the past month, how would you rate your sleep quality overall? *(please tick one circle)*

Very good:
Fairly good:
Fairly bad:
Very bad:

16. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep? *(please tick one circle)*

Not during the past month Less than once a week Once or twice a week Three or more times a week

17. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? *(please tick one circle)*

Not during the past month Less than once a week Once or twice a week Three or more times a week

33. Have you ever been told by a doctor or other health professional that you have a sleep disorder?

- 0 No please go to Question 36
 1 Yes please go to question 34

34. What was the sleep disorder?

- 1 Obstructive Sleep Apnea
 2 Insomnia
 3 Restless legs
 4 Other (please specify) _____

35. What treatments do you now have for your sleep disorder(s)? (please tick as many options that apply to you)

- 1 No treatment
 2 Diet
 3 Exercise
 4 Other (please specify) _____
 5 Medicines, tablets or pills (please specify) _____

36. In the last week, have you experienced an urge to move your legs (usually accompanied by unpleasant sensations)?

- 1 Yes – if “Yes” please go to question 37
 0 No – if “No” please go to question 38

37. If you answered “Yes” to Question 36, is this: (please tick as many options that apply to you)

- 1 Worse at night
 2 More noticeable when you rest?
 3 Relieved by movement?

38. Are you satisfied with the amount, quality, and timing of your sleep?

- 1 Yes
 0 No – If No, would you like to (please tick as many options that apply to you):
 Sleep more
 Sleep less
 Have more refreshing sleep
 Go to sleep earlier
 Go to sleep later
 Get up earlier
 Get up later

39. Most nights, do you sleep... (please tick as many options that apply to you)

- Alone
 With your partner/significant other
 With other children
 With a pet
 Or with someone or something else? (please specify) _____

26. Do you consider that you have a sleep problem?

- 0 No
 1 Yes, lasting less than 4 weeks
 2 Yes, for 1-6 months
 3 Yes, for more than 6 months

Comments welcome →

27. In the last 2 weeks, what has been the severity of the following **INSOMNIA** problem(s)? (please circle one number on every line)

	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
Difficulty falling asleep:	0	1	2	3	4
Difficulty staying asleep:	0	1	2	3	4
Problem waking too early:	0	1	2	3	4

28. How **SATISFIED/DISSATISFIED** are you with your current sleep pattern? (please circle one number)

	VERY SATISFIED	MODERATELY SATISFIED	DISSATISFIED	VERY DISSATISFIED
	0	1	2	3
				4

29. How **NOTICEABLE** to others do you think your sleeping problem is in terms of impairing your quality of life? (please circle one number)

	NOT AT ALL NOTICEABLE	A LITTLE	SOMEWHAT	MUCH	VERY MUCH NOTICEABLE
	0	1	2	3	4

30. How **WORRIED/DISTRESSED** are you about your current sleep problem? (please circle one number)

	NOT AT ALL WORRIED	A LITTLE	SOMEWHAT	MUCH	VERY MUCH WORRIED
	0	1	2	3	4

31. To what extent do you consider your sleep problem to **INTERFERE** with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.) **CURRENTLY**? (please circle one number)

	NOT AT ALL INTERFERING	A LITTLE	SOMEWHAT	MUCH	VERY MUCH INTERFERING
	0	1	2	3	4

32. Does your sleep problem interfere with... (please tick one circle on every line)

	YES	NO	DON'T KNOW	NOT APPLICABLE
a. Your relationship with a child or children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Your relationship with your spouse or partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Caring for your family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Your relationship with your extended family or friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

40. On days when you are **scheduled** to work, study, care for others or have other regular commitments:

- a. I have to get up at _____ AM or _____ PM
- b. To wake up I need _____ minutes
- c. I regularly wake up: before the alarm with the alarm don't use an alarm
- d. I am fully awake from _____ AM or _____ PM
- e. I have an energy dip at _____ AM or _____ PM
- f. On nights before scheduled (e.g. work) days, I go to bed at _____ AM or _____ PM
- g. To fall asleep when I go to bed takes me _____ minutes
- h. If I get the chance, I like to take a nap. Yes No
- i. **If you nap:** I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

41. **Imagine having free days (days when you are NOT scheduled to work, study, care for others or have no other regular commitments). On free days:**

- a. Ideally, I would sleep in until _____ AM or _____ PM
- b. I normally wake up at _____ AM or _____ PM
- c. If I wake up at around the normal (scheduled/work day) alarm time, I try to get back to sleep. Yes No
- d. If I get back to sleep, I sleep for another _____ minutes
- e. I am fully awake from _____ AM or _____ PM
- f. I have an energy dip at around _____ AM or _____ PM
- g. On nights before free days, I go to bed at _____ AM OR _____ PM
- h. To fall asleep when I go to bed takes me _____ minutes
- i. If I get the chance, I like to take a nap. Yes No
- j. **If you nap:** I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

42. Do you usually watch TV or read in bed before falling asleep?

- Yes No

43. If YES, once I am in bed, I would like to watch TV or read for _____ minutes, but I normally fall asleep after a maximum of _____ minutes.

44. Do you prefer to sleep in a completely dark room?

- Yes No

45. Do you wake up more easily when morning light shines into your room?

- Yes No

46. How long on average per day do you spend outside (really outside) exposed to daylight?

On scheduled days: _____ hours & _____ minutes

On free days: _____ hours & _____ minutes

47. How often in the last week did you: (please circle one number on every line)

	NO	DAYS/NIGHTS	EVERY DAY/NIGHT
a. Have difficulty getting to sleep.....	0	1 2 3 4 5 6 7	7
b. Wake up during your sleep period.....	0	1 2 3 4 5 6 7	7
c. Wake up too early at the end of a sleep period.....	0	1 2 3 4 5 6 7	7
d. Feel rested upon awakening at the end of a sleep period.	0	1 2 3 4 5 6 7	7
e. Sleep poorly.....	0	1 2 3 4 5 6 7	7
f. Feel sleepy during the day.....	0	1 2 3 4 5 6 7	7
g. Struggle to stay awake during the day.....	0	1 2 3 4 5 6 7	7
h. Feel irritable during the day.....	0	1 2 3 4 5 6 7	7
i. Feel tired or fatigued during the day.....	0	1 2 3 4 5 6 7	7
j. Feel satisfied with the quality of your sleep.....	0	1 2 3 4 5 6 7	7
k. Feel alert and energetic during the day.....	0	1 2 3 4 5 6 7	7
l. Get too much sleep.....	0	1 2 3 4 5 6 7	7
m. Get too little sleep.....	0	1 2 3 4 5 6 7	7
n. Take a nap at a scheduled time.....	0	1 2 3 4 5 6 7	7
o. Fall asleep at an unscheduled time.....	0	1 2 3 4 5 6 7	7
p. Drink an alcoholic beverage to help you get to sleep.....	0	1 2 3 4 5 6 7	7
q. Use tobacco to help you get to sleep.....	0	1 2 3 4 5 6 7	7
r. Use herbal product to help you get to sleep.....	0	1 2 3 4 5 6 7	7
s. Use an over-the-counter sleeping pill to help you.....	0	1 2 3 4 5 6 7	7
get to sleep			
t. Use a prescription sleeping pill to help you get to sleep.....	0	1 2 3 4 5 6 7	7
u. Use any pain medication to help you get to sleep.....	0	1 2 3 4 5 6 7	7
(e.g. Panadol)			
v. Take anything else to help you sleep.....	0	1 2 3 4 5 6 7	7

If so, what did you take to help you sleep.....

48. In the last week what, if anything, woke you up during the night? (please tick as many options that apply to you)

- Noise
- Pain
- Stress
- Too hot or too cold
- Light
- Unable to get comfortable
- Dreams
- Nightmares
- The need to go to the bathroom
- Wake up for no apparent reason
- Heartburn
- Nasal Congestion
- Leg Cramps
- Contractions
- Baby moving/kicking
- Giving care to child
- Giving care to elderly parent
- Giving care to someone else
- Spouse/bed partner
- Hungry/thirsty
- Medication side effects
- Pets
- Text messages or alerts from phone or other electronic device (not pre-set alarms)
- Can't breathe comfortably
- Worrying or thinking about a child's behaviour
- Worrying or thinking about a disabled or ill family member (adult or child)
- Worrying or thinking about current housing difficulties
- Worrying or thinking about money/finance problems
- Worrying or thinking about world or current events
- Worrying or thinking about balancing work and family
- Worrying or thinking about family members not getting on
- Worrying or thinking about who does household chores
- Something else (please specify) _____
- Nothing awakens me at night
- Don't know

49. Thinking about your sleep and sleep habits within the past month, how often have you done the following in the hour before you went to bed? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Did work relating to your job or study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Watched TV/movie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Listened to the radio or music	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Were on the computer or internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read a book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Exercised	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Did activities with children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Did activities with family / friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Drank a caffeinated beverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Drank an alcoholic beverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Took a hot bath or shower	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. Completed household chores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

50. How frequently do you do the following in the hour before going to sleep? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Listen to radio or music (e.g. using a radio or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Surf internet or use social media (e.g. Facebook/texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other activities using technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please specify					

54. Thinking about your typical day, what are you unable to do because you run out of time? Do you wish you had more time to: (please tick one circle on every line)

	YES, RUN OUT OF TIME	NO
a. Do job-related work	<input type="radio"/>	<input type="radio"/>
b. Spend time with family or friends	<input type="radio"/>	<input type="radio"/>
c. Sleep	<input type="radio"/>	<input type="radio"/>
d. Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>
e. Exercise	<input type="radio"/>	<input type="radio"/>
f. Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>

55. In your usual way of life in recent times, how likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? (please tick one circle on every line)

	WOULD NEVER DOZE	SLIGHT CHANCE	MODERATE CHANCE	HIGH CHANCE
a. Sitting and reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Watching TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Sitting inactive in a public place (e.g. movies, meeting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. As a passenger in a car for an hour without a break	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Lying down in the afternoon when circumstances permit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Sitting and talking to someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Sitting quietly after a lunch without alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. In a car, while stopped for a few minutes in traffic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

56. If you have other children over the age of three years of age living with you, how much does their sleep affect... (please circle one number on every line)

	NO NIGHTS/DAYS	1	2	3	4	5	6	7
a. Your bed time?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Your get up time?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. The number of times you wake at night?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. The amount of sleep you get at night?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. How sleepy you are during the day?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Your mood during the day?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Your ability to do things during the day?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

51. How frequently do you do the following to help fall asleep? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Listen to radio or music (e.g. using a Radio, iPod or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Surf internet or use social media (e.g. Facebook/texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Other activities using technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please specify

52. Do you have the following technology in your bedroom? (please tick as many options as apply)

- TV / computer / laptop / DVD player
- Gaming console
- Smart phone
- Radio or other music only player (e.g. MP3)
- None
- Other technology → Please specify

53. Thinking about your typical day, what are you unable to do because you are too sleepy? Are you too sleepy to: (please tick one circle on every line)

	YES, TOO SLEEPY	NO
a. Do job-related work	<input type="radio"/>	<input type="radio"/>
b. Spend time with family or friends	<input type="radio"/>	<input type="radio"/>
c. Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>
e. Exercise	<input type="radio"/>	<input type="radio"/>
d. Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>

65. Are you currently having any treatment or monitoring for any of these conditions?

- (please tick one circle on every line)
- | | | |
|---|-----------------------|-----------------------|
| | YES | NO |
| a) High blood pressure (including hypertension, pre-eclampsia, toxemia, chronic hypertension) | <input type="radio"/> | <input type="radio"/> |
| b) Pregnancy or pre-existing diabetes (gestational diabetes managed using dietary control, with or without insulin) | <input type="radio"/> | <input type="radio"/> |
| c) Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| d) Abnormal vaginal bleeding | <input type="radio"/> | <input type="radio"/> |
| e) Placenta/whenua low down near the cervix (placenta praevia/low lying placenta) | <input type="radio"/> | <input type="radio"/> |

66. Are you currently having any treatment or monitoring for any of these conditions?

- (please tick one circle on every line)
- | | | |
|--|-----------------------|-----------------------|
| | YES | NO |
| Heart disease | <input type="radio"/> | <input type="radio"/> |
| Stroke | <input type="radio"/> | <input type="radio"/> |
| Diabetes | <input type="radio"/> | <input type="radio"/> |
| Asthma | <input type="radio"/> | <input type="radio"/> |
| Arthritis | <input type="radio"/> | <input type="radio"/> |
| Spinal disorder | <input type="radio"/> | <input type="radio"/> |
| Osteoporosis | <input type="radio"/> | <input type="radio"/> |
| Cancer | <input type="radio"/> | <input type="radio"/> |
| Anxiety (please describe.....) | <input type="radio"/> | <input type="radio"/> |
| Depression | <input type="radio"/> | <input type="radio"/> |
| Other mental illness (please specify.....) | <input type="radio"/> | <input type="radio"/> |
| Chronic pain | <input type="radio"/> | <input type="radio"/> |
| High blood pressure (hypertension) | <input type="radio"/> | <input type="radio"/> |
| High cholesterol | <input type="radio"/> | <input type="radio"/> |
| Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| Allergies | <input type="radio"/> | <input type="radio"/> |
| Thyroid problem | <input type="radio"/> | <input type="radio"/> |
| Respiratory illness | <input type="radio"/> | <input type="radio"/> |
| Other (please specify.....) | <input type="radio"/> | <input type="radio"/> |

57. In the past year, how often have you driven a car or motor vehicle while feeling drowsy? Would you say you have driven drowsy... (please tick one circle)

- 1 3 or more times a week
- 2 1 to 2 times a week
- 3 1 to 2 times a month
- 4 Less than once a month, or
- 5 Never
- 6 Don't drive / Don't have a license / Don't have a car

ABOUT YOUR PREGNANCY

58. What is your height? _____ cms **OR** _____ feet _____ inches

59. What was your weight before this pregnancy? _____ kgs **OR** _____ stones _____ lbs

60. When you got pregnant, were you trying to get pregnant?
 1 Yes 0 No

61. Did you require the assistance of reproductive technology to become pregnant this time?
 (e.g. IVF, GIFT, ICSI) 1 Yes 0 No

62. How many times have you ever been pregnant, including this one? _____ times

63. How many times have you given birth to a baby, including stillbirth, after 24 weeks of pregnancy?
 _____ times

64. In general, would you say that your health is: (please tick one circle)

- Excellent
- Very good
- Good
- Fair
- Poor
- Don't know

67. Please list any medicines you are currently taking.

68. Do you describe yourself as a: *(please tick one circle)*

3 Regular smoker (I smoke one or more cigarettes per day)

2 Occasional smoker (I do not smoke every day)

1 Ex-smoker (I used to smoke but not any more)

0 Non-smoker (I have never smoked regularly)

69. Does anyone smoke inside your house?

3 Yes

2 Sometimes

1 No

70. During this pregnancy, how often do you drink alcohol? *(please tick one circle)*

0 NEVER

1 LESS THAN ONCE A WEEK

2 ONCE EVERY 3-7 DAYS

3 ONCE EVERY 2 DAYS

4 DAILY

71. During this pregnancy, on a typical drinking occasion, how many drinks do you have? *(One drink equals a glass of beer or a glass of wine or a nip of spirits)* *(please tick one circle)*

0 NONE

1 LESS THAN 2 DRINKS

2 2 TO 4 DRINKS

3 5 TO 6 DRINKS

4 MORE THAN 6 DRINKS

72. During this pregnancy, how often do you use street or recreational drugs, including party pills? *(please tick one circle)*

0 NEVER

1 LESS THAN ONCE A WEEK

2 ONCE EVERY 3 TO 7 DAYS

3 ONCE EVERY 2 DAY

4 DAILY

73. Before this pregnancy did your depression ever interfere with your ability to get things done or your relationships with family and friends? *(please circle one number)*

0 NOT AT ALL

1 SOMEWHAT

2

3

4

5 VERY MUCH

74. During this pregnancy have you been distressed by feelings of anxiety or depression for two weeks or more?

0 No *please go to Question 77*

1 Yes *please go to question 75*

75. During this pregnancy has your feelings of anxiety or depression interfere with your ability to get things done or your relationships with family and friends? *(please circle one number)*

0 NOT AT ALL

1 SOMEWHAT

2

3

4

5 VERY MUCH

76. During this pregnancy, has your feelings of anxiety or depression lead you to seek professional help?

1 Yes

0 No

77. Before this pregnancy, have you ever had depression during pregnancy (antenatal depression)?

1 Yes

0 No

78. Has anyone in your family ever been told by a health professional that they have depression or another mental health problem?

