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**Social Determinants of Preschoolers'
Sleep Health in Aotearoa/New Zealand:
A Mixed Methods Study**

A thesis presented in partial fulfilment of the requirements
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Take care of our children. Take care of what they hear, take care of what they see, take care of what they feel. For how the children grow, so will be the shape of Aotearoa.

Dame Whina Cooper

This thesis is dedicated to my children, Emily and Alex.

Ka nui taku aroha ki a koe

My love for you knows no bounds

ABSTRACT

Sleep is important for young children's health and wellbeing. In Aotearoa/New Zealand ethnic and socioeconomic inequities exist in adult sleep, however little is known about the social determinants of young children's sleep and whether sleep inequities exist in early childhood. A mixed methods study was conducted to address this gap in knowledge. Kaupapa Māori epidemiological principles informed the study design and sleep was viewed through a social determinants of health and complementary socioecological theoretical lens.

Sleep and sociodemographic questionnaire data from 340 Māori and 570 non-Māori preschoolers in the *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand* study (*Moe Kura*) were analysed. Log-binomial regression models investigated independent associations between ethnicity, socioeconomic position (SEP) and preschoolers' sleep duration, timing and problems. Ethnicity and socioeconomic deprivation were independently associated with short sleep duration (<10hrs), week/weekend sleep duration difference >1hr, later bedtimes and sleep problems based on a number of maternal-report measures.

A sub-sample of *Moe Kura* mothers (15 Māori and 16 non-Māori with low and high SEP) participated in face-to-face interviews about their preschooler's sleep. Results from thematic analysis identified four themes relating to mothers' perceptions of preschooler sleep: 'child happiness and health', 'maternal wellbeing', 'comfort and connection' and 'family functioning and harmony'. Four additional themes centred around facilitators and barriers to preschoolers sleeping well: 'health, activity and diet', 'sleep promoting physical environments', 'consistency' and 'doing it our way'. Mothers valued their preschooler

ABSTRACT

having good sleep health, however societal factors influenced the degree of autonomy they had over implementing sleep supporting strategies.

Integrated mixed methods findings indicate that ethnic and socioeconomic inequities in preschooler sleep health exist in Aotearoa/New Zealand and that social determinants of preschoolers' sleep include institutional racism, material and financial resources, employment, housing, social support, early childhood education services and child health services.

Results indicate that a victim-blaming approach which does not take into account the broader societal context and places blame and burden on mothers not 'managing' their child's sleep 'properly' must be rejected. Action is required to address the socio-political drivers that lead to the inequitable distribution of social determinants of preschoolers' sleep health.

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TERMS AND ABBREVIATIONS

Actigraphy	A method of objectively estimating sleep/wake patterns based on movement, via the use of a small wearable device that contains an accelerometer
CSHQ	Children’s Sleep Habits Questionnaire
DLMO	Dim light melatonin onset
E Moe, Māmā	E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand study
ECE	Early childhood education
EEG	Electroencephalogram
EMG	Electromyogram
EOG	Electrooculogram
Ethnicity	Social construct reflective of the social group(s) that a person identifies with
Kaitiaki	Guardian
Koha	Gift of appreciation
Māmā	Mother
Moe	Sleep
Moe Kura	Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand study
N1	Stage 1 NREM sleep
N2	Stage 2 NREM sleep
N3	Stage 3 NREM sleep
NREM	Non-rapid eye movement

TERMS AND ABBREVIATIONS

NZDep2013	New Zealand Index of Deprivation 2013. A non-occupational, composite, area-level measure of relative socioeconomic deprivation. Ranges from decile 1 (10% of small areas with lowest levels of deprivation) to decile 10 (10% of small areas with highest levels of deprivation)
NZiDep	New Zealand Individual Deprivation Index. A non-occupational, composite measure of individual-level socioeconomic deprivation based on experiences of 8 deprivation characteristics in the past 12 months. Scores range from 1 (0 deprivation characteristics) to 5 (≥ 5 deprivation characteristics)
OSA	Obstructive sleep apnoea
PSG	Polysomnography
PSQ	Pediatric Sleep Questionnaire
REM	Rapid eye movement
SDB	Sleep disordered breathing
SEP	Socioeconomic position
SES	Socioeconomic status
SOL	Sleep onset latency
SWS	Slow wave sleep
Te Tiriti o Waitangi	The Treaty of Waitangi

CHAPTER 1 INTRODUCTION

Sleep plays a vital role in children's health and development (Sadeh & El-Sheikh, 2015) and poor sleep health in childhood is associated with adverse health and wellbeing outcomes (Anderson, Andridge, & Whitaker, 2016; Bates, Viken, Alexander, Beyers, & Stockton, 2002; Chaput et al., 2017; Hiscock, Canterford, Ukoumunne, & Wake, 2007; M. Miller, Kruisbrink, Wallace, Ji, & Cappuccio, 2018; Reynaud, Vecchierini, Heude, Charles, & Plancoulaine, 2018). While sleep is a fundamental biological need regulated by physiological processes (Carskadon & Dement, 2017; Gander, 2003), it is also a socially determined phenomenon (L. Hale, Emanuele, & James, 2015).

The World Health Organization defines the social determinants of health as "the conditions in which people are born, grow, live, work, and age" (CSDH, 2008a, p.1) and deems poor and unequal living conditions as resulting from "poor social policies and programmes, unfair economic arrangements, and bad politics" (CSDH, 2008a, p.1). The unequal distribution of power, privilege, resources and associated differential conditions of daily living experienced by social groups within society manifests as health inequities (CSDH, 2008a). In Aotearoa/New Zealand (NZ), ethnic and socioeconomic inequities exist in adult sleep health (Paine & Gander, 2013) but little is known about the social patterning of young children's sleep. Understanding the social determinants of young children's sleep and investigating whether inequities in sleep exist in early childhood is an important step in preventing potentially enduring sleep inequities across the lifecourse. Therefore, the primary aim of this thesis is to explore the social determinants of preschool-aged children's sleep health in NZ.