1 Yes

0 No

If 'Yes', what relationship did they have to you: _____

79. Has anyone in your family ever had antenatal or postnatal depression?

1 Yes

0 No

If 'Yes', what relationship did they have to you: _____

ABOUT YOU

80. Which ethnic group do you belong to? *(please tick as many options that apply to you)*

New Zealand European

Cook Island Māori

Chinese

Māori

Tongan

Indian

Samoan

Niuean

Other such as DUTCH, JAPANESE, TOKELAUAN. Please specify: _____

81. Where do you usually live?

Street number _____ Flat number _____

Street name _____

Suburb or rural locality _____ Post Code _____

City, town or district _____

Home telephone number _____

Cell phone number _____

82. Thinking back over the past 5 years, how many times has your family moved house?

(please tick one circle)

- Have not moved house in the past 5 years
- Once
- Twice
- Three times
- Four times
- Five or more times
- Don't know

83. Who normally lives in your household?

PERSON	AGE (Years)	SEX (Male/Female)	THEIR RELATIONSHIP TO YOU (Eg Partner, Friend, Flatmate, Parent, Grandparent, Brother, Sister, Auntie, Uncle, Cousin, Step-child, Another Person's Child)	NIGHTS PER WEEK THEY NORMALLY LIVE THERE (1-7 nights)	ARE YOU REQUIRED TO CARE FOR THEM? (Yes/No)
Me		Female	Not applicable		Not applicable
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

84. If you have a partner, how is your relationship with them at the moment? (please circle one number)

- PERFECTLY HAPPY 0 1 2 3 4 5 6 7
- EXTREMELY UNHAPPY 8
- OR
- NOT APPLICABLE

85. How supportive of this pregnancy is your partner? (please circle one number)

- COMPLETELY SUPPORTIVE 0 1 2 3 4 5 6 7
- NOT AT ALL SUPPORTIVE 8
- OR
- NOT APPLICABLE

86. Do you have the following types of support? (please tick one circle on every line)

- a. Financial support
 - I don't need any support
 - I would like a lot more support
 - I would like some more support
 - I have enough support
- b. Emotional support (e.g. someone who listens or is there for you)
 - I don't need any support
 - I would like a lot more support
 - I would like some more support
 - I have enough support
- c. Advice (e.g. someone you can go to for information or guidance)
 - I don't need any support
 - I would like a lot more support
 - I would like some more support
 - I have enough support
- d. Concrete/Practical support (e.g. childcare, housework, cooking)
 - I don't need any support
 - I would like a lot more support
 - I would like some more support
 - I have enough support

87. What is the total income that you yourself got from all sources, before tax or anything was taken out of it, in the last 12 months? (please tick one circle)

- Loss
- Zero income
- \$1 - \$5,000
- \$5,001 - \$10,000
- \$10,001 - \$15,000
- \$15,001 - \$20,000
- \$20,001 - \$25,000
- \$25,001 - \$30,000
- \$30,001 - \$35,000
- \$35,001 - \$40,000
- \$40,001 - \$50,000
- \$50,001 - \$60,000
- \$60,001 - \$70,000
- \$70,001 - \$100,000
- \$100,001 - \$150,000
- \$150,001 or more
- Don't know

88. What is the total income that your household got from all sources, before tax or anything was taken out of it, in the last 12 months? (please tick one circle)

- Loss
- Zero income
- \$1 - \$5,000
- \$5,001 - \$10,000
- \$10,001 - \$15,000
- \$15,001 - \$20,000
- \$20,001 - \$25,000
- \$25,001 - \$30,000
- \$30,001 - \$35,000
- \$35,001 - \$40,000
- \$40,001 - \$50,000
- \$50,001 - \$60,000
- \$60,001 - \$70,000
- \$70,001 - \$100,000
- \$100,001 - \$150,000
- \$150,001 or more
- Don't know

89. What is your highest secondary school qualification? *(please tick one circle)*

- None
- NZ School Certificate in one or more subjects *or* National Certificate Level 1 *or* NCEA Level 1
- NZ Sixth Form Certificate in one or more subjects *or* National Certificate Level 2 *or* NZ UE before 1986 in one or more subjects *or* NCEA Level 2
- NZ Higher School Certificate *or* Higher Leaving Certificate *or* NZ University Entrance
- Bursary/Scholarship *or* National Certificate Level 3 *or* NCEA Level 3 *or* NZ Scholarship Level 4
- Other secondary school qualification gained in NZ *(please specify)* _____
- Other secondary school qualification gained overseas

90. Apart from secondary school qualifications, do you have another completed qualification? *Please do not count incomplete qualifications or qualifications that take less than 3 months of full-time study to get. Please tell us your highest qualification (please tick one circle)*

- No qualification beyond secondary school
- Bachelor's degree, for example, BA, BSc
- Bachelor's degree with honours
- Masters degree, for example, MA, MSc
- PhD
- Diploma *(not post-graduate)*
- Diploma – Postgraduate
- Trade or technical certificate which took more than 3 months full-time study
- Professional qualification, for example, ACA, teachers, nurses
- Other *(please specify)* _____

91. Are you attending, studying or enrolled at school or anywhere else?

- Full-time (20 hours or more a week)
- Part-time (less than 20 hours a week)
- Neither of these

92. Do you currently work for pay, profit or income?

- 1 Yes, one paid job
- 2 Yes, more than one paid job
- 0 No *Comments welcome* → _____

If you answered 'Yes' please go to question 93, if you answered 'No' go to question 96.

93. In the **LAST WEEK**, how many hours did you work for pay, profit or income?

Please write how many hours here → _____ hours

94. In the **LAST WEEK**, on how many nights did you work for pay, profit or income for at least 3 hours between midnight and 5am? *(please circle one number)*

NO NIGHTS	EVERY NIGHT
0	1
1	2
2	3
3	4
4	5
5	6
6	7

95. Overall how satisfied are you with the balance between your work and other aspects of your life such as time with your family or leisure? *(please tick one circle)*

- Very dissatisfied
- Dissatisfied
- Neither satisfied nor dissatisfied
- Satisfied
- Very satisfied

96. This question is about things that may have happened during the last 12 months. *(please tick as many options that apply to you)*

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

97. Please check the answer that comes closest to how you have felt in the past 7 days, not just how you feel today...

a. I have been able to laugh and see the funny side of things

- 0 As much as I always could
 1 Not quite so much now
 2 Definitely not so much now
 3 Not at all

b. I have looked forward with enjoyment to things

- 0 As much as I ever did
 1 Rather less than I used to
 2 Definitely less than I used to
 3 Hardly at all

c. I have blamed myself unnecessarily when things went wrong

- 3 Yes, most of the time
 2 Yes, some of the time
 1 Not very often
 0 No, never

d. I have been anxious or worried for no good reason

- 0 No, not at all
 1 Hardly ever
 2 Yes, sometimes
 3 Yes, very often

e. I have felt scared or panicky for no good reason

- 3 Yes, quite a lot
 2 Yes, sometimes
 1 No, not much
 0 No, not at all

f. Things have been getting on top of me

- 3 Yes, most of the time I haven't been able to cope at all
 2 Yes, sometimes I haven't been coping as well as usual
 1 No, most of the time I have coped quite well
 0 No, I have been coping as well as ever

g. I have been so unhappy that I have had difficulty sleeping

- 3 Yes, most of the time
 2 Yes, sometimes
 1 Not very often
 0 No, not at all

h. I have felt sad or miserable

- 3 Yes, most of the time
 2 Yes, quite often
 1 Not very often
 0 No, not at all

i. I have been so unhappy that I have been crying

- 3 Yes, most of the time
 2 Yes, quite often
 1 Only occasionally
 0 No, never

j. The thought of harming myself has occurred to me

- 3 Yes, quite often
 2 Sometimes
 1 Hardly ever
 0 Never

98. Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt. (Please tick one circle on every line)

	Not at all true	Rarely true	Sometimes true	Often true	True nearly all the time
I am able to adapt when changes occur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can deal with whatever comes my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to see the humorous side of things when I am faced with problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having to cope with stress can make me stronger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to bounce back after illness, injury, or other hardships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I can achieve my goals, even if there are obstacles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Under pressure, I stay focused and think clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not easily discouraged by failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of myself as a strong person when dealing with life's challenges and difficulties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to handle unpleasant or painful feelings like sadness, fear and anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

All rights reserved. No part of this scale may be reproduced or transmitted in any form, or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from Dr. Davidson at Davidson@CarLifeResearch.com. Copyright © 2001, 2003, 2007, 2011 by Kathryn M. Granger, M.B. and Jonathan R.T. Davidson, M.D.

99. Listed below are a few statements about your relationships with others. How much is each statement TRUE or FALSE for you? (Please tick one circle on every line)

	Definitely True	Mostly True	Don't know	Mostly False	Definitely False
I am always courteous even to people who are disagreeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There have been occasions when I took a advantage of someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes try to get even rather than forgive and forget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes feel resentful when I don't get my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter who I'm talking to, I'm always a good listener	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

100. Date questionnaire completed: _____ / _____ / _____
(day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

A \$50 voucher, from the choice of the following three options, below will be posted to you at the completion of the 3rd trimester measurement / information session. Please ensure you advise us if your address changes.

Please indicate the type of voucher you would prefer (tick one):
 Petrol (MVA) Supermarket (New World) Department store (Farmers)

Important note
 If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Midwife/Lead Maternity Carer, GP/doctor or other health professional.

APPENDIX 20 TRIMESTER 2 QUESTIONNAIRE, SLEEP HAPI STUDY



Sleep and Health during Pregnancy



THIS QUESTIONNAIRE SHOULD BE COMPLETED WHEN YOU ARE 23-25 WEEKS PREGNANT

This questionnaire is about your sleep and health.

Please **tick one** option for questions with **circles like this:**

Please **tick as many** options as apply for questions with **boxes like this:**

6. Please advise if your address has changed since the last questionnaire?
 Street number _____ Flat number _____
 Street name _____
 Suburb or rural locality _____ Post Code _____
 City, town or district _____
 Home telephone number _____
 Cell phone number _____

ABOUT YOUR SLEEP NOW

- When is your baby due? _____ / _____ / _____
 (day) (month) (year)
- How many weeks pregnant are you now? _____ weeks
- Who is providing professional health care for you in this pregnancy?
 Independent (self-employed) midwife/team
 Hospital based midwife/team
 Hospital high risk team
 Specialist Obstetrician
 Shared care (e.g. midwife & obstetrician, midwife & GP)
 No one
 Other: _____
- Please advise if your GP has changed since the last questionnaire?
 Name of GP: _____
 Name of Medical Centre: _____
 Phone: _____
- Please advise if your Midwife / Lead Maternity Carer has changed since the last questionnaire?
 Name of Midwife / UMC: _____
 Phone: _____
- During the past month, how many nights per week could you find a comfortable sleep position? (please circle one number)
 NO NIGHTS
 0 1 2 3 4 5 6 7
- During the past month, what sleeping position did you find yourself being most comfortable? (please tick one circle)
 1 Lying on your left side
 2 Lying on your right side
 3 Lying on either side
 4 Lying on your back
 5 Lying on your stomach
 6 Sitting upright / recumbent
 7 Other (please specify): _____
- During the past month, did you use any sleeping aids (e.g. pillows, mattress toppers) to help you sleep in a comfortable position? (comments welcome...)

- During the past month, when have you usually gone to bed?
 Usual bed time: _____ or _____
 AM PM
- During the past month, how long (in minutes) has it taken you to fall asleep each night?
 Number of minutes: _____
- During the past month, when have you usually gotten up in the morning?
 Usual get up time: _____ or _____
 AM PM

13. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed)

Actual sleep per night: _____ hours & _____ minutes

14. During the past month, how often have you had trouble sleeping because you: (please tick one circle on every line)

Cannot get to sleep within 30 minutes	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Wake up in the middle of the night or early morning	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have to get up to use the bathroom	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cannot breathe comfortably	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cough or snore loudly	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too cold	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too hot	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Had bad dreams	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have pain	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

15. During the past month, how would you rate your sleep quality overall? (please tick one circle)

Very good:

Fairly good:

Fairly bad:

Very bad:

16. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep? (please tick one circle)

Not during the past month

Less than once a week

Once or twice a week

Three or more times a week

17. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? (please tick one circle)

Not during the past month

Less than once a week

Once or twice a week

Three or more times a week

18. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? (please tick one circle)

No problem at all

Only a very slight problem

Somewhat of a problem

A very big problem

19. Do you have a bed partner or roommate? (please tick one circle)

No bed partner or roommate

Partner/roommate in another room

Partner/roommate in same room but not the same bed

Partner/roommate in the same bed

20. If you have a bed partner or roommate, how often in the past month would they say you had: (please tick one circle on every line)

Loud snoring	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Long pauses between breaths while asleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Legs twitching or jerking while you sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Episodes of disorientation or confusion during sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other restlessness while you sleep (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

21. In the last week, how often did you get a good night's sleep? (please circle one number)

NO NIGHTS

0	1	2	3	4	5	6	7
---	---	---	---	---	---	---	---

EVERY NIGHT

22. How many hours sleep do you usually get in 24 hours, including naps?

In the last week, please write the number of hours here: _____ hours

23. On how many days in the last week did you have a daytime nap? (please circle one number)

NO NIGHTS

0	1	2	3	4	5	6	7
---	---	---	---	---	---	---	---

EVERY NIGHT

IF YOU DID NOT NAP DURING THE LAST WEEK, PLEASE GO TO QUESTION 26. IF YOU HAVE HAD A NAP IN THE LAST WEEK, PLEASE GO TO THE NEXT QUESTION.

24. If you have had naps in the last week, how many hours or minutes would you sleep for?

Please write the number of hours and minutes here: _____ hours _____ minutes

25. If you have had had naps in the last week, what time of the day do you like to start napping?

Please write the time here: _____ AM or _____ PM

26. Do you consider that you have a sleep problem?

- 0 No
- 1 Yes, lasting less than 4 weeks
- 2 Yes, for 1-6 months
- 3 Yes, for more than 6 months

Comments welcome →

27. In the last 2 weeks, what has been the severity of the following **INSOMNIA** problem(s)? (please circle one number on every line)

	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
Difficulty falling asleep:	0	1	2	3	4
Difficulty staying asleep:	0	1	2	3	4
Problem waking too early:	0	1	2	3	4

28. How **SATISFIED/DISSATISFIED** are you with your current sleep pattern? (please circle one number)

	MODERATELY SATISFIED	SATISFIED	DISSATISFIED	VERY DISSATISFIED
0	1	2	3	4

29. How **NOTICEABLE** to others do you think your sleeping problem is in terms of impairing your quality of life? (please circle one number)

	NOT AT ALL NOTICEABLE	A LITTLE	SOMEWHAT	MUCH	VERY MUCH NOTICEABLE
0	1	2	3	4	

30. How **WORRIED/DISTRESSED** are you about your current sleep problem? (please circle one number)

	NOT AT ALL WORRIED	A LITTLE	SOMEWHAT	MUCH	VERY MUCH WORRIED
0	1	2	3	4	

31. To what extent do you consider your sleep problem to **INTERFERE** with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.) **CURRENTLY**? (please circle one number)

	NOT AT ALL INTERFERING	A LITTLE	SOMEWHAT	MUCH	VERY MUCH INTERFERING
0	1	2	3	4	

32. Does your sleep problem interfere with... (please tick one circle on every line)

	YES	NO	DON'T KNOW	NOT APPLICABLE
a. Your relationship with a child or children	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3
b. Your relationship with your spouse or partner	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3
c. Caring for your family	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3
d. Your relationship with your extended family or friends	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3

33. In the last week, have you experienced an urge to move your legs (usually accompanied by unpleasant sensations)?

- 1 Yes – if “Yes” please go to question 34
- 0 No – if “No” please go to question 35

34. If you answered “Yes” to Question 33, is this: (please tick as many options that apply to you)

- 1 Worse at night?
- 2 More noticeable when you rest?
- 3 Relieved by movement?

35. Are you satisfied with the amount, quality, and timing of your sleep?

- 1 Yes
- 0 No – if No, would you like to (please tick as many options that apply to you):
 - Sleep more
 - Sleep less
 - Have more refreshing sleep
 - Go to sleep earlier
 - Go to sleep later
 - Get up earlier
 - Get up later

36. Most nights, do you sleep... (please tick as many options that apply to you)

- Alone
- With your partner/significant other
- With other children
- With a pet
- Or with someone or something else? (please specify) _____

37. On days when you are scheduled to work, study, care for others or have other regular commitments:

- a. I have to get up at _____ AM or _____ PM
- b. To wake up I need _____ minutes
- c. I regularly wake up: 1 before the alarm 2 with the alarm 3 don't use an alarm
- d. I am fully awake from _____ AM or _____ PM
- e. I have an energy dip at _____ AM or _____ PM
- f. On nights before scheduled (e.g. work) days, I go to bed at _____ AM or _____ PM
- g. To fall asleep when I go to bed takes me _____ minutes
- h. If I get the chance, I like to take a nap. 1 Yes 0 No
- i. If you nap: I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

38. Imagine having free days (days when you are NOT scheduled to work, study, care for others or have no other regular commitments). On free days:

- a. Ideally, I would sleep in until _____ AM or _____ PM
- b. I normally wake up at _____ AM or _____ PM
- c. If I wake up at around the normal (scheduled/work day) alarm time, I try to get back to sleep. 1 Yes 0 No
- d. If I get back to sleep, I sleep for another _____ minutes
- e. I am fully awake from _____ AM or _____ PM
- f. I have an energy dip at around _____ AM or _____ PM
- g. On nights before free days, I go to bed at _____ AM or _____ PM
- h. To fall asleep when I go to bed takes me _____ minutes
- i. If I get the chance, I like to take a nap. 1 Yes 0 No
- j. If you nap: I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

39. Do you usually watch TV or read in bed before falling asleep?
1 Yes 0 No

40. If YES, once I am in bed, I would like to watch TV or read for _____ minutes, but I normally fall asleep after a maximum of _____ minutes.