1.1 Thesis Contexts

This thesis examines preschoolers' sleep within the unique context of NZ. It uses quantitative and qualitative data collected from participants in a wider programme of longitudinal research on maternal and child sleep and health, the *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura)* study. In order to contextualise the research, a brief overview of aspects of NZ society that are relevant to the thesis and of the methodological principles that guide *Moe Kura* is provided below.

1.1.1 Aotearoa/New Zealand Context

NZ has a population of approximately 4.9 million people (Statistics New Zealand, 2018). Around 24% of the population are children under the age of 18 years and 28% of children are under the age of five (Children's Commissioner, 2016). In NZ, the collection and reporting of ethnicity data for population and health and disability statistics is conducted using well established, standardised protocols (Ministry of Health, 2004, 2017a). Statistics New Zealand define ethnicity as "the ethnic group or groups that people identify with or feel they belong to. Ethnicity is a measure of cultural affiliation, as opposed to race, ancestry, nationality or citizenship. Ethnicity is self-perceived and people can belong to more than one ethnic group. An ethnic group is made up of people who have some or all of the following characteristics:

- a common proper name
- one or more elements of common culture which need not be specified, but may include religion, customs, or language
- unique community of interests, feeling and actions
- a shared sense of common origins or ancestry, and
- a common geographic origin" (Statistics New Zealand, 2005, p.1).

Therefore, ethnicity is a *social* and not a biological construct, reflective of the social group or groups that a person identifies with, which can change over time (Ministry of Health, 2004, 2017a). Māori, the indigenous people of NZ, make up approximately 15% of the total population, alongside other major ethnic groupings including European (74%), Pacific (7%) and Asian (12%) people (Statistics New Zealand, 2013). The age structure of the Māori population is younger than that of the non-Māori population. In 2015, 1 in 3 Māori were under the age of 15 years compared to 1 in 6 non-Māori and 26% of the child population under the age of 15 were Māori (Statistics New Zealand, 2015).

Health inequities are differences in health that “are unnecessary, avoidable, unfair and unjust” (Whitehead, 1992, p.431). Conversely, health equity is the absence of systematic health disparities (Braveman & Gruskin, 2003). Health equity is also the absence of disparities in the major social determinants of health between groups with different social advantages or disadvantages such as wealth, power and prestige (Braveman & Gruskin, 2003). Therefore, health equity is an ethical concept incorporating social justice and human rights, which is achieved by reducing health disparities between groups of people with more and less social and economic advantage (Braveman, 2014a, 2014b; Braveman & Gruskin, 2003).

Stark health inequities exist between Māori and non-Māori in NZ. In 2013, the life expectancy at birth for Māori males was 73.0 years compared to 80.3 years for non-Māori males, and 77.1 years for Māori females compared to 83.9 years for non-Māori females (Ministry of Health, 2015). Māori adults have higher rates of cancer, diabetes, cardiovascular disease, respiratory disease, obesity, depression, anxiety, intentional self-harm and suicide, than non-Māori adults (Ministry of Health, 2015). Māori children have higher rates of obesity than non-Māori children (Ministry of Health, 2015). In addition, Māori children and young people have higher rates of hospitalisation for upper

respiratory tract infections, pneumonia, asthma, bronchiectasis, pertussis, meningococcal disease, acute rheumatic fever, rheumatic heart disease and skin infections, and higher suicide rates than non-Māori non-Pacific children and young people (Simpson et al., 2017).

Socioeconomic position (SEP) encompasses both the social and economic factors that influence the position or positions that an individual or group holds within the structure of society (Lynch & Kaplan, 2000). SEP incorporates resource-based measures, including material and social resources and assets, and prestige-based measures, that relate to a person's rank or status in a social hierarchy (Krieger, 2001a). Krieger (2001a) supports the use of the term socioeconomic position, as opposed to 'socioeconomic status' which she describes as privileging 'status' over material resources.

In NZ, the socioeconomic position of Māori differs significantly from non-Māori, as evident in disparate figures in a number of indicators of SEP. Māori are over-represented in the most socioeconomically deprived neighbourhoods and under-represented in the least deprived areas (Atkinson, Salmond, & Crampton, 2014; Ministry of Health, 2015). Māori adults have lower rates of school completion (Level 2 Certificate or higher) and higher rates of unemployment than non-Māori (Ministry of Health, 2015). A greater proportion of Māori adults have low personal income (less than \$10,000 NZD per year), receive income support and live in crowded households, than non-Māori adults (Ministry of Health, 2015). Over one third of Māori children live in poor households (34%; based on household income after housing costs below 60% of the 2007 median) or households that experience material hardship (39%), compared to 16% and 15% of European children respectively (Simpson, Oben, et al., 2016). In 2013, 25% of Māori children were living in crowded households compared to 8% of non-Māori non-Pacific children (Simpson, Oben, et al., 2016).

SEP is a significant health determinant in NZ (Howden-Chapman & Tobias, 2000). Adults living in the most deprived areas are more likely to be obese, take medication for high blood pressure or asthma, be diagnosed with ischaemic heart disease, diabetes or a mental health condition such as anxiety or depression, or experience chronic pain or psychological distress, compared to adults living in the least deprived neighbourhoods, independent of ethnicity, age and sex (Ministry of Health, 2013). Children aged 2 to 14 years living in the most socioeconomically deprived areas are three times more likely to be obese compared to children living in the least deprived areas, after controlling for ethnicity, age and gender (Ministry of Health, 2013). A social gradient is evident between increasing neighbourhood deprivation and increasing rates of childhood respiratory conditions and skin infections, and children living in the most deprived neighbourhoods have a greater rate of communicable diseases, such as meningococcal disease and rheumatic fever, compared to children living in the least deprived areas (Simpson, Duncanson, et al., 2016).

Health and socioeconomic inequities experienced by Māori reflect historical and contemporary impacts of colonisation (Harris et al., 2006b; Reid & Robson, 2007). The Treaty of Waitangi is one of the founding documents of NZ (Kingi, 2007; Orange, 2011). In 1840, over 500 rangatira (chiefs) signed te Tiriti o Waitangi (Māori text) and representatives of the British Crown signed the Treaty of Waitangi (English text), thus formalising a partnership between Māori and the Crown. However, there were significant discrepancies between the Māori and English versions. Provisions of te Tiriti o Waitangi (Māori text) were Crown authority to *govern* (Article One); tribal authority over cultural, social and economic resources (Article Two); and royal protection and citizenship rights (Article Three). In contrast, provisions of the Treaty of Waitangi (English text) were Crown *sovereignty* (Article One); tribal property rights (Article Two); and royal protection and citizenship rights (Article Three) (Durie, 1998). A recent inquiry has ruled that rangatira

who signed te Tiriti did *not* cede their sovereignty to the British Crown, but rather agreed to a sharing of power and authority (Waitangi Tribunal, 2014).

However, effects of the ensuing post-Tiriti/Treaty British rule and colonisation, including land confiscations and the social and political marginalisation of Māori, are evident in the unequal power relationships between Māori and non-Māori that are entrenched in NZ society today (Robson & Harris, 2007). Colonisation is based on an ideology of racism (Paradies, 2016). Racism is a system that includes an ideology that some racial/ethnic groups are superior to others and the beliefs and practices that come from this (D. Williams & Mohammed, 2013). Various types of racism exist including personally-mediated, internalised and institutional racism (Jones, 2000; D. Williams & Mohammed, 2013).

Māori adults are nearly twice as likely as non-Māori adults to experience 'any' type of racial discrimination (ethnically motivated physical or verbal personal attack; unfair treatment on the basis of ethnicity by a health professional, in the workplace including being refused a job, or when renting or buying a house) (Ministry of Health, 2015). A recent examination of racism and adult health in NZ found significant negative associations between reported recent experiences of racism and physical and mental health (Harris, Stanley, & Cormack, 2018). In regards to children, experiences of 'any' racism are more prevalent for caregivers of Māori children (30%) and Asian children (30%), than caregivers of European/Other children (14.4%), and are associated with poorer child healthcare utilisation (Paine, Harris, Stanley, & Cormack, 2018).

Institutional racism encompasses differential access to goods, services and opportunities by race/ethnicity, which manifests as differential material conditions, power and inherited advantage and disadvantage (Jones, 2000). As it is normative and embedded in the institutions and structures of society, institutional racism does not involve an easily

identifiable perpetrator and can transpire as 'inaction in the face of need' (Jones, 2000). The differential socioeconomic deprivation profile of Māori and non-Māori in NZ is indicative of institutional racism stemming from colonisation, including forced alienation from traditional lands and asset loss (Becares, Cormack, & Harris, 2013; Harris et al., 2006a; Te Puni Kokiri, 2000), and systemic, structural bias experienced by Māori (Reid & Robson, 2007). Therefore, an examination of social determinants of preschoolers' sleep in NZ must take into account NZ's history of colonisation and the resulting marginalised social position experienced by Māori.

1.1.2 Research Context

This thesis is embedded in the *Moe Kura* study of maternal and child sleep and health, which builds upon the *E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand* (*E Moe, Māmā*) study of perinatal sleep and health in NZ (Howe et al., 2015; Paine, Priston, Signal, Sweeney, & Muller, 2013; Signal et al., 2016) (see Chapter 3 for detailed information about the *Moe Kura* study design and methods). A strength of this research programme is that it is grounded in Kaupapa Māori research theory which, amongst other things, locates Māori at the centre of the research and rejects 'victim blame' analyses (Paine et al., 2013; Reid et al., 2017; L. Smith, 2012). Three overarching Kaupapa Māori epidemiological research principles guide *Moe Kura*:

1. Māori participation and control at all stages of the research.
2. Appropriate classification of different ethnic groups to identify and monitor health disparities.
3. Equal explanatory and analytical power (Paine et al., 2013).

The application of these principles includes shared *Moe Kura* leadership by a Māori and a non-Māori co-Principal Investigator, and the Māori co-Principal Investigator taking on the role of kaitiaki (guardian) of Māori participants and their information throughout the

research process. Senior Māori health researchers have provided expertise on *Moe Kura* and *E Moe, Māmā* expert advisory panels, and there has been Māori involvement in all processes relating to the recruitment and retention of Māori participants (Paine et al., 2013).

The equal status of Māori statistical needs alongside those of the total NZ population has been prioritised, as has the importance of ensuring that differences between groups can be explored and potentially explained (Te Ropu Rangahau Hauora a Eru Pomare, 2002). Therefore, the recruitment of equal and sufficiently large numbers of Māori and non-Māori participants to ensure adequate statistical and explanatory power has been endeavoured (Paine et al., 2013).

1.2 Researcher's Identity and Position

My ethnicity is NZ European/Pākehā (non-Māori). I have ancestral roots in Germany and Ireland and my great-grandparents immigrated to NZ from England and America. I do not profess to understand the experience of being Māori, nor is my worldview situated in Māoridom. However, I have a strong commitment to honouring the Kaupapa Māori research principles of the *Moe Kura* study, while recognising that I do so from a Pākehā perspective/position. Before commencing my doctorate, I worked as a Junior Research Officer with the *Moe Kura* and *E Moe, Māmā* study teams. I was in the privileged position of being able to gain an understanding of the research ethos and to receive mentorship from both *Moe Kura* co-Principal Investigators before embarking on (and subsequently during) my study. Having previously had a career as an occupational therapist, working predominantly in mental health, I place great value on social justice, fairness and empowerment. Therefore, I was motivated to investigate sleep in a way that recognises

the importance and influence of the wider societal context in which children live and to conduct research that could be translated into some form of action and positive change.

1.3 Scope of the Thesis

The scope of this research is restricted to preschool-aged children, and their mothers, who are participants in the *Moe Kura* study cohort. This thesis utilises a mixed methods study design, using a combination of quantitative sleep and demographic *Moe Kura* questionnaire data collected when children were 3 to 4 years old and qualitative data on experiences of preschoolers' sleep collected using interviews with a sub-sample of mothers in *Moe Kura*.