41. Do you prefer to sleep in a completely dark room?

1 Yes 0 No

42. Do you wake up more easily when morning light shines into your room?

1 Yes 0 No

43. How long on average per day do you spend outside (really outside) exposed to daylight?

On scheduled days: _____ hours & _____ minutes

On free days: _____ hours & _____ minutes

44. How often in the last week did you: (please circle one number on every line)

	NO	DAYS/NIGHTS	EVERY DAY/NIGHT
a. Have difficulty getting to sleep.....	0	1 2 3 4 5 6 7	7
b. Wake up during your sleep period.....	0	1 2 3 4 5 6 7	7
c. Wake up too early at the end of a sleep period.....	0	1 2 3 4 5 6 7	7
d. Feel rested upon awakening at the end of a sleep period.....	0	1 2 3 4 5 6 7	7
e. Sleep poorly.....	0	1 2 3 4 5 6 7	7
f. Feel sleepy during the day.....	0	1 2 3 4 5 6 7	7
g. Struggle to stay awake during the day.....	0	1 2 3 4 5 6 7	7
h. Feel irritable during the day.....	0	1 2 3 4 5 6 7	7
i. Feel tired or fatigued during the day.....	0	1 2 3 4 5 6 7	7
j. Feel satisfied with the quality of your sleep.....	0	1 2 3 4 5 6 7	7
k. Feel alert and energetic during the day.....	0	1 2 3 4 5 6 7	7
l. Get too much sleep.....	0	1 2 3 4 5 6 7	7
m. Get too little sleep.....	0	1 2 3 4 5 6 7	7
n. Take a nap at a scheduled time.....	0	1 2 3 4 5 6 7	7
o. Fall asleep at an unscheduled time.....	0	1 2 3 4 5 6 7	7
p. Drink an alcoholic beverage to help you get to sleep.....	0	1 2 3 4 5 6 7	7
q. Use tobacco to help you get to sleep.....	0	1 2 3 4 5 6 7	7
r. Use herbal product to help you get to sleep.....	0	1 2 3 4 5 6 7	7
s. Use an over-the-counter sleeping pill to help you get to sleep.....	0	1 2 3 4 5 6 7	7
t. Use a prescription sleeping pill to help you get to sleep.....	0	1 2 3 4 5 6 7	7
u. Use any pain medication to help you get to sleep..... (e.g. Panadol)	0	1 2 3 4 5 6 7	7
v. Take anything else to help you sleep.....	0	1 2 3 4 5 6 7	7

If so, what did you take to help you sleep: _____

45. In the last week what, if anything, woke you up during the night? (please tick *as many* options that apply to you)

- Noise
- Pain
- Stress
- Too hot or too cold
- Light
- Unable to get comfortable
- Dreams
- Nightmares
- The need to go to the bathroom
- Wake up for no apparent reason
- Heartburn
- Nasal Congestion
- Leg Cramps
- Contractions
- Baby moving/kicking
- Giving care to child
- Giving care to elderly parent
- Giving care to someone else
- Spouse/bed partner
- Hungry/thirsty
- Medication side effects
- Pets
- Text messages or alerts from phone or other electronic device (not pre-set alarms)
- Can't breathe comfortably
- Worrying or thinking about a child's behaviour
- Worrying or thinking about a disabled or ill family member (adult or child)
- Worrying or thinking about *current* housing difficulties
- Worrying or thinking about money/finance problems
- Worrying or thinking about world or current events
- Worrying or thinking about balancing work and family
- Worrying or thinking about family members not getting on
- Worrying or thinking about who does household chores
- Something else: (please specify) _____
- Nothing awakens me at night
- Don't know

46. Thinking about your sleep and sleep habits within the past month, how often have you done the following in the hour before you went to bed? (please tick *one* circle *on every line*)

- | | EVERY NIGHT
OR ALMOST
EVERY NIGHT | A FEW
NIGHTS A
WEEK | A FEW
NIGHTS A
MONTH | RARELY | NEVER |
|---|---|---------------------------|----------------------------|-----------------------|-----------------------|
| a. Did work relating to your job or study | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Watched TV/movie | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Listened to the radio or music | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Were on the computer or internet | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read a book | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Exercised | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Did activities with children | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| h. Did activities with family / friends | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| i. Drank a caffeinated beverage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| j. Drank an alcoholic beverage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| k. Took a hot bath or shower | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| l. Completed household chores | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

47. How frequently do you do the following in the hour before going to sleep? (please tick *one* circle *on every line*)

- | | EVERY NIGHT
OR ALMOST
EVERY NIGHT | A FEW
NIGHTS A
WEEK | A FEW
NIGHTS A
MONTH | RARELY | NEVER |
|---|---|---------------------------|----------------------------|-----------------------|-----------------------|
| a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Listen to radio or music (e.g. using a radio or MP3 player) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Play games (e.g. using a computer, phone or gaming console) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Surf internet or use social media (e.g. Facebook/texting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other activities using technology | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

↓ Please specify _____

48. How frequently do you do the following to help fall asleep? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Listen to radio or music (e.g. using a Radio, iPod or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Surf internet or use social media (e.g. Facebook/texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Other activities using technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please specify _____

49. Do you have the following technology in your bedroom? (please tick as many options that apply to you)

TV / computer / laptop / DVD player

Cellphone - not a smart phone (e.g. pager / Blackberry)

Gaming console

e-reader with a bright screen (e.g. Kobo, iPad, other tablet)

Smart phone

Radio or other music only player (e.g. MP3)

e-reader without a bright screen (e.g. non-backlit Kindle)

None

Other technology ➔ Please specify _____

50. Thinking about your typical day, what are you unable to do because you are too sleepy? Are you too sleepy to: (please tick one circle on every line)

	YES, TOO SLEEPY	NO
a. Do job-related work	<input type="radio"/>	<input type="radio"/>
b. Spend time with family or friends	<input type="radio"/>	<input type="radio"/>
c. Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>
e. Exercise	<input type="radio"/>	<input type="radio"/>
d. Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>

51. Thinking about your typical day, what are you unable to do because you run out of time? Do you wish you had more time to: (please tick one circle on every line)

	YES, RUN OUT OF TIME	NO
a. Do job-related work	<input type="radio"/>	<input type="radio"/>
b. Spend time with family or friends	<input type="radio"/>	<input type="radio"/>
c. Sleep	<input type="radio"/>	<input type="radio"/>
d. Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>
e. Exercise	<input type="radio"/>	<input type="radio"/>
f. Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>

52. In your usual way of life in recent times, how likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? (please tick one circle on every line)

	WOULD NEVER DOZE	SLIGHT CHANGE	MODERATE CHANGE	HIGH CHANGE
a. Sitting and reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Watching TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Sitting inactive in a public place (e.g. movies, meeting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. As a passenger in a car for an hour without a break	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Lying down in the afternoon when circumstances permit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Sitting and talking to someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Sitting quietly after a lunch without alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. In a car, while stopped for a few minutes in traffic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

53. If you have other children over the age of three years of age living with you, how much does their sleep affect.... (please circle one number on every line)

	NO NIGHTS/ DAYS	1	2	3	4	5	6	7
a. Your bed time?	0	1	2	3	4	5	6	7
b. Your get up time?	0	1	2	3	4	5	6	7
c. The number of times you wake at night?	0	1	2	3	4	5	6	7
d. The amount of sleep you get at night?	0	1	2	3	4	5	6	7
e. How sleepy you are during the day?	0	1	2	3	4	5	6	7
f. Your mood during the day?	0	1	2	3	4	5	6	7
g. Your ability to do things during the day?	0	1	2	3	4	5	6	7

54. In the past year, how often have you driven a car or motor vehicle while feeling drowsy? Would you say you have driven drowsy.... (please tick one circle)
- 1. 3 or more times a week
 - 2. 1 to 2 times a week
 - 3. 1 to 2 times a month
 - 4. Less than once a month, or
 - 5. Never
 - 6. Don't drive / Don't have a license / Don't have a car

ABOUT YOUR PREGNANCY

55. In general, would you say that your health is: (please tick one circle)
- Excellent
 - Very good
 - Good
 - Fair
 - Poor
 - Don't know

56. Are you currently having any treatment or monitoring for any of these conditions? (please tick one circle on every line)
- | | YES | NO |
|---|-----------------------|-----------------------|
| a) High blood pressure (including hypertension, pre-eclampsia, toxemia, chronic hypertension) | <input type="radio"/> | <input type="radio"/> |
| b) Pregnancy or pre-existing diabetes (gestational diabetes managed using dietary control, with or without insulin) | <input type="radio"/> | <input type="radio"/> |
| c) Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| d) Abnormal vaginal bleeding | <input type="radio"/> | <input type="radio"/> |
| e) Placenta/when low down near the cervix (placenta praevia/low lying placenta) | <input type="radio"/> | <input type="radio"/> |

57. Are you currently having any treatment or monitoring for any of these conditions? (please tick one circle on every line)
- | | YES | NO |
|---|-----------------------|-----------------------|
| Heart disease | <input type="radio"/> | <input type="radio"/> |
| Stroke | <input type="radio"/> | <input type="radio"/> |
| Diabetes | <input type="radio"/> | <input type="radio"/> |
| Asthma | <input type="radio"/> | <input type="radio"/> |
| Arthritis | <input type="radio"/> | <input type="radio"/> |
| Spinal disorder | <input type="radio"/> | <input type="radio"/> |
| Osteoporosis | <input type="radio"/> | <input type="radio"/> |
| Cancer | <input type="radio"/> | <input type="radio"/> |
| Anxiety (please describe _____) | <input type="radio"/> | <input type="radio"/> |
| Depression | <input type="radio"/> | <input type="radio"/> |
| Other mental illness (please specify _____) | <input type="radio"/> | <input type="radio"/> |
| Chronic pain | <input type="radio"/> | <input type="radio"/> |
| High blood pressure (hypertension) | <input type="radio"/> | <input type="radio"/> |
| High cholesterol | <input type="radio"/> | <input type="radio"/> |
| Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| Allergies | <input type="radio"/> | <input type="radio"/> |
| Thyroid problem | <input type="radio"/> | <input type="radio"/> |
| Respiratory illness | <input type="radio"/> | <input type="radio"/> |
| Other (please specify _____) | <input type="radio"/> | <input type="radio"/> |

58. Please list any medicines you are currently taking.

59. Does anyone smoke inside your house? (please tick one circle)
- 3. Yes
 - 2. Sometimes
 - 1. No

60. During this pregnancy, how often do you drink alcohol? (please tick one circle)
- | | | | | |
|--------------------------------|--|--|--|--------------------------------|
| 0. <input type="radio"/> NEVER | 1. <input type="radio"/> LESS THAN ONCE A WEEK | 2. <input type="radio"/> ONCE EVERY 3-7 DAYS | 3. <input type="radio"/> ONCE EVERY 2 DAYS | 4. <input type="radio"/> DAILY |
|--------------------------------|--|--|--|--------------------------------|

61. During this pregnancy, on a typical drinking occasion, how many drinks do you have? (One drink equals a glass of beer or a glass of wine or a nip of spirits)? *(please tick ONE circle)*

0 NONE LESS THAN 2 DRINKS 2 TO 4 DRINKS 5 TO 6 DRINKS MORE THAN 6 DRINKS
 1 2 3 4

62. During this pregnancy, how often do you use street or recreational drugs, including party pills? *(please tick ONE number)*

0 NEVER LESS THAN ONCE A WEEK 1 ONCE EVERY 3 TO 7 DAYS 2 ONCE EVERY 2 DAY 3 ONCE EVERY 2 DAY 4 DAILY

63. During this pregnancy have you been distressed by feelings of anxiety or depression for two weeks or more?
 0 No *please go to Question 66* 1 Yes *please go to question 64*

64. During this pregnancy has your feelings of anxiety or depression interfere with your ability to get things done or your relationships with family and friends? *(please circle ONE number)*

0 NOT AT ALL 1 SOMEWHAT 2 3 4 5 VERY MUCH

65. During this pregnancy has your feelings of anxiety or depression lead you to seek professional help?
 1 Yes 0 No

ABOUT YOU

66. If you have a partner, how is your relationship with them at the moment? *(please circle ONE number)*

PERFECTLY HAPPY 0 1 2 3 4 5 6 7 EXTREMELY UNHAPPY 8 Not applicable

67. How supportive of this pregnancy is your partner? *(please circle ONE number)*

COMPLETELY SUPPORTIVE 0 1 2 3 4 5 6 7 NOT AT ALL SUPPORTIVE 8 Not applicable

68. Do you have the following types of support? *(please tick ONE circle on every line)*

- a. Financial support
 I don't need any support I would like a lot more support I have enough support
- b. Emotional support (e.g. someone who listens or is 'there' for you)
 I don't need any support I would like a lot more support I have enough support
- c. Advice (e.g. someone you can go to for information or guidance)
 I don't need any support I would like a lot more support I have enough support
- d. Concrete/Practical support (e.g. childcare, housework, cooking)
 I don't need any support I would like a lot more support I have enough support

69. Are you attending, studying or enrolled at school or anywhere else?

- Full-time (20 hours or more a week)
- Part-time (less than 20 hours a week)
- Neither of these

70. Do you currently work for pay, profit or income?

- 1 Yes, one paid job
- 2 Yes, more than one paid job
- 0 No *Comments welcome →*

If you answered 'Yes' go to question 71, if you answered 'No' please go to question 74.

71. In the **LAST WEEK**, how many hours did you work for pay, profit or income?

Please write how many hours here → _____ hours

72. In the **LAST WEEK**, on how many nights did you work for pay, profit or income for at least 3 hours between midnight and 5am? *(please circle ONE number)*

Circle the number of nights

EVERY NIGHT	7
EVERY NIGHT	6
EVERY NIGHT	5
EVERY NIGHT	4
EVERY NIGHT	3
EVERY NIGHT	2
EVERY NIGHT	1
EVERY NIGHT	0

73. Overall how satisfied are you with the balance between your work and other aspects of your life such as time with your family or leisure? *(please tick one circle)*

- Very dissatisfied
- Dissatisfied
- Neither satisfied nor dissatisfied
- Satisfied
- Very satisfied

74. This question is about things that may have happened during the last 12 months. *(please tick as many options that apply to you)*

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

75. Please check the answer that comes closest to how you have felt in the past 7 days, not just how you feel today...

- a. I have been able to laugh and see the funny side of things
 - 0 As much as I always could
 - 1 Not quite so much now
 - 2 Definitely not so much now
 - 3 Not at all
- b. I have looked forward with enjoyment to things
 - 0 As much as I ever did
 - 1 Rather less than I used to
 - 2 Definitely less than I used to
 - 3 Hardly at all

c. I have blamed myself unnecessarily when things went wrong

- 3 Yes, most of the time
- 2 Yes, some of the time
- 1 Not very often
- 0 No, never

d. I have been anxious or worried for no good reason

- 0 No, not at all
- 1 Hardly ever
- 2 Yes, sometimes
- 3 Yes, very often

e. I have felt scared or panicky for no good reason

- 3 Yes, quite a lot
- 2 Yes, sometimes
- 1 No, not much
- 0 No, not at all

f. Things have been getting on top of me

- 3 Yes, most of the time I haven't been able to cope at all
- 2 Yes, sometimes I haven't been coping as well as usual
- 1 No, most of the time I have coped quite well
- 0 No, I have been coping as well as ever

g. I have been so unhappy that I have had difficulty sleeping

- 3 Yes, most of the time
- 2 Yes, sometimes
- 1 Not very often
- 0 No, not at all

h. I have felt sad or miserable

- 3 Yes, most of the time
- 2 Yes, quite often
- 1 Not very often
- 0 No, not at all

77. Listed below are a few statements about your relationships with others. How much is each statement TRUE or FALSE for you? (Please tick one circle on every line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
I am always courteous even to people who are disagreeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There have been occasions when I took a advantage of someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes try to get even rather than forgive and forget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes feel resentful when I don't get my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter who I'm talking to, I'm always a good listener	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

78. Date questionnaire completed: _____ / _____ / _____ (day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

Important note
If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Midwife/Lead Maternity Carer, GP/doctor or other health professional.


- i. I have been so unhappy that I have been crying
 - 3 Yes, most of the time
 - 2 Yes, quite often
 - 1 Only occasionally
 - 0 No, never
- j. The thought of harming myself has occurred to me
 - 3 Yes, quite often
 - 2 Sometimes
 - 1 Hardly ever
 - 0 Never

76. Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt. (Please tick one circle on every line)


	Not at all true	Rarely true	Sometimes true	Often true	True nearly all the time
I am able to adapt when changes occur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can deal with whatever comes my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to see the humorous side of things when I am faced with problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having to cope with stress can make me stronger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to bounce back after illness, injury, or other hardships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I can achieve my goals, even if there are obstacles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Under pressure, I stay focused and think clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not easily discouraged by failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of myself as a strong person when dealing with life's challenges and difficulties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to handle unpleasant or painful feelings like sadness, fear and anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

All rights reserved. No part of this scale may be reproduced or transmitted in any form, or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from Dr. Davidson at J.Davidson@JHU.edu. Copyright © 2001, 2003, 2007, 2011 by Kathryn M. Connor, M.D. and Jonathan R.T. Davidson, M.D.

APPENDIX 21 TRIMESTER 3 QUESTIONNAIRE, SLEEP HAPI STUDY



Sleep and Health during Pregnancy



SLEEP-HAPI
PREGNANT WOMEN

THIS QUESTIONNAIRE SHOULD BE COMPLETED WHEN YOU ARE 33-36 WEEKS PREGNANT

This questionnaire is about your sleep and health.

Please **tick one** option for questions with **circles** like this:

Please **tick as many** options as apply for questions with **boxes** like this:

6. Please advise if your address has changed since the last questionnaire?

Street number _____ Flat number _____

Street name _____

Suburb or rural locality _____ Post Code _____

City, town or district _____

Home telephone number _____

Cell phone number _____

ABOUT YOUR SLEEP NOW

7. During the past month, how many nights per week could you find a comfortable sleep position? (please circle one number)
- | | | | | | | | |
|-------------|---|---|---|---|---|---|---|
| NO | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| EVERY NIGHT | | | | | | | |
8. During the past month, what sleeping position did you find yourself being most comfortable? (please tick one circle)
- 1 Lying on your left side
- 2 Lying on your right side
- 3 Lying on either side
- 4 Lying on your back
- 5 Lying on your stomach
- 6 Sitting upright / recumbent
- 7 Other (please specify): _____
9. During the past month, did you use any sleeping aids (e.g. pillows, mattress toppers) to help you sleep in a comfortable position? (comments welcome...)
10. During the past month, when have you usually gone to bed?
- Usual bed time: _____ or _____
11. During the past month, how long (in minutes) has it taken you to fall asleep each night?
- Number of minutes: _____
12. During the past month, when have you usually gotten up in the morning?
- Usual get up time: _____ or _____

1. When is your baby due? _____ / _____ / _____ (day) / _____ (month) / _____ (year)
2. How many weeks pregnant are you now? _____ weeks
3. Who is providing professional health care for you in this pregnancy?
- Independent (self-employed) midwife/team
- Hospital based midwife/team
- Hospital high risk team
- Specialist Obstetrician
- Shared care (e.g. midwife & obstetrician, midwife & GP)
- No one
- Other: _____

4. Please advise if your GP has changed since the last questionnaire?

Name of GP: _____

Name of Medical Centre: _____

Phone: _____

5. Please advise if your Midwife / Lead Maternity Carer has changed since the last questionnaire?

Name of Midwife / LMC: _____

Phone: _____

13. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed)

Actual sleep per night: _____ hours & _____ minutes

14. During the past month, how often have you had trouble sleeping because you: (please tick one circle on every line)

Cannot get to sleep within 30 minutes	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Wake up in the middle of the night or early morning	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have to get up to use the bathroom	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cannot breathe comfortably	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cough or snore loudly	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too cold	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too hot	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Had bad dreams	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have pain	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

15. During the past month, how would you rate your sleep quality overall? (please tick one circle)

- Very good:
- Fairly good:
- Fairly bad:
- Very bad:

16. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep? (please tick one circle)

- Not during the past month
- Less than once a week
- Once or twice a week
- Three or more times a week

17. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? (please tick one circle)

- Not during the past month
- Less than once a week
- Once or twice a week
- Three or more times a week

18. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? (please tick one circle)

- No problem at all
- Only a very slight problem
- Somewhat of a problem
- A very big problem

19. Do you have a bed partner or roommate? (please tick one circle)

- No bed partner or roommate
- Partner/roommate in another room
- Partner/roommate in same room but not the same bed
- Partner/roommate in the same bed

20. If you have a bed partner or roommate, how often in the past month would they say you had: (please tick one circle on every line)

Loud snoring	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Long pauses between breaths while asleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Legs twitching or jerking while you sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Episodes of disorientation or confusion during sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other restlessness while you sleep (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

21. In the last week, how often did you get a good night's sleep? (please circle one number)

NO NIGHTS	0	1	2	3	4	5	6	7
EVERY NIGHT								

22. How many hours sleep do you usually get in 24 hours, including naps?

In the last week, please write the number of hours here: _____ hours

23. On how many days in the last week did you have a daytime nap? (please circle one number)

NO NIGHTS	0	1	2	3	4	5	6	7
EVERY NIGHT								

IF YOU DID NOT NAP DURING THE LAST WEEK, PLEASE GO TO QUESTION 26. IF YOU HAVE HAD A NAP IN THE LAST WEEK, PLEASE GO TO THE NEXT QUESTION.