1.4 Thesis Structure

This thesis combines 'traditionally' written chapters with four manuscripts that have been prepared for publication. At the time that this thesis was submitted for examination, two manuscripts were in press, having been accepted for publication; one manuscript was under review; and one was prepared for journal submission. During the course of the thesis being marked, the manuscript that was undergoing peer review was accepted for publication. Each manuscript has been reformatted, in keeping with the overall style of the thesis, and references are incorporated into the main reference list. Manuscripts do include some unavoidable repetition, particularly in the methods sections, however each has a discrete focus relating to the overall aim of the thesis.

Following this introductory chapter, Chapter 2 provides background information derived from published literature relevant to the thesis. It includes information on the physiology, function and measurement of sleep, along with preschoolers' sleep patterns, sleep problems and associations with wellbeing. It outlines the social patterning of

preschoolers' sleep in countries outside of NZ, associated theoretical models and current data on the sleep of preschoolers in NZ. Chapter 2 concludes by highlighting the knowledge gaps that this research aims to address and the quantitative, qualitative and mixed methods research questions of the thesis.

Chapter 3 describes the mixed methods research methodology and the quantitative and qualitative study methods employed, including study design, recruitment and data collection processes and analysis methods.

Results from the quantitative study, in the form of two manuscripts, are incorporated in Chapters 4 and 5. The first manuscript focuses on the duration of preschoolers' sleep and associations with ethnicity and SEP. This has been accepted for publication in the journal *Sleep Health*. The second manuscript centres around preschoolers' sleep timing and sleep problems and their relationship with ethnicity and SEP. This has been prepared for submission to the journal *Sleep Medicine*.

Results from the qualitative study are presented in Chapters 6 and 7, in the form of two manuscripts. The first manuscript focusses on the perceptions and experiences of preschoolers' sleep of a sub-sample of *Moe Kura* Māori and non-Māori mothers, with low and high SEP, and has been accepted for publication in the journal *Qualitative Health Research*. Using the same sample of women, the second manuscript explores mothers' experiences of facilitators and barriers to preschoolers sleeping well. This has been accepted for publication in the journal *Sleep Health*.

The final chapter, Chapter 8, synthesises the findings from the concurrent quantitative and qualitative studies to address the overarching aim of the thesis. The implications of findings are discussed, along with personal reflections on the research process, strengths and limitations, recommendations for future research and overall conclusion of the thesis.

CHAPTER 2 BACKGROUND

This chapter provides an overview of what sleep is, why it is important for children's wellbeing, current literature on the social patterning of preschoolers' sleep, and the knowledge gaps in this area in NZ. It concludes with the research questions that this thesis aims to address.

2.1 Defining Sleep

Until the discovery of rapid eye movement (REM) sleep in the 1950s, sleep was considered to be a passive process of brain inactivity (Pelayo & Dement, 2017). It is now known that normal human sleep is not merely the absence of waking, but rather an active process comprising of two discrete states, non-rapid eye movement (NREM) sleep and REM sleep (Carskadon & Dement, 2017). Sleep incorporates both physiological and behavioural aspects and has been described as a “complex amalgam of physiologic and behavioural processes . . . typically (but not necessarily) accompanied by postural recumbence, behavioural quiescence, closed eyes, and all the other indicators commonly associated with sleeping” (Carskadon & Dement, 2017, p. 15).

Expanding on this definition of sleep is the positive construct of 'sleep health'. Sleep health is “a multidimensional pattern of sleep-wakefulness, adapted to individual, social and environmental demands, that promotes physical and mental wellbeing. Good sleep health is characterised by subjective satisfaction, appropriate timing, adequate duration, high efficiency, and sustained alertness during waking hours” (Buysse, 2014, p. 12). Considering sleep in this way provides a positive frame of reference for how well individuals or populations are sleeping, recognises good sleep health as being more than just the absence of sleep disorders, incorporates multiple facets of sleep and associated waking function and embeds sleep within the wider social and environmental context

(Buysse, 2014). Thus, in the relatively short history of sleep science, the move to examining 'sleep health' as opposed to focussing on identifying and treating individual sleep disorders has been ground breaking.

2.2 Sleep Architecture

'Sleep architecture' refers to the basic organisational structure of sleep, comprising of NREM sleep, REM sleep and wake in children and adults. Relatively low levels of brain activity occur during NREM sleep, but physiological systems in the body are actively regulated and body movements remain intact. NREM sleep is categorised into three stages: Stages N1, N2 and N3. Stage N1, transitional sleep, is characterised by slow rolling eye movements, disengagement from surroundings, short involuntary muscle contractions called hypnic jerks and the slowing of brain activity. Electroencephalogram (EEG) activity changes from low voltage, mixed frequency and alpha waves (8 – 13Hz) to theta waves (3 – 7 Hz) (Carskadon & Dement, 2017; Mindell & Owens, 2015).

Stage N2, often deemed the beginning of 'true sleep', involves occasional bursts of rapid rhythmic EEG activity (sleep spindles) and high amplitude slow wave spikes (K-complexes). As Stage 2 progresses, larger, slower delta waves (<2 Hz) start to occur (Carskadon & Dement, 2017; Mindell & Owens, 2015).

Stage N3, or slow wave sleep (SWS), is often described as 'deep sleep' and is characterised by a significant proportion of delta waves. Breathing is slow and regular and during this sleep stage it is difficult to be woken (Carskadon & Dement, 2017; Mindell & Owens, 2015).

In contrast, REM sleep is characterised by bursts of rapid eye movements under closed eyelids, brain activity that closely resembles that of being awake and low activity in

postural muscles, which inhibits voluntary movement. This is the sleep stage in which most dreaming occurs. It is sometimes referred to as 'paradoxical sleep', with the paradox being high levels of cortical brain activity associated with dreaming, but with virtual body paralysis (Carskadon & Dement, 2017).