24. If you have had naps in the last week, how many hours or minutes would you sleep for?

Please write the number of hours and minutes here: _____ hours _____ minutes

25. If you have had naps in the last week, what time of the day do you like to start napping?

Please write the time here: _____ AM or _____ PM

26. Do you consider that you have a sleep problem?

- 0 No
- 1 Yes, lasting less than 4 weeks
- 2 Yes, for 1-6 months
- 3 Yes, for more than 6 months

Comments welcome →

27. In the last 2 weeks, what has been the severity of the following **INSOMNIA** problem(s)? (please circle one number as every line)

	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
Difficulty falling asleep:	0	1	2	3	4
Difficulty staying asleep:	0	1	2	3	4
Problem waking too early:	0	1	2	3	4

28. How **SATISFIED/DISSATISFIED** are you with your current sleep pattern? (please circle one number)

	VERY SATISFIED	MODERATELY SATISFIED	SATISFIED	DISSATISFIED	VERY DISSATISFIED
	0	1	2	3	4

29. How **NOTICEABLE** to others do you think your sleeping problem is in terms of impairing your quality of life? (please circle one number)

	NOT AT ALL NOTICEABLE	ALITTLE	SOMEWHAT	MUCH	VERY MUCH NOTICEABLE
	0	1	2	3	4

30. How **WORRIED/DISTRESSED** are you about your current sleep problem? (please circle one number)

	NOT AT ALL WORRIED	ALITTLE	SOMEWHAT	MUCH	VERY MUCH WORRIED
	0	1	2	3	4

31. To what extent do you consider your sleep problem to **INTERFERE** with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.) **CURRENTLY**? (please circle one number)

	NOT AT ALL INTERFERING	ALITTLE	SOMEWHAT	MUCH	VERY MUCH INTERFERING
	0	1	2	3	4

32. Does your sleep problem interfere with... (please tick one circle as every line)

	YES	NO	DON'T KNOW	NOT APPLICABLE
a. Your relationship with a child or children	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3
b. Your relationship with your spouse or partner	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3
c. Caring for your family	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3
d. Your relationship with your extended family or friends	<input type="radio"/> 1	<input type="radio"/> 0	<input type="radio"/> 2	<input type="radio"/> 3

33. In the last week, have you experienced an urge to move your legs (usually accompanied by unpleasant sensations)?

- 1 Yes – if "Yes", please go to question 34
- 0 No – if "No" please go to question 35

34. If you answered "Yes" to Question 33, is this: (please tick as many options that apply to you)

- 1 Worse at night?
- 2 More noticeable when you rest?
- 3 Relieved by movement?

35. Are you satisfied with the amount, quality, and timing of your sleep?

- 1 Yes
- 0 No – if No, would you like to (please tick as many options that apply to you):
 - Sleep more
 - Sleep less
 - Have more refreshing sleep
 - Go to sleep earlier
 - Go to sleep later
 - Get up earlier
 - Get up later

36. Most nights, do you sleep... (please tick as many options that apply to you)

- Alone
- With your partner/significant other
- With other children
- With a pet
- Or with someone or something else? (please specify) _____

37. On days when you are scheduled to work, study, care for others or have other regular commitments:

- a. I have to get up at _____ AM or _____ PM
- b. To wake up I need _____ minutes
- c. I regularly wake up: 1 before the alarm 2 with the alarm 3 don't use an alarm
- d. I am fully awake from _____ AM or _____ PM
- e. I have an energy dip at _____ AM or _____ PM
- f. On nights before scheduled (e.g. work) days, I go to bed at _____ AM or _____ PM
- g. To fall asleep when I go to bed takes me _____ minutes
- h. If I get the chance, I like to take a nap. 1 Yes 0 No
- i. If you nap: I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

38. **Imagine having free days** (days when you are **NOT** scheduled to work, study, care for others or have no other regular commitments). **On free days:**

- a. Ideally, I would sleep in until _____ AM or _____ PM
- b. I normally wake up at _____ AM or _____ PM
- c. If I wake up at around the normal (scheduled/work day) alarm time, I try to get back to sleep. 1 Yes 0 No
- d. If I get back to sleep, I sleep for another _____ minutes
- e. I am fully awake from _____ AM or _____ PM
- f. I have an energy dip at around _____ AM or _____ PM
- g. On nights before free days, I go to bed at _____ AM or _____ PM
- h. To fall asleep when I go to bed takes me _____ minutes
- i. If I get the chance, I like to take a nap. 1 Yes 0 No
- j. If you nap: I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

39. Do you usually watch TV or read in bed before falling asleep?
1 Yes 0 No

40. If YES, once I am in bed, I would like to watch TV or read for _____ minutes, but I normally fall asleep after a maximum of _____ minutes.

41. Do you prefer to sleep in a completely dark room?
1 Yes 0 No

42. Do you wake up more easily when morning light shines into your room?
1 Yes 0 No

43. How long on average per day do you spend outside (really outside) exposed to daylight?

On scheduled days: _____ hours & _____ minutes
On free days: _____ hours & _____ minutes

44. How often in the last week did you: (please circle one number on every line)

	NO	DAYS/NIGHTS	EVERY DAY/NIGHT
a. Have difficulty getting to sleep.....	0	1 2 3 4 5 6 7	7
b. Wake up during your sleep period.....	0	1 2 3 4 5 6 7	7
c. Wake up too early at the end of a sleep period.....	0	1 2 3 4 5 6 7	7
d. Feel rested upon awakening at the end of a sleep period..	0	1 2 3 4 5 6 7	7
e. Sleep poorly.....	0	1 2 3 4 5 6 7	7
f. Feel sleepy during the day.....	0	1 2 3 4 5 6 7	7
g. Struggle to stay awake during the day.....	0	1 2 3 4 5 6 7	7
h. Feel irritable during the day.....	0	1 2 3 4 5 6 7	7
i. Feel tired or fatigued during the day.....	0	1 2 3 4 5 6 7	7
j. Feel satisfied with the quality of your sleep.....	0	1 2 3 4 5 6 7	7
k. Feel alert and energetic during the day.....	0	1 2 3 4 5 6 7	7
l. Get too much sleep.....	0	1 2 3 4 5 6 7	7
m. Take a nap at a scheduled time.....	0	1 2 3 4 5 6 7	7
n. Fall asleep at an unscheduled time.....	0	1 2 3 4 5 6 7	7
o. Drink an alcoholic beverage to help you get to sleep.....	0	1 2 3 4 5 6 7	7
p. Use tobacco to help you get to sleep.....	0	1 2 3 4 5 6 7	7
q. Use herbal product to help you get to sleep.....	0	1 2 3 4 5 6 7	7
r. Use an over-the-counter sleeping pill to help you.....	0	1 2 3 4 5 6 7	7
s. get to sleep			
t. Use a prescription sleeping pill to help you get to sleep....	0	1 2 3 4 5 6 7	7
u. Use any pain medication to help you get to sleep.....	0	1 2 3 4 5 6 7	7
v. Take anything else to help you sleep.....	0	1 2 3 4 5 6 7	7

If so, what did you take to help you sleep: _____

46. Thinking about your sleep and sleep habits within the past month, how often have you done the following in the hour before you went to bed? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Did work relating to your job or study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Watched TV/movie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Listened to the radio or music	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Were on the computer or internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read a book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Exercised	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Did activities with children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Did activities with family / friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Drank a caffeinated beverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Drank an alcoholic beverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Took a hot bath or shower	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. Completed household chores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

47. How frequently do you do the following in the hour before going to sleep? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Listen to radio or music (e.g. using a radio or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Surf internet or use social media (e.g. Facebook/texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other activities using technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please specify _____

45. In the last week what, if anything, woke you up during the night? (please tick as many options that apply to you)

- Noise
- Pain
- Stress
- Too hot or too cold
- Light
- Unable to get comfortable
- Dreams
- Nightmares
- The need to go to the bathroom
- Wake up for no apparent reason
- Heartburn
- Nasal Congestion
- Leg Cramps
- Contractions
- Baby moving/kicking
- Giving care to child
- Giving care to elderly parent
- Giving care to someone else
- Spouse/bed partner
- Hungry/thirsty
- Medication side effects
- Pets
- Text messages or alerts from phone or other electronic device (not pre-set alarms)
- Can't breathe comfortably
- Worrying or thinking about a child's behaviour
- Worrying or thinking about a disabled or ill family member (adult or child)
- Worrying or thinking about current housing difficulties
- Worrying or thinking about money/finance problems
- Worrying or thinking about world or current events
- Worrying or thinking about balancing work and family
- Worrying or thinking about family members not getting on
- Worrying or thinking about who does household chores
- Something else (please specify) _____
- Nothing awakens me at night
- Don't know

51. Thinking about your typical day, what are you unable to do because you run out of time? Do you wish you had more time to: (please tick one circle on every line)

- | | YES, RUN OUT OF TIME | NO |
|---|-----------------------|-----------------------|
| a. Do job-related work | <input type="radio"/> | <input type="radio"/> |
| b. Spend time with family or friends | <input type="radio"/> | <input type="radio"/> |
| c. Sleep | <input type="radio"/> | <input type="radio"/> |
| d. Do leisure activities such as watching TV or reading | <input type="radio"/> | <input type="radio"/> |
| e. Exercise | <input type="radio"/> | <input type="radio"/> |
| f. Eat right or cook a healthy meal | <input type="radio"/> | <input type="radio"/> |

52. In your usual way of life in recent times, how likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? (please tick one circle on every line)

- | | WOULD NEVER DOZE | SLIGHT CHANCE | MODERATE CHANCE | HIGH CHANCE |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Sitting and reading | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Watching TV | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Sitting inactive in a public place (e.g. movies, meeting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. As a passenger in a car for an hour without a break | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Lying down in the afternoon when circumstances permit | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Sitting and talking to someone | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Sitting quietly after a lunch without alcohol | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| h. In a car, while stopped for a few minutes in traffic | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

53. If you have other children over the age of three years of age living with you, how much does their sleep affect..... (please circle one number on every line)

- | | NO NIGHTS/DAYS | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|----------------|---|---|---|---|---|---|---|
| a. Your bed time? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b. Your get up time? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c. The number of times you wake at night? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| d. The amount of sleep you get at night? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| e. How sleepy you are during the day? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| f. Your mood during the day? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| g. Your ability to do things during the day? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

48. How frequently do you do the following to help fall asleep? (please tick one circle on every line)

- | | EVERY NIGHT OR ALMOST EVERY NIGHT | A FEW NIGHTS A WEEK | A FEW NIGHTS A MONTH | RARELY | NEVER |
|---|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Listen to radio or music (e.g. using a Radio, iPod or MP3 player) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Play games (e.g. using a computer, phone or gaming console) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Surf internet or use social media (e.g. Facebook/texting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Other activities using technology | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Please specify _____

49. Do you have the following technology in your bedroom? (please tick as many options that apply to you)

- TV / computer / laptop / DVD player
- Gaming console
- Smart phone
- Radio or other music only player (e.g. MP3)
- None
- Other technology → Please specify _____
- Cellphone - not a smart phone (e.g. pager / Blackberry)
- e-reader with a bright screen (e.g. Kobo, iPad, other tablet)
- e-reader without a bright screen (e.g. non-backlit Kindle)

50. Thinking about your typical day, what are you unable to do because you are too sleepy? Are you too sleepy to: (please tick one circle on every line)

- | | YES, TOO SLEEPY | NO |
|---|-----------------------|-----------------------|
| a. Do job-related work | <input type="radio"/> | <input type="radio"/> |
| b. Spend time with family or friends | <input type="radio"/> | <input type="radio"/> |
| c. Do leisure activities such as watching TV or reading | <input type="radio"/> | <input type="radio"/> |
| e. Exercise | <input type="radio"/> | <input type="radio"/> |
| d. Eat right or cook a healthy meal | <input type="radio"/> | <input type="radio"/> |

54. In the past year, how often have you driven a car or motor vehicle while feeling drowsy? Would you say you have driven drowsy, ... (please tick one circle)
- 1 3 or more times a week
 - 2 1 to 2 times a week
 - 3 1 to 2 times a month
 - 4 Less than once a month, or
 - 5 Never
 - 6 Don't drive / Don't have a license / Don't have a car

ABOUT YOUR PREGNANCY

55. In general, would you say that your health is: (please tick one circle)
- Excellent
 - Very good
 - Good
 - Fair
 - Poor
 - Don't know

56. Are you currently having any treatment or monitoring for any of these conditions? (please tick one circle on every line)
- | | YES | NO |
|---|-----------------------|-----------------------|
| a) High blood pressure (including hypertension, pre-eclampsia, toxemia, chronic hypertension) | <input type="radio"/> | <input type="radio"/> |
| b) Pregnancy or pre-existing diabetes (gestational diabetes managed using dietary control, with or without insulin) | <input type="radio"/> | <input type="radio"/> |
| c) Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| d) Abnormal vaginal bleeding | <input type="radio"/> | <input type="radio"/> |
| e) Placenta/whitena low down near the cervix (placenta praevia/low lying placenta) | <input type="radio"/> | <input type="radio"/> |

57. Are you currently having any treatment or monitoring for any of these conditions? (please tick one circle on every line)
- | | YES | NO |
|---|-----------------------|-----------------------|
| Heart disease | <input type="radio"/> | <input type="radio"/> |
| Stroke | <input type="radio"/> | <input type="radio"/> |
| Diabetes | <input type="radio"/> | <input type="radio"/> |
| Asthma | <input type="radio"/> | <input type="radio"/> |
| Arthritis | <input type="radio"/> | <input type="radio"/> |
| Spinal disorder | <input type="radio"/> | <input type="radio"/> |
| Osteoporosis | <input type="radio"/> | <input type="radio"/> |
| Cancer | <input type="radio"/> | <input type="radio"/> |
| Anxiety (please describe _____) | <input type="radio"/> | <input type="radio"/> |
| Depression | <input type="radio"/> | <input type="radio"/> |
| Other mental illness (please specify _____) | <input type="radio"/> | <input type="radio"/> |
| Chronic pain | <input type="radio"/> | <input type="radio"/> |
| High blood pressure (hypertension) | <input type="radio"/> | <input type="radio"/> |
| High cholesterol | <input type="radio"/> | <input type="radio"/> |
| Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| Allergies | <input type="radio"/> | <input type="radio"/> |
| Thyroid problem | <input type="radio"/> | <input type="radio"/> |
| Respiratory illness | <input type="radio"/> | <input type="radio"/> |
| Other (please specify _____) | <input type="radio"/> | <input type="radio"/> |

58. Please list any medicines you are currently taking.

59. Does anyone smoke inside your house? (please tick one circle)
- 3 Yes
 - 2 Sometimes
 - 1 No

60. During this pregnancy, how often do you drink alcohol? (please tick one circle)
- | | | | | | |
|-----------------------|-------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | NEVER | <input type="radio"/> | LESS THAN ONCE A WEEK | <input type="radio"/> | ONCE EVERY 3-7 DAYS |
| <input type="radio"/> | | <input type="radio"/> | | <input type="radio"/> | <input type="radio"/> |
| | | | | <input type="radio"/> | <input type="radio"/> |
| | | | | <input type="radio"/> | <input type="radio"/> |
| | | | | <input type="radio"/> | <input type="radio"/> |

61. During this pregnancy, on a typical drinking occasion, how many drinks do you have? (One drink equals a glass of beer or a glass of wine or a nip of spirits)? (please tick one circle)

- 0 NONE
 1 LESS THAN 2 DRINKS
 2 2 TO 4 DRINKS
 3 5 TO 6 DRINKS
 4 MORE THAN 6 DRINKS

62. During this pregnancy, how often do you use street or recreational drugs, including party pills? (please tick one number)

- 0 NEVER
 1 LESS THAN ONCE A WEEK
 2 ONCE EVERY 3 TO 7 DAYS
 3 ONCE EVERY 2 DAY
 4 DAILY

63. During this pregnancy have you been distressed by feelings of anxiety or depression for two weeks or more?

- 0 No
 1 Yes (please go to question 64)

64. During this pregnancy has your feelings of anxiety or depression interfere with your ability to get things done or your relationships with family and friends? (please circle one number)

- 0 NOT AT ALL
 1 SOMEWHAT
 2
 3
 4
 5 VERY MUCH

65. During this pregnancy has your feelings of anxiety or depression lead you to seek professional help?

- 1 Yes
 0 No

ABOUT YOU

66. If you have a partner, how is your relationship with them at the moment? (please circle one number)

- 0 PERFECTLY HAPPY
 1
 2
 3
 4
 5
 6
 7 EXTREMELY UNHAPPY
 OR
 8 Not applicable

67. How supportive of this pregnancy is your partner? (please circle one number)

- 0 COMPLETELY SUPPORTIVE
 1
 2
 3
 4
 5
 6
 7 NOT AT ALL SUPPORTIVE
 OR
 8 Not applicable

68. Do you have the following types of support? (please tick one circle on every line)

- a. Financial support
- 0 I don't need any support
 1 I would like a lot more support
 2 I would like some more support
 3 I have enough support
- b. Emotional support (e.g. someone who listens or is 'there' for you)
- 0 I don't need any support
 1 I would like a lot more support
 2 I would like some more support
 3 I have enough support
- c. Advice (e.g. someone you can go to for information or guidance)
- 0 I don't need any support
 1 I would like a lot more support
 2 I would like some more support
 3 I have enough support
- d. Concrete/Practical support (e.g. childcare, housework, cooking)
- 0 I don't need any support
 1 I would like a lot more support
 2 I would like some more support
 3 I have enough support

69. Are you attending, studying or enrolled at school or anywhere else?

- 0 Full-time (20 hours or more a week)
 1 Part-time (less than 20 hours a week)
 2 Neither of these

70. Do you currently work for pay, profit or income?

- 1 Yes, one paid job
 2 Yes, more than one paid job
 0 No
 Comments welcome → _____

If you answered 'Yes' go to question 71, if you answered 'No' please go to question 74.