From the beginning of a sleep period sleep becomes progressively deeper and individuals become more difficult to wake across NREM Stages 1 to 3, followed by a return to lighter stages of NREM, before entering REM sleep. NREM and REM alternate cyclically across the sleep period, with higher proportions of deeper NREM sleep earlier in the night and significantly more REM sleep later in the sleep period (Bathory & Tomopoulos, 2017; Carskadon & Dement, 2017; Mindell & Owens, 2015).

2.3 Sleep/Wake Regulation

Physiologically, two main processes are involved in regulating the sleep/wake cycle – the sleep homeostatic process and the circadian drive for arousal (Achermann, 2004; Borbély & Achermann, 1992, 2005). Sleep homeostasis is an internal, sleep/wake dependent process that produces pressure to sleep the longer that someone is awake. Once asleep, this pressure dissipates exponentially via SWS across the sleep period. In contrast, the circadian process involves a 'master clock' or pacemaker in the suprachiasmatic nuclei (SCN) of the anterior hypothalamus, which regulates circadian rhythms of a multitude of physiological processes and behaviours including alertness and sleep/wake timing (Kurth, Olini, Huber, & LeBourgeois, 2015; Vetter, 2018). Output from the SCN to the pineal gland promotes melatonin secretion, with melatonin levels being high at night before sleep and low during the day (LeBourgeois et al., 2013; Tahkamo, Partonen, & Pesonen, 2019). The endogenous period of the circadian clock is usually slightly longer than 24 hours and environmental time cues known as zeitgebers enable the clock to adjust, or entrain, to

earth's 24 hour day/night cycle (Vetter, 2018). Light is the strongest zeitgeber for the human circadian system (Duffy & Wright, 2005), however other factors including social and physical activity can also be of influence (Czeisler & Buxton, 2017; Vetter, 2018).

The two-process model (Figure 1), first published by Borbély (1982), posits that it is the interaction of the sleep homeostatic process (Process S) and the circadian drive for arousal (Process C) that results in times of the day and night when we are physiologically driven to be asleep or awake (Achermann, 2004; Borbély & Achermann, 1992; Jenni & Le Bourgeois, 2006). When Process S reaches the upper threshold of Process C then sleep occurs and, conversely, when Process S reaches the lower threshold waking occurs (Borbely, Daan, Wirz-Justice, & Deboer, 2016).

Source: Achermann (2004, p.A38)

Figure 1. Schematic of the two-process model of sleep regulation

2.4 Developmental Changes in Sleep

A number of changes in sleep architecture, timing and duration occur across the lifespan, and particularly in the first five years of life (Bathory & Tomopoulos, 2017). From birth to 6 months of age, the physiology of infants' sleep is different from that of older children and adults, so the terms 'active' sleep (which develops to become REM sleep) and 'quiet' sleep (which develops to become NREM sleep) are used (Jenni & Carskadon, 2012). Newborn babies spend approximately 16 to 17 hours per 24 hour period sleeping, which gradually decreases to around 13 to 14 hours by 6 to 8 months of age. Newborns' sleep onset is usually through active sleep, which gradually changes to sleep onset through quiet sleep by approximately 12 weeks. Quiet sleep can be categorised into three distinct stages around this time. REM sleep makes up approximately 30% of total sleep time in the latter part of the first year of life and reduces to 20% to 25% between the ages of 2 and 5 years, similar to that of adults. At 2 years of age average sleep onset latency, or the time taken to fall asleep, is approximately 15 minutes. This increases to 15 to 30 minutes by the age of 5 (Sheldon, 2014a).

The length of NREM/REM cycles increase with age and are approximately 60 minutes in duration at 2 to 3 years, increasing to around 60 to 90 minutes at 4 to 5 years (Lopp, Navidi, Achermann, LeBourgeois, & Behn, 2017; Sheldon, 2014a). Two to 5 year olds spend up to two hours per night in deep N3 sleep, most of which usually occurs in the first third of the night (Sheldon, 2014a). This predominance of SWS decreases by 40% to 60% after puberty and continues to decline with age (Mindell & Owens, 2015).

The distribution of sleep across 24 hours gradually changes over the first 12 months of life, to include a consolidated longer sleep period at night in conjunction with daytime nap sleeps. Between the ages of 3 and 5 years, some children transition to sleeping in one consolidated nocturnal period, although not all children stop napping by 5 (Acebo et al.,

2005; Weissbluth, 1995). It has been proposed that the gradual transition from a biphasic to a monophasic sleep pattern that occurs between early and middle childhood for some children is influenced physiologically by maturational changes in the homeostatic process (Jenni & Carskadon, 2012; Jenni & Le Bourgeois, 2006). As illustrated in Figure 2, the proposition is that younger children accumulate sleep pressure more quickly and therefore need to sleep during the day and, conversely, older children accumulate sleep pressure more slowly and can sustain wakefulness for longer (Jenni & Le Bourgeois, 2006). While such maturational changes in sleep pressure may influence children's napping, so too do cultural norms and practices (Jenni & O'Connor, 2005).

Source: Jenni & Le Bourgeois (2006, p.284)

Figure 2. Proposed developmental changes with age, in the accumulation of sleep pressure across the day

Developmental changes in the circadian system also occur. In newborns, daily sleep/wake rhythms may not be apparent and sleeping and waking episodes may be distributed randomly across the day and night (Jenni & Carskadon, 2012; Jenni, Deboer, & Achermann, 2006), although some research has found day-night differences and a circadian component in the sleep/wake behaviour of infants as early as the first few weeks of life (Lohr & Siegmund, 1999; Tomioka & Tomioka, 1991). Circadian rhythms in core body temperature, cortisol and melatonin production develop over the first three months, although this can vary greatly between individuals (Jenni & Carskadon, 2012; McGraw, Hoffmann, Harker, & Herman, 1999; Wyatt, 2014). A 24 hour rest-activity pattern tends to emerge over the first few months, with children beginning to sleep more at night than during the day, and a robust consolidation of sleep at night is usually established sometime between 5 and 10 months of age (Jenni & Carskadon, 2012; Jenni et al., 2006). An age-related shift in the timing of endogenous circadian sleep/wake rhythms across childhood has been demonstrated, based on measures of dim light melatonin onset (DLMO) (Kurth et al., 2015). Toddlers have been shown to have an average DLMO of 19:29 (LeBourgeois et al., 2013), whereas 9 to 12 year olds and 13 to 16 year olds have been shown to have average DLMOs of 20:42 and 21:09 respectively (Crowley, Acebo, Fallone, & Carskadon, 2006).

From infancy to adolescence, a gradual decline in average sleep duration across 24 hours occurs (Mindell & Owens, 2015) which is reflected in recent US National Sleep Foundation (NSF) sleep duration guidelines (Figure 3) (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Adams Hillard, et al., 2015; Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015). Based on expert panel reviews of published scientific evidence and experience, both the NSF and American Academy of Sleep Medicine recommend that preschoolers (3 – 5 year olds) obtain 10 to 13 hours of sleep per 24 hours, which may include naps (Hirshkowitz, Whiton, Albert, Alessi, Bruni,

DonCarlos, Hazen, Herman, Adams Hillard, et al., 2015; Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015; Paruthi et al., 2016a, 2016b). Recognising that sleep need can differ between individuals, NSF guidelines indicate that 8 to 9 hours or up to 14 hours may be appropriate for some preschoolers (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015).

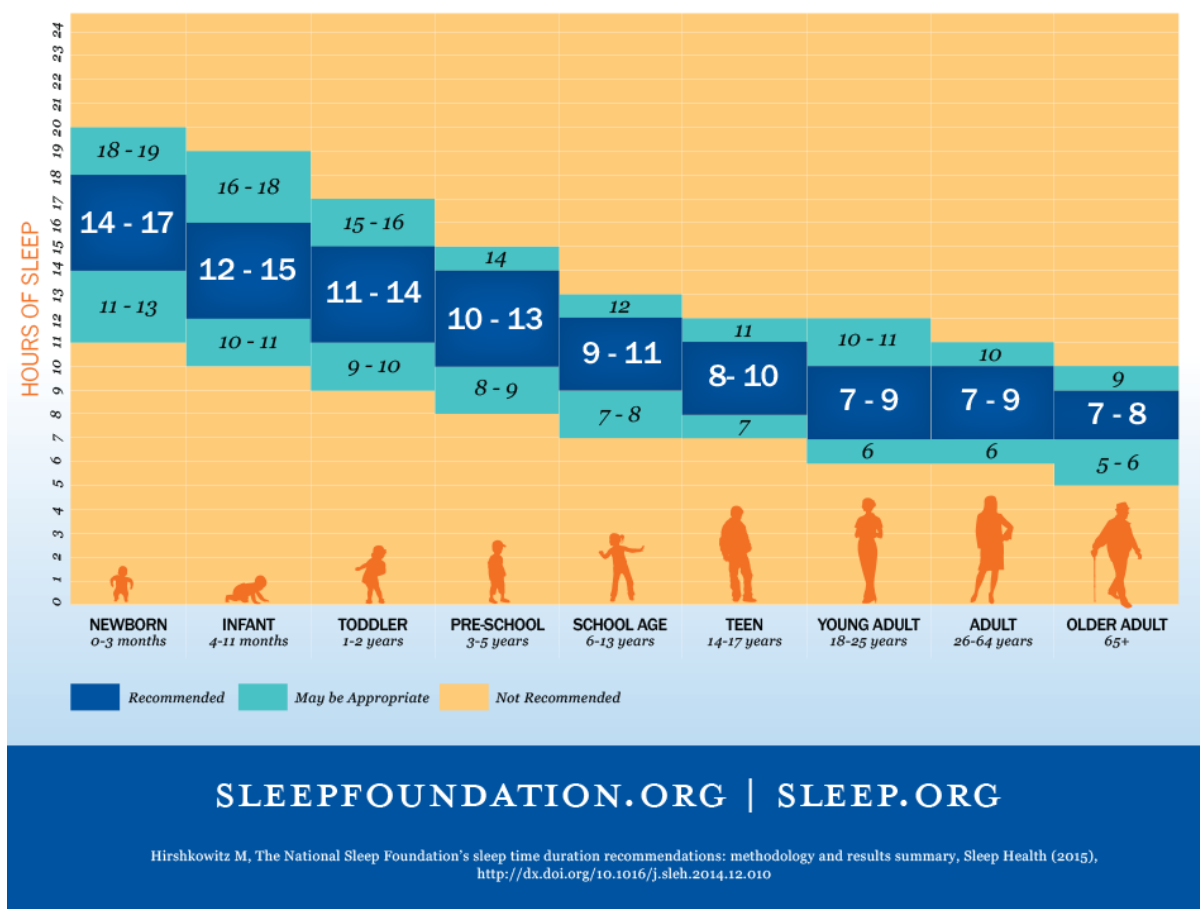


Figure 3. National Sleep Foundation's sleep duration recommendations across the lifespan

2.5 The Function of Sleep

A number of theories exist regarding why we sleep, however the primary function of sleep remains elusive (Assefa, Diaz-Abad, Wickwire, & Scharf, 2015; Barone & Krieger, 2015; Krueger, Frank, Wisor, & Roy, 2016; Sheldon, 2014b; Siegel, 2005). Restoration theory is based on the premise that wake-induced somatic and cerebral deficits are repaired or restored during sleep. NREM sleep is associated with aiding the growth and repair of body tissues, and REM sleep with the restoration of brain tissue and central nervous system development. However, it may not be sleep per se that is involved in tissue restoration, but rather that sleep influences other physiological processes that are involved (Sheldon, 2014b).