71. In the LAST WEEK, how many hours did you work for pay, profit or income?

Please write how many hours here → _____ hours

72. In the LAST WEEK, on how many nights did you work for pay, profit or income for at least 3 hours between midnight and 5am? (please circle one number)

- 0
 1
 2
 3
 4
 5
 6
 7
 Circle the number of nights

73. Overall how satisfied are you with the balance between your work and other aspects of your life such as time with your family or leisure? *(Please tick one circle)*

- Very dissatisfied
- Dissatisfied
- Neither satisfied nor dissatisfied
- Satisfied
- Very satisfied

74. This question is about things that may have happened during the last 12 months.

(Please tick as many options that apply to you)

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

75. Please check the answer that comes closest to how you have felt in the past 7 days, not just how you feel today...

- a. I have been able to laugh and see the funny side of things
 - 0 As much as I always could
 - 1 Not quite so much now
 - 2 Definitely not so much now
 - 3 Not at all
- b. I have looked forward with enjoyment to things
 - 0 As much as I ever did
 - 1 Rather less than I used to
 - 2 Definitely less than I used to
 - 3 Hardly at all

c. I have blamed myself unnecessarily when things went wrong

- 3 Yes, most of the time
- 2 Yes, some of the time
- 1 Not very often
- 0 No, never

d. I have been anxious or worried for no good reason

- 0 No, not at all
- 1 Hardly ever
- 2 Yes, sometimes
- 3 Yes, very often

e. I have felt scared or panicky for no good reason

- 3 Yes, quite a lot
- 2 Yes, sometimes
- 1 No, not much
- 0 No, not at all

f. Things have been getting on top of me

- 3 Yes, most of the time I haven't been able to cope at all
- 2 Yes, sometimes I haven't been coping as well as usual
- 1 No, most of the time I have coped quite well
- 0 No, I have been coping as well as ever

g. I have been so unhappy that I have had difficulty sleeping

- 3 Yes, most of the time
- 2 Yes, sometimes
- 1 Not very often
- 0 No, not at all

h. I have felt sad or miserable

- 3 Yes, most of the time
- 2 Yes, quite often
- 1 Not very often
- 0 No, not at all

77. Listed below are a few statements about your relationships with others. How much is each statement TRUE or FALSE for you? (please tick one circle on every line)

	Definitely True	Mostly True	Don't know	Mostly False	Definitely False
I am always courteous even to people who are disagreeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There have been occasions when I took a advantage of someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes try to get even rather than forgive and forget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes feel resentful when I don't get my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter who I'm talking to, I'm always a good listener	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

78. Date questionnaire completed: _____ / _____ / _____ (day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

Important note

If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Midwife/Lead Maternity Carer, GP/doctor or other health professional.

- i. I have been so unhappy that I have been crying
 - 3 Yes, most of the time
 - 2 Yes, quite often
 - 1 Only occasionally
 - 0 No, never
- j. The thought of harming myself has occurred to me
 - 3 Yes, quite often
 - 2 Sometimes
 - 1 Hardly ever
 - 0 Never

76. Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt. (please tick one circle on every line)

	Not at all true	Rarely true	Sometimes true	Often true	True nearly all the time
I am able to adapt when changes occur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can deal with whatever comes my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to see the humorous side of things when I am faced with problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having to cope with stress can make me stronger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to bounce back after illness, injury, or other hardships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I can achieve my goals, even if there are obstacles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Under pressure, I stay focused and think clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not easily discouraged by failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of myself as a strong person when dealing with life's challenges and difficulties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to handle unpleasant or painful feelings like sadness, fear and anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

All rights reserved. No part of this scale may be reproduced or transmitted in any form, or by any means, electronic or mechanical, including photocopying or by any information storage or retrieval system, without permission in writing from Dr. Davidson at [mail@lead-sc.com](mailto:lead@sc.com). Copyright © 2001, 2003, 2007, 2011 by Kathryn M. Connor, M.D. and Jonathan R.T. Davidson, M.D.

APPENDIX 22 6 WEEKS POSTNATAL QUESTIONNAIRE, SLEEP HAPI STUDY



Postnatal Sleep and Health



THIS QUESTIONNAIRE SHOULD BE COMPLETED WHEN YOU ARE 6 WEEKS POSTNATAL

This questionnaire is about your sleep and health.

Please tick one option for questions with circles like this:

Please tick as many options as apply for questions with boxes like this:

1. Please advise if your GP has changed since the last questionnaire?

Name of GP: _____
 Name of Medical Centre: _____
 Phone: _____

2. Please advise if your address has changed since the last questionnaire?

Street number _____ Flat number _____
 Street name _____
 Suburb or rural locality _____ Post Code _____
 City, town or district _____
 Home telephone number _____
 Cell phone number _____

3. When was your baby born? _____ / _____ / _____
(day) (month) (year)

4. How old is your baby now? _____ weeks

ABOUT YOUR SLEEP NOW

5. During the past month, how many nights per week could you find a comfortable sleep position? *(please circle one number)*

NO NIGHTS
 0 1 2 3 4 5 6 7
 EVERY NIGHT

6. During the past month, what sleeping position did you find yourself being most comfortable? *(please tick one circle)*

- 1 Lying on your left side
- 2 Lying on your right side
- 3 Lying on either side
- 4 Lying on your back
- 5 Lying on your stomach
- 6 Sitting upright / recumbent
- 7 Other *(please specify)*: _____

7. During the past month, did you use any sleeping aids (e.g. pillows, mattress toppers) to help you sleep in a comfortable position? *(comments welcome...)*

8. During the past month, when have you usually gone to bed?

Usual bed time: _____ AM or _____ PM

9. During the past month, how long (in minutes) has it taken you to fall asleep each night?

Number of minutes: _____

10. During the past month, when have you usually gotten up in the morning?

Usual get up time: _____ AM or _____ PM

11. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed)

Actual sleep per night: _____ hours & _____ minutes

16. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? (please tick one circle)

No problem at all Only a very slight problem Somewhat of a problem A very big problem

17. Do you have a bed partner or roommate? (please tick one circle)

No bed partner or roommate Partner/roommate in another room Partner/roommate in same room but not in the same bed Partner/roommate in the same bed

18. If you have a bed partner or roommate, how often in the past month would they say you had: (please tick one circle on every line)

Loud snoring	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Long pauses between breaths while asleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Legs twitching or jerking while you sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Episodes of disorientation or confusion during sleep	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other restlessness while you sleep (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

19. In the last week, how often did you get a good night's sleep? (please circle one number)

NO NIGHTS 0 1 2 3 4 5 6 7
EVERY NIGHT

20. How many hours sleep do you usually get in 24 hours, including naps?

In the last week, please write the number of hours here: _____ hours

21. On how many days in the last week did you have a daytime nap? (please circle one number)

NO NIGHTS 0 1 2 3 4 5 6 7
EVERY NIGHT

IF YOU DID NOT NAP DURING THE LAST WEEK, PLEASE GO TO QUESTION 24. IF YOU HAVE HAD A NAP IN THE LAST WEEK, PLEASE GO TO THE NEXT QUESTION.

22. If you have had naps in the last week, how many hours or minutes would you sleep for?

Please write the number of hours and minutes here: _____ hours _____ minutes

23. If you have had naps in the last week, what time of the day do you like to start napping?

Please write the time here: _____ AM or _____ PM

12. During the past month, how often have you had trouble sleeping because you: (please tick one circle on every line)

Cannot get to sleep within 30 minutes	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Wake up in the middle of the night or early morning	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have to get up to use the bathroom	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cannot breathe comfortably	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cough or snore loudly	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too cold	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too hot	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Had bad dreams	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have pain	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

13. During the past month, how would you rate your sleep quality overall? (please tick one circle)

Very good:
Fairly good:
Fairly bad:
Very bad:

14. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep? (please tick one circle)

Not during the past month Less than once a week Once or twice a week Three or more times a week

15. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? (please tick one circle)

Not during the past month Less than once a week Once or twice a week Three or more times a week

31. In the last week, have you experienced an urge to move your legs (usually accompanied by unpleasant sensations)?

- 1 Yes - if "yes" please go to question 32
- 0 No - if "No" please go to question 33

32. If you answered "Yes" to Question 31, is this: (please tick as many options that apply to you)

- 1 Worse at night?
- 2 More noticeable when you rest?
- 3 Relieved by movement?

33. Are you satisfied with the amount, quality, and timing of your sleep?

- 1 Yes
- 0 No - if No, would you like to (please tick as many options that apply to you):

- Sleep more
- Sleep less
- Have more refreshing sleep
- Go to sleep earlier
- Go to sleep later
- Get up earlier
- Get up later

34. Most nights, do you sleep... (please tick as many options that apply to you)

- Alone
- With your partner/significant other
- Or with someone or something else? (please specify) _____
- With your baby
- With a pet

35. On days when you are scheduled to work, study, care for others or have other regular commitments:

- a. I have to get up at _____ AM or _____ PM
- b. To wake up I need _____ minutes
- c. I regularly wake up: 1 before the alarm 2 with the alarm 3 don't use an alarm
- d. I am fully awake from _____ AM or _____ PM
- e. I have an energy dip at _____ AM or _____ PM
- f. On nights before scheduled (e.g. work) days, I go to bed at _____ AM or _____ PM
- g. To fall asleep when I go to bed takes me _____ minutes
- h. If I get the chance, I like to take a nap. 1 Yes 0 No
- i. If you nap: I like to nap at _____ AM or _____ PM
I like to nap for _____ minutes.

24. Do you consider that you have a sleep problem?

- 1 Yes, lasting less than 4 weeks
- 2 Yes, for 1-6 months
- 3 Yes, for more than 6 months

Comments welcome ->

25. In the last 2 weeks, what has been the severity of the following INSOMNIA problem(s)? (please circle one number on every line)

	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
Difficulty falling asleep:	0	1	2	3	4
Difficulty staying asleep:	0	1	2	3	4
Problem waking too early:	0	1	2	3	4

26. How SATISFIED/DISSATISFIED are you with your current sleep pattern? (please circle one number)

MODERATELY SATISFIED	SATISFIED	DISATISFIED	VERY DISATISFIED	
0	1	2	3	4

27. How NOTICEABLE to others do you think your sleeping problem is in terms of impairing your quality of life? (please circle one number)

NOT AT ALL NOTICEABLE	ALITTLE	SOMEWHAT	MUCH	VERY MUCH NOTICEABLE
0	1	2	3	4

28. How WORRIED/DISTRESSED are you about your current sleep problem? (please circle one number)

NOT AT ALL WORRIED	ALITTLE	SOMEWHAT	MUCH	VERY MUCH WORRIED
0	1	2	3	4

29. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY? (please circle one number)

NOT AT ALL INTERFERING	ALITTLE	SOMEWHAT	MUCH	VERY MUCH INTERFERING
0	1	2	3	4

30. Does your sleep problem interfere with... (please tick one circle on every line)

	YES	NO	DON'T KNOW	NOT APPLICABLE
a. Your relationship with a child or children	1	0	2	3
b. Your relationship with your spouse or partner	1	0	2	3
c. Caring for your family	1	0	2	3
d. Your relationship with your extended family or friends	1	0	2	3

36. Imagine having free days (days when you are NOT scheduled to work, study, care for others or have no other regular commitments). On free days:

- a. Ideally, I would sleep in until _____ AM or _____ PM
- b. I normally wake up at _____ AM or _____ PM
- c. If I wake up at around the normal (scheduled/work day) alarm time, I try to get back to sleep.
 1 Yes 0 No
- d. If I get back to sleep, I sleep for another _____ minutes
- e. I am fully awake from _____ AM or _____ PM
- f. I have an energy dip at around _____ AM or _____ PM
- g. On nights before free days, I go to bed at _____ AM OR _____ PM
- h. To fall asleep when I go to bed takes me _____ minutes
- i. If I get the chance, I like to take a nap. 1 Yes 0 No
- j. If you nap: I like to nap at _____ AM or _____ PM
 I like to nap for _____ minutes.

37. Do you usually watch TV or read in bed before falling asleep?

- 1 Yes 0 No

38. If YES, once I am in bed, I would like to watch TV or read for _____ minutes, but I normally fall asleep after a maximum of _____ minutes.

39. Do you prefer to sleep in a completely dark room?

- 1 Yes 0 No

40. Do you wake up more easily when morning light shines into your room?

- 1 Yes 0 No

41. How long on average per day do you spend outside (really outside) exposed to daylight?

On scheduled days: _____ hours & _____ minutes

On free days: _____ hours & _____ minutes

42. How often in the last week did you: (please circle one number on every line)

	NO	1	2	3	4	5	6	7
	DAYS/NIGHTS							
	EVERY DAY/NIGHT							
a. Have difficulty getting to sleep.....	0	1	2	3	4	5	6	7
b. Wake up during your sleep period.....	0	1	2	3	4	5	6	7
c. Wake up too early at the end of a sleep period.....	0	1	2	3	4	5	6	7
d. Feel rested upon awakening at the end of a sleep period.....	0	1	2	3	4	5	6	7
e. Sleep poorly.....	0	1	2	3	4	5	6	7
f. Feel sleepy during the day.....	0	1	2	3	4	5	6	7
g. Struggle to stay awake during the day.....	0	1	2	3	4	5	6	7
h. Feel irritable during the day.....	0	1	2	3	4	5	6	7
i. Feel tired or fatigued during the day.....	0	1	2	3	4	5	6	7
j. Feel satisfied with the quality of your sleep.....	0	1	2	3	4	5	6	7
k. Feel alert and energetic during the day.....	0	1	2	3	4	5	6	7
l. Get too much sleep.....	0	1	2	3	4	5	6	7
m. Get too little sleep.....	0	1	2	3	4	5	6	7
n. Take a nap at a scheduled time.....	0	1	2	3	4	5	6	7
o. Fall asleep at an unscheduled time.....	0	1	2	3	4	5	6	7
p. Drink an alcoholic beverage to help you get to sleep.....	0	1	2	3	4	5	6	7
q. Use tobacco to help you get to sleep.....	0	1	2	3	4	5	6	7
r. Use herbal product to help you get to sleep.....	0	1	2	3	4	5	6	7
s. Use an over-the-counter sleeping pill to help you get to sleep.....	0	1	2	3	4	5	6	7
t. Use a prescription sleeping pill to help you get to sleep.....	0	1	2	3	4	5	6	7
u. Use any pain medication to help you get to sleep.....	0	1	2	3	4	5	6	7
(e.g. Painadol)								
v. Take anything else to help you sleep.....	0	1	2	3	4	5	6	7

↓
If so, what did you take to help you sleep: _____

43. In the last week what, if anything, woke you up during the night? (please tick as many options that apply to you)

- Noise
- Pain
- Stress
- Too hot or too cold
- Light
- Unable to get comfortable
- Dreams
- Nightmares
- The need to go to the bathroom
- Wake up for no apparent reason
- Heartburn
- Nasal Congestion
- Leg Cramps
- Breast leaking or tenderness
- Baby moving/baby sounds
- Giving care to your baby or other child
- Giving care to elderly parent
- Giving care to someone else
- Spouse/bed partner
- Hungry/thirsty
- Medication side effects
- Pets
- Text messages or alerts from phone or other electronic device (not pre-set alarms)
- Can't breathe comfortably
- Worrying or thinking about your baby's or other child's behaviour
- Worrying or thinking about a disabled or ill family member (adult or child)
- Worrying or thinking about current housing difficulties
- Worrying or thinking about money/finance problems
- Worrying or thinking about world or current events
- Worrying or thinking about balancing work and family
- Worrying or thinking about family members not getting on
- Worrying or thinking about who does household chores
- Something else (please specify) _____
- Nothing awakens me at night
- Don't know

44. Thinking about your sleep and sleep habits within the past month, how often have you done the following in the hour before you went to bed? (please tick one circle on every line)

- | | EVERY NIGHT OR ALMOST EVERY NIGHT | A FEW NIGHTS A WEEK | A FEW NIGHTS A MONTH | BARELY | NEVER |
|---|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Did work relating to your job or study | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Watched TV/movie | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Listened to the radio or music | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Were on the computer or internet | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read a book | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Exercised | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Did activities with your baby | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| h. Did activities with family / friends | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| i. Drank a caffeinated beverage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| j. Drank an alcoholic beverage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| k. Took a hot bath or shower | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| l. Completed household chores | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

45. How frequently do you do the following in the hour before going to sleep? (please tick one circle on every line)

- | | EVERY NIGHT OR ALMOST EVERY NIGHT | A FEW NIGHTS A WEEK | A FEW NIGHTS A MONTH | BARELY | NEVER |
|---|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Listen to radio or music (e.g. using a radio or MP3 player) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Play games (e.g. using a computer, phone or gaming console) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Surf internet or use social media (e.g. Facebook/texting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other activities using technology | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Please specify _____

49. Thinking about your typical day, what are you unable to do because you run out of time? Do you wish you had more time to: (please tick one circle on every line)

	YES, RUN OUT OF TIME	NO
a. Do job-related work	<input type="radio"/>	<input type="radio"/>
b. Spend time with family or friends	<input type="radio"/>	<input type="radio"/>
c. Sleep	<input type="radio"/>	<input type="radio"/>
d. Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>
e. Exercise	<input type="radio"/>	<input type="radio"/>
f. Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>

50. In your usual way of life in recent times, how likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? (please tick one circle on every line)

	WOULD NEVER DOZE	SLIGHT CHANCE	MODERATE CHANCE	HIGH CHANCE
a. Sitting and reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Watching TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Sitting inactive in a public place (e.g. movies, meeting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. As a passenger in a car for an hour without a break	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Lying down in the afternoon when circumstances permit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Sitting and talking to someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Sitting quietly after a lunch without alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. In a car, while stopped for a few minutes in traffic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

51. How much does your baby's sleep affect.... (please circle one number on every line)

	NO NIGHTS/DAYS	1	2	3	4	5	6	7
a. Your bed time?	0	1	2	3	4	5	6	7
b. Your get up time?	0	1	2	3	4	5	6	7
c. The number of times you wake at night?	0	1	2	3	4	5	6	7
d. The amount of sleep you get at night?	0	1	2	3	4	5	6	7
e. How sleepy you are during the day?	0	1	2	3	4	5	6	7
f. Your mood during the day?	0	1	2	3	4	5	6	7
g. Your ability to do things during the day?	0	1	2	3	4	5	6	7

46. How frequently do you do the following to help fall asleep? (please tick one circle on every line)

	EVERY NIGHT OR ALMOST EVERY NIGHT	A FEW NIGHTS A WEEK	A FEW NIGHTS A MONTH	RARELY	NEVER
a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Listen to radio or music (e.g. using a Radio, iPod or MP3 player)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Play games (e.g. using a computer, phone or gaming console)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Surf internet or use social media (e.g. Facebook/texting)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Other activities using technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please specify _____

47. Do you have the following technology in your bedroom? (please tick as many options that apply to you)

- TV / computer / laptop / DVD player
- Cellphone - not a smart phone (e.g. pager / BlackBerry)
- Gaming console
- e-reader with a bright screen (e.g. Kobo, iPad, other tablet)
- Smart phone
- Radio or other music only player (e.g. MP3)
- e-reader without a bright screen (e.g. non-backlit Kindle)
- None
- Other technology → Please specify _____

48. Thinking about your typical day, what are you unable to do because you are too sleepy? Are you too sleepy to: (please tick one circle on every line)

	YES, TOO SLEEPY	NO
a. Do job-related work	<input type="radio"/>	<input type="radio"/>
b. Spend time with family or friends	<input type="radio"/>	<input type="radio"/>
c. Do leisure activities such as watching TV or reading	<input type="radio"/>	<input type="radio"/>
e. Exercise	<input type="radio"/>	<input type="radio"/>
d. Eat right or cook a healthy meal	<input type="radio"/>	<input type="radio"/>

52. In the past year, how often have you driven a car or motor vehicle while feeling drowsy? Would you say you have driven drowsy... (please tick one circle)

- 1 3 or more times a week
- 2 1 to 2 times a week
- 3 1 to 2 times a month
- 4 Less than once a month, or
- 5 Never
- 6 Don't drive / Don't have a car

ABOUT YOUR HEALTH

53. In general, would you say that your health is: (please tick one circle)

- Excellent
- Very good
- Good
- Fair
- Poor
- Don't know

54. Are you currently having any treatment or monitoring for any of these conditions? (please tick one circle or every line)

- | | | |
|---------------------------------------|-----------------------|-----------------------|
| | YES | NO |
| a) High blood pressure (hypertension) | <input type="radio"/> | <input type="radio"/> |
| b) Pain as a result of birth | <input type="radio"/> | <input type="radio"/> |
| c) Low iron or anaemia | <input type="radio"/> | <input type="radio"/> |
| d) Abnormal vaginal bleeding | <input type="radio"/> | <input type="radio"/> |
| e) Breast infection (mastitis) | <input type="radio"/> | <input type="radio"/> |
| f) Birth related infection | <input type="radio"/> | <input type="radio"/> |
| g) Incontinence | <input type="radio"/> | <input type="radio"/> |

55. Are you currently having any treatment or monitoring for any other conditions?

Other medical issue(s) - please specify (e.g. diabetes, back problems, anaemia, allergies, thyroid, etc.)

Mental health issue(s) - please specify (e.g. depression, anxiety, postpartum psychosis, etc.)

Diagnosed sleep condition(s) - please specify (e.g. obstructive sleep apnoea, restless legs syndrome, etc.)

56. Please list any medicines you are currently taking.

57. Does anyone smoke inside your house? (please tick one circle)

- 3 Yes
- 2 Sometimes
- 1 No

58. How often do you drink alcohol? (please tick one circle)

- 0 NEVER
- 1 LESS THAN ONCE A WEEK
- 2 ONCE EVERY 3-7 DAYS
- 3 ONCE EVERY 2 DAYS
- 4 DAILY

59. On a typical drinking occasion, how many drinks do you have? (One drink equals a glass of beer or a glass of wine or a nip of spirits)? (please tick one circle)

- 0 NONE
- 1 LESS THAN 2 DRINKS
- 2 2 TO 4 DRINKS
- 3 5 TO 6 DRINKS
- 4 MORE THAN 6 DRINKS

60. How often do you use street or recreational drugs, including party pills? (please tick one circle, number)

- 0 NEVER
- 1 LESS THAN ONCE A WEEK
- 2 ONCE EVERY 3 TO 7 DAYS
- 3 ONCE EVERY 2 DAY
- 4 DAILY

ABOUT YOU

61. During this most recent pregnancy were you been distressed by feelings of anxiety or depression for two weeks or more?

1 Yes – if “Yes”, please go to question 62 0 No – if “No” please go to Question 64

62. Did these feelings of anxiety or depression interfere with your ability to get things done or your relationships with family and friends? (please circle one number)

NOT AT ALL 0 1 2 3 4 5 VERY MUCH

63. Did your feelings of anxiety or depression lead you to seek professional help?

1 Yes 0 No

64. In the first week after your baby was born did you experience times of unexplained tears, feeling very up then very down or feeling like you were on an emotional roller-coaster – sometimes called the “baby blues”?

1 Yes – if “Yes”, please go to question 65 0 No – if “No” please go to Question 66

65. If “Yes” to question 64, how long did these feelings last? (please circle one number)

0 Less than a day 1 One to two days 2 Three days to a week 3 More than a week

66. Since the birth of your baby, have you been distressed by feelings of anxiety or depression for two weeks or more?

1 Yes – if “Yes” please go to question 67 0 No – if “No” please go to Question 69

67. Have these feelings of anxiety or depression interfere with your ability to get things done or your relationships with family and friends? (please circle one number)

NOT AT ALL 0 1 2 3 4 5 VERY MUCH

68. Did your feelings of anxiety or depression lead you to seek professional help?

1 Yes 0 No

69. If you have a partner, how is your relationship with them at the moment? (please circle one number)

PERFECTLY HAPPY 0 1 2 3 4 5 6 7 EXTREMELY UNHAPPY 8 Not applicable

70. How supportive is your partner of you and your baby? (please circle one number)

COMPLETELY SUPPORTIVE 0 1 2 3 4 5 6 7 NOT AT ALL SUPPORTIVE 8 Not applicable

71. Do you have the following types of support? (please tick one circle one every line)

- a. Financial support 1 I don't need any support 2 I would like a lot more support 3 I would like some more support 4 I have enough support
- b. Emotional support (e.g. someone who listens or is 'there' for you) 1 I don't need any support 2 I would like a lot more support 3 I would like some more support 4 I have enough support
- c. Advice (e.g. someone you can go to for information or guidance) 1 I don't need any support 2 I would like a lot more support 3 I would like some more support 4 I have enough support
- d. Concrete/Practical support (e.g. childcare, housework, cooking) 1 I don't need any support 2 I would like a lot more support 3 I would like some more support 4 I have enough support

72. Are you attending, studying or enrolled at school or anywhere else?

- Full-time (20 hours or more a week)
- Part-time (less than 20 hours a week)
- Neither of these

73. Do you currently work for pay, profit or income?

- 1 Yes, one paid job
- 2 Yes, more than one paid job
- 0 No Comments welcome → _____

If you answered 'Yes' go to question 74, if you answered 'No' please go to question 77.

74. In the **LAST WEEK**, how many **hours** did you work for pay, profit, or income?

Please write how many hours here → _____ hours

75. In the **LAST WEEK**, on how many **nights** did you work for pay, profit or income for at least **3 hours** between midnight and 5am? (please circle *one* number)

Circle the number of nights

NO NIGHTS	0	1	2	3	4	5	6	7
EVERY NIGHT								

76. Overall how satisfied are you with the balance between your work and other aspects of your life such as time with your family or leisure? (please tick *one* circle)

- Very dissatisfied
- Dissatisfied
- Neither satisfied nor dissatisfied
- Satisfied
- Very satisfied

77. This question is about things that may have happened during the last 12 months.

(please tick *as many* options that apply to you)

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

78. Please check the answer that comes closest to how you have felt in the past 7 days, not just how you feel today...

- a. I have been able to laugh and see the funny side of things
 - 0 As much as I always could
 - 1 Not quite so much now
 - 2 Definitely not so much now
 - 3 Not at all
- b. I have looked forward with enjoyment to things
 - 0 As much as I ever did
 - 1 Rather less than I used to
 - 2 Definitely less than I used to
 - 3 Hardly at all
- c. I have blamed myself unnecessarily when things went wrong
 - 0 Yes, most of the time
 - 1 Yes, some of the time
 - 2 Not very often
 - 3 No, never
- d. I have been anxious or worried for no good reason
 - 0 No, not at all
 - 1 Hardly ever
 - 2 Yes, sometimes
 - 3 Yes, very often
- e. I have felt scared or panicky for no good reason
 - 0 Yes, quite a lot
 - 1 Yes, sometimes
 - 2 No, not much
 - 3 No, not at all
- f. Things have been getting on top of me
 - 0 Yes, most of the time I haven't been able to cope at all
 - 1 Yes, sometimes I haven't been coping as well as usual
 - 2 No, most of the time I have coped quite well
 - 3 No, I have been coping as well as ever

80. Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt. (Please tick one circle on every line)

	Not at all true	Rarely true	Sometimes true	Often true	True nearly all the time
I am able to adapt when changes occur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can deal with whatever comes my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to see the humorous side of things when I am faced with problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having to cope with stress can make me stronger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to bounce back after illness, injury, or other hardships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I can achieve my goals, even if there are obstacles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Under pressure, I stay focused and think clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not easily discouraged by failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of myself as a strong person when dealing with life's challenges and difficulties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to handle unpleasant or painful feelings like sadness, fear and anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

All rights reserved. No part of this scale may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, or by any information storage or retrieval system, without permission in writing from Dr. David Aaron at mail@dafisc.com. Copyright © 2001, 2003, 2007, 2011 by Kathryn M. Connor, M.D. and Jonathan R.T. Davidson, M.D.

81. Date questionnaire completed: _____ / _____ / _____ (day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

A \$20 voucher, from the choice of the following three options, below will be posted to you at the completion of the 6 and 12 week postnatal questionnaires. Please ensure you advise us if your address changes.

Please indicate the type of voucher you would prefer (tick one):
 Petrol Supermarket Department store

Important note

If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Midwife/Lead Maternity Carer, GP/doctor or other health professional.

g. I have been so unhappy that I have had difficulty sleeping

3 Yes, most of the time
 2 Yes, sometimes
 1 Not very often
 0 No, not at all

h. I have felt sad or miserable

3 Yes, most of the time
 2 Yes, quite often
 1 Not very often
 0 No, not at all

i. I have been so unhappy that I have been crying

3 Yes, most of the time
 2 Yes, quite often
 1 Only occasionally
 0 No, never

j. The thought of harming myself has occurred to me

3 Yes, quite often
 2 Sometimes
 1 Hardly ever
 0 Never

79. Listed below are a few statements about your relationships with others. How much is each statement TRUE or FALSE for you? (Please tick one circle on every line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
I am always courteous even to people who are disagreeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There have been occasions when I took a advantage of someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes try to get even rather than forgive and forget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes feel resentful when I don't get my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter who I'm talking to, I'm always a good listener	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX 23 12 WEEKS POSTNATAL QUESTIONNAIRE, SLEEP HAPI STUDY



Postnatal Sleep and Health

THIS QUESTIONNAIRE SHOULD BE COMPLETED WHEN YOU ARE 12 WEEKS POSTNATAL

This questionnaire is about your sleep and health.
 Please **tick one** option for questions with **circles like this:**
 Please **tick as many** options as apply for questions with **boxes like this:**

1. Please advise if your GP has changed since the last questionnaire?

Name of GP: _____
 Name of Medical Centre: _____
 Phone: _____

2. Please advise if your address has changed since the last questionnaire?

Street number _____ Flat number _____
 Street name _____
 Suburb or rural locality _____ Post Code _____
 City, town or district _____
 Home telephone number _____
 Cell phone number _____

ABOUT YOUR SLEEP NOW

3. During the past month, how many nights per week could you find a comfortable sleep position? (please circle one number)

NO NIGHTS	1	2	3	4	5	6	7

4. During the past month, what sleeping position did you find yourself being most comfortable? (please tick one circle)

- 1 Lying on your left side
- 2 Lying on your right side
- 3 Lying on either side
- 4 Lying on your back
- 5 Lying on your stomach
- 6 Sitting upright / recumbent
- 7 Other (please specify): _____

- 5. During the past month, did you use any sleeping aids (e.g. pillows, mattress toppers) to help you sleep in a comfortable position? (comments welcome...)
- 6. During the past month, when have you usually gone to bed?
 Usual bed time: _____ AM or PM

7. During the past month, how long (in minutes) has it taken you to fall asleep each night?

Number of minutes: _____

8. During the past month, when have you usually gotten up in the morning?

Usual get up time: _____ AM or PM

9. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed)

Actual sleep per night: _____ hours & _____ minutes

10. During the past month, how often have you had trouble sleeping because you: (please tick one circle on every line)

Cannot get to sleep within 30 minutes	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Wake up in the middle of the night or early morning	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have to get up to use the bathroom	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cannot breathe comfortably	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Cough or snore loudly	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too cold	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Feel too hot	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Had bad dreams	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Have pain	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week
Other (please specify): _____	<input type="radio"/> Not during the past month	<input type="radio"/> Less than once a week	<input type="radio"/> Once or twice a week	<input type="radio"/> Three or more times a week

17. In the last week, how often did you get a good night's sleep? *(please circle one number)*
- NO EVERY NIGHT
 NIGHTS 0 1 2 3 4 5 6 7
18. How many hours sleep do you usually get in 24 hours, including naps?
In the last week, please write the number of hours here: _____ hours
19. On how many days in the last week did you have a daytime nap? *(please circle one number)*
- NO EVERY NIGHT
 NIGHTS 0 1 2 3 4 5 6 7
- IF YOU DID NOT NAP DURING THE LAST WEEK, PLEASE GO TO QUESTION 22. IF YOU HAVE HAD A NAP IN THE LAST WEEK, PLEASE GO TO THE NEXT QUESTION.
20. If you have had naps in the last week, how many hours or minutes would you sleep for?
Please write the number of hours and minutes here: _____ hours _____ minutes
21. If you have had naps in the last week, what time of the day do you like to start napping?
Please write the time here: _____ AM or _____ PM
22. Do you consider that you have a sleep problem?
 1 Yes, lasting less than 4 weeks
 2 Yes, for 1-6 months
 3 Yes, for more than 6 months
 4 No
Comments welcome →
23. In the last 2 weeks, what has been the severity of the following **INSOMNIA** problem(s)? *(please circle one number on every line)*
- | | NONE | MILD | MODERATE | SEVERE | VERY SEVERE |
|----------------------------|------|------|----------|--------|-------------|
| Difficulty falling asleep: | 0 | 1 | 2 | 3 | 4 |
| Difficulty staying asleep: | 0 | 1 | 2 | 3 | 4 |
| Problem waking too early: | 0 | 1 | 2 | 3 | 4 |
24. How SATISFIED/DISSATISFIED are you with your current sleep pattern? *(please circle one number)*
- | | VERY SATISFIED | MODERATELY SATISFIED | DISSATISFIED | VERY DISSATISFIED |
|--|----------------|----------------------|--------------|-------------------|
| | 0 | 1 | 2 | 3 |
| | | | | 4 |
25. How NOTICEABLE to others do you think your sleeping problem is in terms of impairing your quality of life? *(please circle one number)*
- | | NOT AT ALL NOTICEABLE | A LITTLE | SOMEWHAT | MUCH | VERY MUCH NOTICEABLE |
|--|-----------------------|----------|----------|------|----------------------|
| | 0 | 1 | 2 | 3 | 4 |

11. During the past month, how would you rate your sleep quality overall? *(please tick one circle)*
- Very good:
 Fairly good:
 Fairly bad:
 Very bad:
12. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep? *(please tick one circle)*
- Not during the past month Less than once a week Once or twice a week Three or more times a week
13. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? *(please tick one circle)*
- Not during the past month Less than once a week Once or twice a week Three or more times a week
14. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done? *(please tick one circle)*
- No problem at all Only a very slight problem Somewhat of a problem A very big problem
15. Do you have a bed partner or roommate? *(please tick one circle)*
- No bed partner or roommate Partner/roommate in another room Partner/roommate in same room but not the same bed Partner/roommate in the same bed
16. If you have a bed partner or roommate, how often in the past month would they say you had: *(please tick one circle on every line)*
- | | Not during the past month | Less than once a week | Once or twice a week | Three or more times a week |
|---|---------------------------|-----------------------|-----------------------|----------------------------|
| Loud snoring | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Long pauses between breaths while asleep | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Legs twitching or jerking while you sleep | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Episodes of disorientation or confusion during sleep | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other restlessness while you sleep <i>(please specify):</i> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

26. How WORRIED/DISTRESSED are you about your current sleep problem? (please circle ONE number)

- NOT AT ALL WORRIED 0, A LITTLE 1, SOMEWHAT 2, MUCH 3, VERY MUCH WORRIED 4

27. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY? (please circle ONE number)

- NOT AT ALL INTERFERING 0, A LITTLE 1, SOMEWHAT 2, MUCH 3, VERY MUCH INTERFERING 4

28. Does your sleep problem interfere with... (please tick ONE circle ON EVERY LINE)

- a. Your relationship with a child or children, b. Your relationship with your spouse or partner, c. Caring for your family, d. Your relationship with your extended family or friends

29. In the last week, have you experienced an urge to move your legs (usually accompanied by unpleasant sensations)?

- 1 Yes - if "Yes", please go to question 30, 0 No - if "No" please go to question 31

30. If you answered "Yes" to Question 29, is this: (please tick AS MANY options that apply to you)

- 1 Worse at night?, 2 More noticeable when you rest?, 3 Relieved by movement?

31. Are you satisfied with the amount, quality, and timing of your sleep?

- 1 Yes, 0 No - if No, would you like to (please tick AS MANY options that apply to you): Sleep more, Sleep less, Have more refreshing sleep, Go to sleep earlier, Go to sleep later, Get up earlier, Get up later

32. Most nights, do you sleep... (please tick AS MANY options that apply to you)

- Alone, With your partner/significant other, Or with someone or something else? (please specify)

33. On days when you are SCHEDULED to work, study, care for others or have other regular commitments:

- a. I have to get up at AM or PM, b. To wake up I need minutes, c. I regularly wake up: 1 before the alarm, 2 with the alarm, 3 don't use an alarm, d. I am fully awake from AM or PM, e. I have an energy dip at AM or PM, f. On nights before scheduled (e.g. work) days, I go to bed at AM or PM, g. To fall asleep when I go to bed takes me minutes, h. If I get the chance, I like to take a nap. 1 Yes, 0 No, i. If you nap: I like to nap at AM or PM, I like to nap for minutes.

34. Imagine having free days (days when you are NOT scheduled to work, study, care for others or have no other regular commitments). On free days:

- a. Ideally, I would sleep in until AM or PM, b. I normally wake up at AM or PM, c. If I wake up at around the normal (scheduled/work day) alarm time, I try to get back to sleep. 1 Yes, 0 No, d. If I get back to sleep, I sleep for another minutes, e. I am fully awake from AM or PM, f. I have an energy dip at around AM or PM, g. On nights before free days, I go to bed at AM OR PM, h. To fall asleep when I go to bed takes me minutes, i. If I get the chance, I like to take a nap. 1 Yes, 0 No, j. If you nap: I like to nap at AM or PM, I like to nap for minutes.