Energy conservation theory posits that sleep's function is to conserve energy, with energy reduction being greater during periods of sleep than quiet wakefulness (Berger & Phillips, 1995). However this theory has been questioned in relation to humans, who experience an 8% to 10% reduction in metabolic rate when sleeping versus during relaxed wakefulness, which would equate to a minimal difference in energy expenditure (Sheldon, 2014b). In support of the energy conservation theory, long sleep durations of children may be necessary for conserving energy due to relatively high metabolic rates compared to shorter sleep durations in adulthood when metabolic rates are relatively lower (Siegel, 2009). Alternatively, sleep can be viewed as an evolutionary adaptive response, whereby sleep-associated inactivity occurs at times that would have been of high predator risk and, vice versa, wake-associated activity occurs at times that would have coincided with optimal food and prey availability and minimal predator risk (Siegel, 2009). Thus, sleep may have developed as a predominantly safety and survival mechanism.

Two theories of the function of sleep relate to the process of learning and memory: learning theory and unlearning theory (Sheldon, 2014b). Findings from a comprehensive

body of research indicate that sleep prior to and following learning plays a fundamental role in declarative (fact-based) and non-declarative (action- and behaviour-based) memory encoding, working memory and memory consolidation in children and adults (Kopasz et al., 2010; Stickgold, 2013; Stickgold & Walker, 2005; M. Walker, 2008; M. Walker & Stickgold, 2006). The juxtaposing theory of unlearning is based on the premise that the role of sleep is to reduce or prevent the storage of unwanted or spurious information that is acquired during waking and that this ‘unlearning mechanism’ may be REM sleep dependent (Sheldon, 2014b; R. Walker & Russo, 2004).

A related proposition is that a central function of sleep is in brain connectivity/plasticity, with sleep playing a role in modifying the strength and/or structure of neural networks (Krueger et al., 2016; M. Walker, 2008; M. Walker & Stickgold, 2006). For example, the synaptic homeostasis hypothesis (SHY) proposes that sleep’s fundamental function is to preserve synaptic homeostasis (Tononi & Cirelli, 2012, 2014, 2019). SHY posits that during sleep, when the brain is “offline” from the environment, a net decrease in synaptic strength occurs during SWS. This is required to counterbalance the net increase in synaptic strength due to learning when awake and, of particular relevance to preschoolers, due to the significant degree of synaptogenesis that occurs during development (Tononi & Cirelli, 2019). Sleep is therefore viewed as necessary to avoid impaired learning due to synaptic saturation (Tononi & Cirelli, 2012, 2014, 2019).

A glymphatic function of sleep has also been proposed, which provides a potential explanation as to why sleep is restorative and why sleep deprivation impairs brain functioning (Xie et al., 2013). Research with mice has shown that neurotoxic waste products, including amyloid- β , are cleared from the brain via a fluid-clearance “glymphatic” pathway and that glymphatic function greatly increases during SWS compared to wake (Xie et al., 2013). Research with humans has identified some features

and pathways resembling the rodent glymphatic system and have found increased accumulation of amyloid- β in the brain after sleep deprivation in healthy adults (Rasmussen, Mestre, & Nedergaard, 2018). However, further research is required to understand the role that sleep may play in neurotoxin clearance (Benveniste et al., 2018; Rasmussen et al., 2018).

While debate continues regarding its primary function(s), sleep is a biological imperative with significant roles to play in the optimal functioning of both the brain and the body (Czeisler, 2015). It is therefore of particular importance in early childhood, which is a time of rapid growth and development (El-Sheikh & Sadeh, 2015).

2.6 Measuring Preschool-Aged Children's Sleep

As sleep is a multidimensional phenomenon it can be assessed in a variety of ways (Lewandowski, Toliver-Sokol, & Palermo, 2011; Sadeh, 2015). The choice of sleep measure depends on a number of factors, including the research aim or clinical assessment goal, the age of the child and the availability of resources, including finances, equipment, technical expertise and time (Sadeh, 2015).

2.6.1 Polysomnography

Polysomnography (PSG) is considered the gold standard for objectively measuring sleep (Meltzer, Walsh, Traylor, & Westin, 2012; Sadeh, 2015). PSG studies with young children are usually conducted in a sleep laboratory, to ensure safety and technical compliance, and involve the attachment of electrodes and sensors to children prior to bedtime which remain attached throughout the night. The simplest PSG montage for assessing sleep architecture includes brain activity (electroencephalogram; EEG), muscle activation (electromyogram; EMG) and eye movements (electrooculogram; EOG) (Keenan &

Hirshkowitz, 2017; Krishna, 2014; Sadeh, 2015). A standardised procedure is usually used to determine where EEG electrodes are placed on the head, based on the International 10-20 grid system (Klem, Luders, Jasper, & Elger, 1999). Once collected, trained sleep technologists normally score the data in 30 second intervals (epochs) using standardised scoring protocols (American Academy of Sleep Medicine, 2007; Rechtschaffen & Kales, 1968).

While the advantage of PSG is the detailed and rich array of information that it provides and, when conducted in the laboratory, the controlled conditions within which data are collected, it is an expensive process requiring specialised equipment and trained staff. Usually only one or two nights of data collection is affordable, with only a small number of children, and sleep scoring is labour intensive. Sleeping away from their natural environment and having electrodes and sensors attached is potentially anxiety inducing for children, and may result in data that are not representative of typical sleep at home. As many preschoolers nap at inconsistent times, measuring all natural sleep episodes across 24 hours with PSG is also challenging (Sadeh, 2015).

2.6.2 Direct Behavioural Observation and Videosomnography

Children's sleep patterns and behaviours can be assessed using trained observers directly watching a child sleep and scoring sleep and wakefulness in real time across a specified period (Sadeh, 2015) or by video recording children's sleep to assess children's sleep patterns, sleeping arrangements, parental interactions during the night, sleep disorders (Sadeh, 2015) and bed sharing behaviour (Baddock, Galland, Taylor, & Bolton, 2007). Both methods can be advantageous, in that they are able to assess sleep within a child's naturalistic environment. However, direct behavioural observation is labourious, is usually only conducted for short periods of time during the day rather than at night and is often restricted to very young children. Videosomnography requires technical expertise

for home installation, relies on parents/caregivers turning on the recorder prior to children sleeping, is unable to record children's sleep if they move to another sleep location that is not monitored and visual inspection and scoring of video data is time consuming. Families may also find the presence of an observer or video camera in their house intrusive (Sadeh, 2015; Sitnick, Goodlin-Jones, & Anders, 2008).