35. Do you usually watch TV or read in bed before falling asleep?
 1 Yes
 0 No

36. IF YES, once I am in bed, I would like to watch TV or read for _____ minutes, but I normally fall asleep after a maximum of _____ minutes.

37. Do you prefer to sleep in a completely dark room?
 1 Yes
 0 No

38. Do you wake up more easily when morning light shines into your room?
 1 Yes
 0 No

39. How long on average per day do you spend outside (really outside) exposed to daylight?
 On scheduled days: _____ hours & _____ minutes
 On free days: _____ hours & _____ minutes

40. How often in the last week did you: *(please circle one number on every line)*

	NO DAYS/NIGHTS	1	2	3	4	5	6	7	EVERY DAY/NIGHT
a. Have difficulty getting to sleep	0	1	2	3	4	5	6	7	
b. Wake up during your sleep period.....	0	1	2	3	4	5	6	7	
c. Wake up too early at the end of a sleep period.....	0	1	2	3	4	5	6	7	
d. Feel rested upon awakening at the end of a sleep period..	0	1	2	3	4	5	6	7	
e. Sleep poorly	0	1	2	3	4	5	6	7	
f. Feel sleepy during the day	0	1	2	3	4	5	6	7	
g. Struggle to stay awake during the day.....	0	1	2	3	4	5	6	7	
h. Feel irritable during the day.....	0	1	2	3	4	5	6	7	
i. Feel tired or fatigued during the day	0	1	2	3	4	5	6	7	
j. Feel satisfied with the quality of your sleep	0	1	2	3	4	5	6	7	
k. Feel alert and energetic during the day	0	1	2	3	4	5	6	7	
l. Get too much sleep	0	1	2	3	4	5	6	7	
m. Get too little sleep	0	1	2	3	4	5	6	7	
n. Take a nap at a scheduled time	0	1	2	3	4	5	6	7	
o. Fall asleep at an unscheduled time.....	0	1	2	3	4	5	6	7	
p. Drink an alcoholic beverage to help you get to sleep.....	0	1	2	3	4	5	6	7	
q. Use tobacco to help you get to sleep.....	0	1	2	3	4	5	6	7	
r. Use herbal product to help you get to sleep	0	1	2	3	4	5	6	7	
s. Use an over-the-counter sleeping pill to help you..... get to sleep	0	1	2	3	4	5	6	7	
t. Use a prescription sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7	
u. Use any pain medication to help you get to sleep..... (e.g. Panadol)	0	1	2	3	4	5	6	7	
v. Take anything else to help you sleep	0	1	2	3	4	5	6	7	

If so, what did you take to help you sleep: _____

41. In the last week what, if anything, woke you up during the night? (please tick as many options that apply to you)

- Noise
- Pain
- Stress
- Too hot or too cold
- Light
- Unable to get comfortable
- Dreams
- Nightmares
- The need to go to the bathroom
- Wake up for no apparent reason
- Heartburn
- Nasal Congestion
- Leg Cramps
- Breast leaking or tenderness
- Baby moving/baby sounds
- Giving care to your baby or other child
- Giving care to elderly parent
- Giving care to someone else
- Spouse/bed partner
- Hungry/thirsty
- Medication side effects
- Pets
- Text messages or alerts from phone or other electronic device (not pre-set alarms)
- Can't breathe comfortably
- Worrying or thinking about your baby's or other child's behaviour
- Worrying or thinking about a disabled or ill family member (adult or child)
- Worrying or thinking about current housing difficulties
- Worrying or thinking about money/finance problems
- Worrying or thinking about world or current events
- Worrying or thinking about balancing work and family
- Worrying or thinking about family members not getting on
- Worrying or thinking about who does household chores
- Something else (please specify) _____
- Nothing awakens me at night
- Don't know

42. Thinking about your sleep and sleep habits within the past month, how often have you done the following in the hour before you went to bed? (please tick one circle on every line)

- | | EVERY NIGHT
OR ALMOST
EVERY NIGHT | A FEW
NIGHTS A
WEEK | A FEW
NIGHTS A
MONTH | RARELY | NEVER |
|---|---|---------------------------|----------------------------|-----------------------|-----------------------|
| a. Did work relating to your job or study | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Watched TV/movie | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Listened to the radio or music | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Were on the computer or internet | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read a book | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Exercised | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Did activities with your baby | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| h. Did activities with family / friends | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| i. Drank a caffeinated beverage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| j. Drank an alcoholic beverage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| k. Took a hot bath or shower | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| l. Completed household chores | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

43. How frequently do you do the following in the hour before going to sleep? (please tick one circle on every line)

- | | EVERY NIGHT
OR ALMOST
EVERY NIGHT | A FEW
NIGHTS A
WEEK | A FEW
NIGHTS A
MONTH | RARELY | NEVER |
|---|---|---------------------------|----------------------------|-----------------------|-----------------------|
| a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Listen to radio or music (e.g. using a radio or MP3 player) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Play games (e.g. using a computer, phone or gaming console) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Surf internet or use social media (e.g. Facebook/texting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other activities using technology | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- Please specify _____

47. Thinking about your typical day, what are you unable to do because you run out of time? Do you wish you had more time to: (please tick one circle on every line)

- | | YES, RUN OUT OF TIME | NO |
|---|-----------------------|-----------------------|
| a. Do job-related work | <input type="radio"/> | <input type="radio"/> |
| b. Spend time with family or friends | <input type="radio"/> | <input type="radio"/> |
| c. Sleep | <input type="radio"/> | <input type="radio"/> |
| d. Do leisure activities such as watching TV or reading | <input type="radio"/> | <input type="radio"/> |
| e. Exercise | <input type="radio"/> | <input type="radio"/> |
| f. Eat right or cook a healthy meal | <input type="radio"/> | <input type="radio"/> |

48. In your usual way of life in recent times, how likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? (please tick one circle on every line)

- | | WOULD NEVER DOZE | SLIGHT CHANCE | MODERATE CHANCE | HIGH CHANCE |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Sitting and reading | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Watching TV | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Sitting inactive in a public place (e.g. movies, meeting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. As a passenger in a car for an hour without a break | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Lying down in the afternoon when circumstances permit | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Sitting and talking to someone | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Sitting quietly after a lunch without alcohol | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| h. In a car, while stopped for a few minutes in traffic | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

49. How much does your baby's sleep affect... (please circle one number on every line)

- | | NO NIGHTS/DAYS | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Your bed time? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Your get up time? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. The number of times you wake at night? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. The amount of sleep you get at night? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. How sleepy you are during the day? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Your mood during the day? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Your ability to do things during the day? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

44. How frequently do you do the following to help fall asleep? (please tick one circle on every line)

- | | EVERY NIGHT OR ALMOST EVERY NIGHT | A FEW NIGHTS A WEEK | A FEW NIGHTS A MONTH | RARELY | NEVER |
|---|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Watch movies or television (e.g. on TV, portable DVD player, iPad, laptop, computer) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Listen to radio or music (e.g. using a Radio, iPod or MP3 player) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Play games (e.g. using a computer, phone or gaming console) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Read using an e-reader with a bright screen (e.g. Kobo, iPad, other tablet) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Read using an e-reader without a bright screen (e.g. non-backlit Kindle) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. Surf internet or use social media (e.g. Facebook/texting) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. Other activities using technology | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Please specify _____

45. Do you have the following technology in your bedroom? (please tick as many options that apply to you)

- TV / computer / laptop / DVD player
- Cellphone - not a smart phone (e.g. pager / Blackberry)
- Gaming console
- e-reader with a bright screen (e.g. Kobo, iPad, other tablet)
- Smart phone
- e-reader without a bright screen (e.g. non-backlit Kindle)
- Radio or other music only player (e.g. MP3)
- None
- Other technology → Please specify _____

46. Thinking about your typical day, what are you unable to do because you are too sleepy? Are you too sleepy to: (please tick one circle on every line)

- | | YES, TOO SLEEPY | NO |
|---|-----------------------|-----------------------|
| a. Do job-related work | <input type="radio"/> | <input type="radio"/> |
| b. Spend time with family or friends | <input type="radio"/> | <input type="radio"/> |
| c. Do leisure activities such as watching TV or reading | <input type="radio"/> | <input type="radio"/> |
| e. Exercise | <input type="radio"/> | <input type="radio"/> |
| d. Eat right or cook a healthy meal | <input type="radio"/> | <input type="radio"/> |

50. In the past year, how often have you driven a car or motor vehicle while feeling drowsy? Would you say you have driven drowsy.... (please tick one circle)

- 1 3 or more times a week
- 2 1 to 2 times a week
- 3 1 to 2 times a month
- 4 Less than once a month, or
- 5 Never
- 6 Don't drive / Don't have a car

ABOUT YOUR HEALTH

51. In general, would you say that your health is: (please tick one circle)

- Excellent
- Very good
- Good
- Fair
- Poor
- Don't know

52. Are you currently having any treatment or monitoring for any of these conditions? (please tick one circle on every line)

- | | | |
|---------------------------------------|-------------------------|-------------------------|
| | YES | NO |
| a) High blood pressure (hypertension) | 1 <input type="radio"/> | 0 <input type="radio"/> |
| b) Pain as a result of birth | 1 <input type="radio"/> | 0 <input type="radio"/> |
| c) Low iron or anaemia | 1 <input type="radio"/> | 0 <input type="radio"/> |
| d) Abnormal vaginal bleeding | 1 <input type="radio"/> | 0 <input type="radio"/> |
| e) Breast infection (mastitis) | 1 <input type="radio"/> | 0 <input type="radio"/> |
| f) Birth related infection | 1 <input type="radio"/> | 0 <input type="radio"/> |
| g) Incontinence | 1 <input type="radio"/> | 0 <input type="radio"/> |

53. Are you currently having any treatment or monitoring for any other conditions?

Other medical issue(s) - please specify (e.g. diabetes, back problems, anaemia, allergies, thyroid, etc.)

Mental health issue(s) - please specify (e.g. depression, anxiety, postpartum psychosis, etc.)

Diagnosed sleep condition(s) - please specify (e.g. obstructive sleep apnea, restless legs syndrome, etc.)

54. Please list any medicines you are currently taking.

55. Does anyone smoke inside your house? (please tick one circle)

- 3 Yes
- 2 Sometimes
- 1 No

56. How often do you drink alcohol? (please tick one circle)

- 0 NEVER
- 1 LESS THAN ONCE A WEEK
- 2 ONCE EVERY 3-7 DAYS
- 3 ONCE EVERY 2 DAYS
- 4 DAILY

57. On a typical drinking occasion, how many drinks do you have? (One drink equals a glass of beer or a glass of wine or a nip of spirits)? (please tick one circle)

- 0 NONE
- 1 LESS THAN 2 DRINKS
- 2 2 TO 4 DRINKS
- 3 5 TO 6 DRINKS
- 4 MORE THAN 6 DRINKS

58. How often do you use street or recreational drugs, including party pills? (please tick one number)

- 0 NEVER
- 1 LESS THAN ONCE A WEEK
- 2 ONCE EVERY 3 TO 7 DAYS
- 3 ONCE EVERY 2 DAY
- 4 DAILY

59. Since giving birth, have you been distressed by feelings of anxiety or depression for two weeks or more?

- 1 Yes – If “Yes” please go to question 60 0 No – If “No” please go to Question 62

60. Did these feelings of anxiety or depression interfere with your ability to get things done or your relationships with family and friends? (please circle one number)

- NOT AT ALL SOMEWHAT VERY MUCH
 0 1 2 3 4 5

61. Did your feelings of anxiety or depression lead you to seek professional help?

- 1 Yes 0 No

ABOUT YOU

62. If you have a partner, how is your relationship with them at the moment? (please circle one number)

- PERFECTLY HAPPY EXTREMELY UNHAPPY OR Not applicable
 0 1 2 3 4 5 6 7

63. How supportive is your partner of you and your baby? (please circle one number)

- COMPLETELY SUPPORTIVE NOT AT ALL SUPPORTIVE OR Not applicable
 0 1 2 3 4 5 6 7

64. Do you have the following types of support? (please tick one circle on every line)

- a. Financial support

<input type="radio"/> 0 I don't need any support	<input type="radio"/> 1 I would like a lot more support	<input type="radio"/> 2 I would like some more support	<input type="radio"/> 3 I have enough support
--	---	--	---
- b. Emotional support (e.g. someone who listens or is there for you)

<input type="radio"/> 0 I don't need any support	<input type="radio"/> 1 I would like a lot more support	<input type="radio"/> 2 I would like some more support	<input type="radio"/> 3 I have enough support
--	---	--	---
- c. Advice (e.g. someone you can go to for information or guidance)

<input type="radio"/> 0 I don't need any support	<input type="radio"/> 1 I would like a lot more support	<input type="radio"/> 2 I would like some more support	<input type="radio"/> 3 I have enough support
--	---	--	---
- d. Concrete/Practical support (e.g. childcare, housework, cooking)

<input type="radio"/> 0 I don't need any support	<input type="radio"/> 1 I would like a lot more support	<input type="radio"/> 2 I would like some more support	<input type="radio"/> 3 I have enough support
--	---	--	---

65. Are you attending, studying or enrolled at school or anywhere else?

- Full-time (20 hours or more a week)
 Part-time (less than 20 hours a week)
 Neither of these

66. Do you currently work for pay, profit or income?

- 1 Yes, one paid job
 2 Yes, more than one paid job
 0 No Comments welcome → _____

If you answered 'Yes' go to question 67, if you answered 'No' please go to question 70.

67. In the LAST WEEK, how many hours did you work for pay, profit or income?

Please write how many hours here → _____ hours

68. In the LAST WEEK, on how many nights did you work for pay, profit or income for at least 3 hours between midnight and 5am? (please circle one number)

- NO NIGHTS EVERY NIGHT
 0 1 2 3 4 5 6 7

69. Overall how satisfied are you with the balance between your work and other aspects of your life such as time with your family or leisure? (please tick one circle)

- Very dissatisfied
 Dissatisfied
 Neither satisfied nor dissatisfied
 Satisfied
 Very satisfied

70. This question is about things that may have happened during the last 12 months.

(Please tick as many options that apply to you)

- A close family member was very sick and had to go into hospital
- I broke up with, got separated or divorced from my partner
- I moved to a new address
- I was homeless
- My partner lost their job
- I lost my job even though I wanted to go on working
- I argued with my partner more than usual
- My partner said they did not want me to be pregnant
- I had a lot of bills I couldn't pay
- I was in a physical fight
- My partner or I went to jail
- Someone very close to me had a bad problem with drinking or drugs
- Someone very close to me died

71. Please check the answer that comes closest to how you have felt in the past 7 days, not just how you feel today...

- a. I have been able to laugh and see the funny side of things
 - 0 As much as I always could
 - 1 Not quite so much now
 - 2 Definitely not so much now
 - 3 Not at all
- b. I have looked forward with enjoyment to things
 - 0 As much as I ever did
 - 1 Rather less than I used to
 - 2 Definitely less than I used to
 - 3 Hardly at all
- c. I have blamed myself unnecessarily when things went wrong
 - 3 Yes, most of the time
 - 2 Yes, some of the time
 - 1 Not very often
 - 0 No, never

- d. I have been anxious or worried for no good reason
 - 0 No, not at all
 - 1 Hardly ever
 - 2 Yes, sometimes
 - 3 Yes, very often
- e. I have felt scared or panicky for no good reason
 - 3 Yes, quite a lot
 - 2 Yes, sometimes
 - 1 No, not much
 - 0 No, not at all
- f. Things have been getting on top of me
 - 3 Yes, most of the time I haven't been able to cope at all
 - 2 Yes, sometimes I haven't been coping as well as usual
 - 1 No, most of the time I have coped quite well
 - 0 No, I have been coping as well as ever
- g. I have been so unhappy that I have had difficulty sleeping
 - 3 Yes, most of the time
 - 2 Yes, sometimes
 - 1 Not very often
 - 0 No, not at all
- h. I have felt sad or miserable
 - 3 Yes, most of the time
 - 2 Yes, quite often
 - 1 Not very often
 - 0 No, not at all
- i. I have been so unhappy that I have been crying
 - 3 Yes, most of the time
 - 2 Yes, quite often
 - 1 Only occasionally
 - 0 No, never
- j. The thought of harming myself has occurred to me
 - 3 Yes, quite often
 - 2 Sometimes
 - 1 Hardly ever
 - 0 Never

72. Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt. (Please tick one circle on every line)

	Not at all true	Rarely true	Sometimes true	Often true	True nearly all the time
I am able to adapt when changes occur	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I can deal with whatever comes my way	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I try to see the humorous side of things when I am faced with problems	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Having to cope with stress can make me stronger	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I tend to bounce back after illness, injury, or other hardships	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I believe I can achieve my goals, even if there are obstacles	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Under pressure, I stay focused and think clearly	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I am not easily discouraged by failure	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I think of myself as a strong person when dealing with life's challenges and difficulties	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I am able to handle unpleasant or painful feelings like sadness, fear and anger	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4

All rights reserved. No part of this scale may be reproduced or transmitted in any form, or by any means, electronic or mechanical, including photocopying, or by any information storage or retrieval system, without permission in writing from Dr. Davidson at Davidson@umich.edu. Copyright © 2001, 2003, 2007, 2011 by Kathryn M. Carner, M.B., and Jonathan K.T. Davidson, M.D.

73. Listed below are a few statements about your relationships with others. How much is each statement TRUE or FALSE for you? (Please tick one circle on every line)

	Definitely True	Mostly True	Don't know	Mostly False	Definitely False
I am always courteous even to people who are disagreeable	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
There have been occasions when I took a advantage of someone	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I sometimes try to get even rather than forgive and forget	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
I sometimes feel resentful when I don't get my way	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
No matter who I'm talking to, I'm always a good listener	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4

74. Date questionnaire completed: _____ / _____ / _____
(day) (month) (year)

Please take a moment now to flick through every page of this survey and check that you have answered all the questions you meant to.

Important note

If you feel concerned about any of the issues raised by completing this questionnaire, we suggest that you discuss these with your Midwife/Lead Maternity Carer, GP/doctor or other health professional.

APPENDIX 24 FEEDBACK QUESTIONNAIRE, SLEEP HAPI STUDY

1. Before you joined the study, how much did you know about...

- | | NONE | A LITTLE BIT | ABOUT HALF | MOST OF IT | ALL OF IT |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Sleep in general (why sleep is important, how sleep works, what affects our sleep, aspects of good sleep)? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. How and why sleep changes in each trimester of pregnancy? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Sleep strategies and ideas for improving your sleep during pregnancy? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Your own sleep? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

2. Thinking about the one-on-one sessions, how helpful was the information you received on...

- | | REALLY HELPFUL | QUITE HELPFUL | AVERAGE | NOT THAT HELPFUL | NOT AT ALL HELPFUL |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Sleep in general (why sleep is important, how sleep works, what affects our sleep, aspects of good sleep)? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. How and why sleep changes in each trimester? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Sleep strategies and ideas for improving your sleep during pregnancy? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Your own sleep data in each trimester (actigrams and summaries)? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

3. Thinking about each of the following, do you feel like you were less worried or felt less anxious about your sleep because you had more knowledge about ...

- | | ALOT | QUITE A BIT | A LITTLE BIT | NOT REALLY | NO |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Sleep in general (why sleep is important, how sleep works, what affects our sleep, aspects of good sleep)? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. How and why sleep changes in each trimester? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Useful sleep tips and strategies for each trimester? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Your own sleep? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

4. When you think about wearing the activewatches...

- | | WAS NO PROBLEM AT ALL | WASN'T MUCH OF PROBLEM | WAS OK | WAS A BIT OF A PROBLEM | WAS A BIG PROBLEM |
|---|-----------------------|------------------------|-----------------------|------------------------|-----------------------|
| a. The comfort of wearing the watch... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Remembering to press the event marker... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- Comments...**

5. When you think about filling out the sleep diaries...

- | | WAS NO PROBLEM AT ALL | WASN'T MUCH OF PROBLEM | WAS OK | WAS A BIT OF A PROBLEM | WAS A BIG PROBLEM |
|--|-----------------------|------------------------|-----------------------|------------------------|-----------------------|
| a. The amount of time it took to fill out the diary each day... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Understanding the format and what information was required to be filled in... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- Comments...**

6. When you think about filling out the questionnaires...

- | | WAS NO PROBLEM AT ALL | WASN'T MUCH OF PROBLEM | WAS OK | WAS A BIT OF A PROBLEM | WAS A BIG PROBLEM |
|---|-----------------------|------------------------|-----------------------|------------------------|-----------------------|
| a. The amount of time it took to fill out the each questionnaire... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Feeling comfortable about answering all the questions... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- Comments...**

7. When you think about the one-on-one meetings with the researcher to talk about sleep and your sleep data...

- | | WAS NO PROBLEM AT ALL | WASN'T MUCH OF PROBLEM | WAS OK | WAS A BIT OF A PROBLEM | WAS A BIG PROBLEM |
|--|-----------------------|------------------------|-----------------------|------------------------|-----------------------|
| a. The amount of time it took to go through the information... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Organising meeting times, drop off/pick up or equipment... | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- Comments...**

8. Where/how did you find out about the study?

I preferred a researcher guiding me through the booklet I could have read and understood the booklet on my own

Comments, if any:

9. I enrolled in the study because...

14. What was the most significant or helpful thing you learned throughout the education sessions?

10. Comparing your pre-pregnancy sleep to your sleep throughout your pregnancy...

IT CHANGED A LOT	IT CHANGED A LITTLE	IT DIDN'T CHANGE
<input type="radio"/> I WASN'T EXPECTING IT TO I WAS EXPECTING IT TO	<input type="radio"/> I WASN'T EXPECTING IT TO I WAS EXPECTING IT TO	<input type="radio"/> I WASN'T EXPECTING IT TO I WAS EXPECTING IT TO

11. After seeing your own personal sleep data, did you think your actual sleep was...

BETTER THAN I THOUGHT IT WAS WHAT I EXPECTED IT TO BE WORSE THAN I THOUGHT IT WAS

12. Was the information in the booklet easy to understand and easy to navigate through?

YES NO

If 'no', what could be improved?

13. Was it helpful to have a researcher work through the booklet with you, or do you think you could have read and understood it on your own?

I preferred a researcher guiding me through the booklet I could have read and understood the booklet on my own

Comments, if any:

14. What was the most significant or helpful thing you learned throughout the education sessions?

15. Were there any sleep tips or strategies that you found particularly helpful?

16. Was there any information you thought could be covered in greater depth/added and/or could be given less attention/dropped?

17. Do you think meeting for a face-to-face session once every trimester was enough/too much contact?

I WOULD'VE LIKED TO HAVE HAD MORE FACE-TO-FACE CONTACT I WOULD'VE LIKED TO HAVE HAD LESS FACE-TO-FACE CONTACT

Comments, if any:

18. I found the time dedicated to this study was?

TOO MUCH AND IT WAS DIFFICULT TO FIT IN OKAY BUT WOULDN'T HAVE WANTED TO DEDICATE ANY MORE TIME TO IT

Comments, if any:

19. Thinking about how the research was explained to you at the beginning of the study, please rate how well you understood each of the following items:

- | | I UNDERSTOOD COMPLETELY | I UNDERSTOOD QUITE WELL | I SOMEWHAT UNDERSTOOD | I DID NOT UNDERSTAND VERY WELL | I DID NOT UNDERSTAND AT ALL |
|--|-------------------------|-------------------------|-----------------------|--------------------------------|-----------------------------|
| a. What the researchers were trying to learn by doing the study? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. How much time you would spend in the study? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. What I was expected to do over the course of the study? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. What the possible risks or discomforts of the study were? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. What the possible benefits to you participating in the study were? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| f. How your privacy and confidential information would be protected? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| g. How your participation in the study may benefit other people in the future? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| h. Who to contact if you had any questions or concerns? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

20. Thinking about the researcher, please rate the following items:

- | | ALL OF THE TIME | MOST OF THE TIME | SOMETIMES | NOT VERY OFTEN | NEVER |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Was the researcher respectful and friendly? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Was the researcher organised? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Was the researcher knowledgeable about the topic? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Did you feel as though the researcher was approachable, and that you were able to communicate your concerns and thoughts about sleep freely? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Did you feel as though the researcher was flexible to fit in with your work and social schedules? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Did you feel as though the researcher was dedicated to help improve your sleep? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

21. Thinking about how the research in general...

- | | DEFINITELY | MAYBE | NEVER/NO |
|---|-----------------------|-----------------------|-----------------------|
| a. I would recommend this study to others, if they met the study criteria? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. What I learned about sleep will be useful to me in the future? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. I feel like I understand my own sleep better than before joining the study? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. The benefits of being in the study outweigh the time and energy it required? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Overall, being in a research study has been a positive experience. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

If you said 'No' or 'Maybe', what changes could we make to make the study better?

22. Is there anything that would have improved your experience as a participant in this research?

23. Do you have any other comments or feedback about your participation in this study?

24. Date questionnaire completed

..... / /
(day) (month) (year)

Please take a moment now to flick through every page of this questionnaire and check that you have answered all the questions you meant to. Thankyou.

APPENDIX 25 ACTIGRAPHY SCORING PROTOCOL, *SLEEP HAPI* STUDY

Scoring of individual actigraphy records

The rules used for scoring each individual actigraphy record in this research are provided below:

Rest Interval

- Start and end times are set by the researcher using 3 sources of information:
 - Change in actigraphy data
 - Event marker
 - Sleep diary

Compare all 3 sources of information; when information doesn't match:

- Actigraphy and event marker match but diary does not:
 - Use actigraphy and event marker
- Actigraphy and diary match but event marker does not:
 - Use actigraphy and diary
- Event marker and diary match but actigraphy does not:
 - Use event marker and diary
- Neither actigraphy, event marker and diary match:
 - Actigraphy data primary source, then event marker, followed by sleep diary

Double scoring

To assess the reliability of manual selection of rest intervals, 20% of files are to be double scored by a second independent trained researcher. Any discrepancies of more than 15 minutes for either 'start time' or 'end time' of the rest interval need to be flagged, reanalysed, and checked by a third independent person if the two researchers cannot reach agreement.

The percentage of start times and the percentage of end times where the discrepancy between scorers was greater than 15 minutes are reported, as is the overall agreement rate (agreement being classed as 15 minutes or less difference between scorers).

APPENDIX 26 REFERENCES USED FOR *SLEEP HAPI* EDUCATION BOOKLET

(Baratte-Beebe & Lee, 1999; Bei, Coo, Baker, et al., 2015; Best Practice NZ, 2012; Caparroz et al., 2016; Chen et al., 2018; Conrad, 2011; Crowe, Sanchez, Howard, Western, & Barger, 2018; Davis, 1996; Eccles, 2000; Ellegård & Karlsson, 2006; Gellis & Lichstein, 2009; Goldsmith & Weiss, 2009; Hedman et al., 2002; Hensley, 2009; Irish et al., 2015; Jednak et al., 1999; Jefferson et al., 2005; Jin, 2016; Kivlighan, DiPietro, Costigan, & Laudenslager, 2008; Koo, 2015; Kothari, Shefner, & Eichler, 2019; Krahn, Tovar, & Miller, 2015; Malfertheiner, Malfertheiner, Kropf, Costa, & Malfertheiner, 2012; Marshall, Senadheera, Parry, & Girling, 2017; McParlin et al., 2016; Meems, Spek, Pop, Truijens, & Visser, 2015; Monderer, Wu, & Thorpy, 2010; Montgomery, 2002; Nazik & Eryilmaz, 2014; Patel et al., 2017; Picchietti et al., 2015; Raines & Cooper, 2019; Sabino & Grauer, 2008; Sandman et al., 2006; B. Smith, Thompson, Clarkson, & Dawson, 2014; B. P. Smith et al., 2017; Srivanitchapoom et al., 2014; Stanisiere, Mousset, & Lafay, 2018; Stepanski & Wyatt, 2003; Thurston et al., 2013; Trotter, 2017; Vazquez, 2015; Viljoen, Visser, Koen, & Musekiwa, 2014; Viola-Saltzman, 2006; Wagner, 1996; Wells, 2009; Wesström, Skalkidou, Manconi, Fulda, & Sundström-Poromaa, 2014; World Health Organization, 2016; K. Zhou et al., 2015); Australian Sleep Health Foundation; National Sleep Foundation (Sleep.org); American Academy of Sleep Medicine; American Sleep Association;

APPENDIX 27 RESULTS BROCHURE, SLEEP HAPI STUDY

What we found >>>

Going to the bathroom and feeling too hot or cold remain common throughout pregnancy and early postnatal. Waking due to discomfort, heartburn, dreams/nightmares, pain and fetal movements were common throughout pregnancy, but not postnatally. As expected, common reasons for waking postnatally were to feed and care for their baby as well as baby noise and movement.



Take home message >>>

It is normal to experience a change in your sleep during pregnancy and while getting good sleep can be challenging, there is no better time to make sleep a priority. Knowing how sleep works, being aware of your sleep patterns, having realistic expectations of your sleep during pregnancy and trying some new practices to improve your sleep may help you and your baby's health.

What we found >>>

- We measured different aspects of sleep:
 - Sleep duration and sleep quality
 - Daytime sleepiness and insomnia symptoms
 - Sleep timing (difference between weekend and weekday sleep patterns)
- None of these aspects of sleep changed significantly throughout pregnancy
- Most aspects of sleep were worse at 6 weeks postnatal, however, they generally improved by 12 weeks postnatal, but not to pregnancy levels
- Women had more depressive symptoms in trimester 1, and fewer symptoms by the end of pregnancy
- Depressive symptoms increased at 6 weeks postnatal but decreased by 12 weeks postnatal
- At the end of pregnancy, we also compared the sleep and depressive symptoms of the Sleep HAPI group to another group that had not received a sleep education program:
 - Sleep HAPI mothers had better sleep quality, and were able to get to sleep and stay asleep better than the comparison group
 - Sleep HAPI mothers also had significantly lower depression symptoms than the comparison group





Acknowledgements & sincere thank you >>>

- To all of the women who participated in the Sleep HAPI and E Moe Mama studies
- To the midwives who assisted in recruitment
- To the team at Sleep/Wake Research Centre and Massey University



Findings from the Sleep HAPI pilot study: Sleep and mental health from 12 weeks pregnancy to 12 weeks postnatal



Clare Ladyman
Sleep/Wake Research Centre, Massey University

Associate Professor T. Leigh Signal
Sleep/Wake Research Centre, Massey University

Dr Bronwyn Sweeney
Sleep/Wake Research Centre, Massey University

Professor Philippa Gander
Sleep/Wake Research Centre, Massey University

Dr Mark Huthwaite
Department of Psychological Medicine
University of Otago

Sleep HAPI

Why we did this study >>>

Sleep is important to our overall wellbeing, both physically and mentally. Research has shown that getting healthy sleep in pregnancy is important, but this can be difficult with the large number of changes most women experience.

This study aimed to provide information on how sleep works and why it is important, the changes that happen to sleep in different trimesters and ideas and strategies to help make the most of every sleep opportunity.




We wanted to see if providing mothers with information on sleep and strategies for improving their sleep could decrease the likelihood of the depressive symptoms in pregnancy.

How we did the study >>>

Women completed:

- Pregnancy questionnaires in the first, second and third trimesters
- Postnatal questionnaires at six and twelve weeks postnatal
- Two weeks of sleep recording in each trimester
- A feedback questionnaire after the last sleep education session

Women also participated in three one-on-one, face-to-face sleep education sessions (one in each trimester) that were guided by a researcher and information presented in the Sleep HAPI booklet. Women were also presented with print-outs of their sleep recordings, so they could see what their own sleep looked like.

Ethical Approval >>>

The study was approved by the Massey University Human Ethics Committee (Human Ethics Southern A Committee (SOA 16/29)). It was also reviewed and registered with the Australian & New Zealand Clinical Trials Registry (ACTRN1261700055303).

Mothers in this study >>>

A group of 22 women enrolled in Sleep HAPI, and data from 15 women were used in the analysis. Four women did not complete the study because of miscarriage or pre-term birth. All women were having their first baby, were NZ European, had a high level of education, had a history of depression, did not smoke nor consume drugs throughout the study and were not employed in shift work. The average age was 31 years.

APPENDIX 28 STATEMENT OF CONTRIBUTION, CHAPTER 3

DRC 16



MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Clare Iona Ladyman

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Ladyman, C., & Signal, T. L. (2018). Sleep health in pregnancy: A scoping review. *Sleep Medicine Clinics*, 13(3), 307-333. doi:10.1016/j.jsmc.2018.04.004

In which Chapter is the Published Work: Chapter 3

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: **60%**
and / or
- Describe the contribution that the candidate has made to the Published Work:
The candidate made a significant contribution to the review design, data collection, analysis and manuscript preparation which was reviewed and approved by the second author.

Clare Ladyman Digitally signed by Clare Ladyman
Date: 2020.01.14 20:42:42 +1300'

Candidate's Signature

14/01/2020

Date

Leigh Signal Digitally signed by Leigh Signal
Date: 2020.01.15 08:59:09
+1300'

Principal Supervisor's signature

15/01/2020

Date

APPENDIX 29 STATEMENT OF CONTRIBUTION, CHAPTER 4

DRC 16



MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Clare Iona Ladyman

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Title: Multiple dimensions of sleep are consistently associated with chronically elevated depressive symptoms from late pregnancy to three years postnatally
 Authors: Ladyman, C. I., Signal, T. L., Sweeney, B. S., Jefferies, M., Huthwaite, M., Gander, P. H., & Paine, S-J.
 This manuscript has been prepared for submission to the journal Australian and New Zealand Journal of Psychiatry

In which Chapter is the Published Work: Chapter 4

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: **70%**
and / or
- Describe the contribution that the candidate has made to the Published Work:
The candidate made a significant contribution to the study design and was responsible for preparing the manuscript which was reviewed and approved by all authors.

Clare Ladyman Digitally signed by Clare Ladyman
Date: 2020.01.14 20:46:29 +13'00'

Candidate's Signature

14/01/2020

Date

Leigh Signal Digitally signed by Leigh Signal
Date: 2020.01.15 08:58:23
+13'00'

Principal Supervisor's signature

15/01/2020

Date

APPENDIX 30 STATEMENT OF CONTRIBUTION, CHAPTER 5

DRC 16



MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Clare Iona Ladyman

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Title: Sleep HAPI: A feasibility and descriptive analysis of an early and longitudinal sleep education intervention for pregnant women with a history of depression
Authors: Ladyman, C. I., Gander, P. H., Huthwaite, M., Sweeney, B. S. & Signal, T. L.
This manuscript is under review with the journal Behavioural Sleep Medicine

In which Chapter is the Published Work: Chapter 5

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: **80%**
and / or
- Describe the contribution that the candidate has made to the Published Work:

The candidate made a significant contribution to the study design and prepared all study materials. She was responsible for coordinating recruitment, data collection, and conducted the statistical analysis. She wrote the original and subsequent drafts of the manuscript which were reviewed and approved by all authors.

Clare Ladyman Digitally signed by Clare Ladyman
Date: 2020.01.14 20:47:58 +1300

Candidate's Signature

14/01/2020

Date

Leigh Signal Digitally signed by Leigh Signal
Date: 2020.01.15 08:57:35
+1300

Principal Supervisor's signature

15/01/2020

Date

APPENDIX 31 STATEMENT OF CONTRIBUTION, CHAPTER 6

DRC 16



MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Clare Ladyman

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Title: A longitudinal sleep education intervention from early pregnancy and its effect on optimising sleep and minimising depressive symptoms

Authors: Ladyman C. I., Signal T. L., Sweeney B. S., Gander P. H., Paine S-J., Huthwaite M.

This manuscript is under review with the journal Sleep Health

In which Chapter is the Published Work: Chapter 6

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: **70%**
and / or
- Describe the contribution that the candidate has made to the Published Work:

The candidate made a significant contribution to the study design, prepared all study materials, coordinated recruitment, and conducted data collection for the Sleep HAPI study. The candidate checked and cleaned the Moe Kura data, created and reviewed descriptive statistics and conducted all statistical analyses used in this manuscript. She wrote the original and subsequent drafts of the manuscript which were reviewed by all authors.

Clare Ladyman Digitally signed by Clare Ladyman
Date: 2020.01.14 20:49:01 +13'00'
Candidate's Signature

14/01/2020
Date

Leigh Signal Digitally signed by Leigh Signal
Date: 2020.01.15 08:44:48
+13'00'
Principal Supervisor's signature

15/01/2020
Date

“The sun, has gone, to bed and so must I.”
— Oscar Hammerstein & Richard Rodgers, *Sound of Music*, 1959