2.6.3 Actigraphy

An actigraph is a small, wearable device which contains an accelerometer that continuously monitors body movements (Sadeh, 2015). Actigraphs are usually worn on the wrist or, in the case of infants and toddlers, the ankle or calf to measure sleep/wake patterns via detection of the presence or absence of movement (Horne & Biggs, 2013; Meltzer, Montgomery-Downs, Insana, & Walsh, 2012). Actigraphy is relatively non-intrusive, cost effective and can continuously and objectively estimate sleep/wake patterns in children's natural settings over an extended period of time (Meltzer, Montgomery-Downs, et al., 2012; Sadeh, 2015).

In a study of preschoolers (n = 58), actigraphy demonstrated high (97%) sensitivity (i.e. the ability to accurately detect sleep) but low (24%) specificity (i.e. the ability to accurately detect wake during the sleep period), compared to videosomnography (Sitnick et al., 2008). Similar limitations in specificity, compared to PSG and direct observation, have been found in studies of infant, child and adolescent sleep (Meltzer, Montgomery-Downs, et al., 2012). As actigraphy is movement-based, it is unable to detect neurophysiological signals that PSG measures and is therefore unable to determine sleep architecture (Galland, Meredith-Jones, Terrill, & Taylor, 2014). It is prone to movement artefact, such as when a child is sleeping in a moving stroller (which may be inaccurately measured as 'wake'), and is unable to differentiate between quiet wakefulness and sleep. Therefore, actigraphy is best used in conjunction with a sleep diary to assist with scoring

(Galland et al., 2014; Horne & Biggs, 2013; Sadeh, 2015). Other limitations include the lack of standardised scoring criteria for nap sleep, the use of variable scoring rules across studies, inconsistencies in the reporting of actigraphic study results (Galland et al., 2014) and practical challenges of implementing actigraphy in large-scale studies.

2.6.4 Sleep Diaries

For young children, sleep diaries usually require parents/caregivers to record children's sleep schedules, including bedtimes, sleep start times and wake times, night wakings and naps on a daily basis over a period of time, such as a week or month (Sadeh, 2015). Sleep diaries have been shown to be reasonably reliable at measuring children's sleep schedules, although parents/caregivers tend to over-estimate children's nighttime sleep periods and under-report children's night wakings when compared to actigraphy (Acebo et al., 2005; Iwasaki et al., 2010; J. Lam, Mahone, Mason, & Scharf, 2011a; Tikotzky & Sadeh, 2001).

Sleep diaries are low cost, relatively easy to complete, can collect information on children's sleep in a range of contexts and can measure parental perceptions of children's sleep quality. However, limitations include potential participant burden if used over a long period of time, temporal variability in compliance, the reliance on caregivers being aware of children's sleep behaviours such as waking during the night and a lack of standardisation of diary formats (Horne & Biggs, 2013; Sadeh, 2015).

2.6.5 Sleep Questionnaires

An alternative way of subjectively measuring children's sleep is via the use of sleep questionnaires. A raft of parent- and child-report sleep questionnaires have been developed in the last 25 years or so, spanning infancy through to adolescence, and focussing on specific areas such as sleep initiation and maintenance, daytime sleepiness, sleep habits, and cognitions/beliefs about sleep, or incorporating multiple dimensions of

behavioural- and medical-based aspects of child sleep (Lewandowski et al., 2011; Spruyt & Gozal, 2011).

Sleep questionnaires are advantageous in that they are a low cost way of collecting extensive information, including in large samples, on children's sleep patterns, sleep behaviours, sleep difficulties and sleep contexts (Lewandowski et al., 2011; Sadeh, 2015). While questionnaires do not objectively assess sleep quantity or quality, they can measure parental/caregiver 'real world' perceptions of sleep quality and sleep problems which can be just as relevant, depending on the focus of the study. Conversely, as they rely on parent/caregiver report in young children there is the potential for response biases and issues relating to a lack of awareness of sleep-related behaviours, such as night waking (Sadeh, 2015).

Given the range of paediatric sleep questionnaires that are available, consideration is required in regard to psychometric properties, the age range of children for which they are designed and the purpose of research, when deciding on the most appropriate tool. For use with preschoolers, the Pediatric Sleep Questionnaire (PSQ; Chervin, Hedger, Dillon, & Pituch, 2000) and Children's Sleep Habits Questionnaire (CSHQ; Goodlin-Jones, Sitnick, Tang, Liu, & Anders, 2008; Owens, Spirito, & McGuinn, 2000) are two well established, multi-dimensional sleep questionnaires (Lewandowski et al., 2011). The 70-item PSQ includes sleep-related breathing disorders (SRDB) and periodic leg movement (PLMS) scales which have been validated against PSG for use in clinical research with 2 to 18 year olds (Chervin & Hedger, 2001; Chervin et al., 2000). The widely used CSHQ is a screening tool for behavioural- and medical-based sleep disturbances, using 33 scored items based on common symptoms of paediatric sleep problems as per the *International Classification of Sleep Disorders* (Diagnostic Classification Steering Committee, 1990) (Owens, Spirito, & McGuinn, 2000). While originally designed for use with 4 to 10 year

olds, it has since been validated against sleep logs and actigraphy for toddlers and preschoolers (Goodlin-Jones et al., 2008).

2.7 Preschool-Aged Children's Sleep Patterns: Normative Data

What is 'normal' preschooler sleep? A growing body of international data are available on the sleep of typically developing preschoolers. This provides the opportunity to gain a better understanding of how long, when and how well young children are sleeping, although care must be taken when interpreting and comparing 'norms'. Average values do not necessarily reflect the sleep of children at either end of the sleep health continuum and most studies have been conducted in industrialised societies, often with demographically homogeneous samples, thus limiting the generalisability of data. Below is a summary of international literature on the duration, timing and quality of preschoolers' sleep.

A systematic review of observational paediatric sleep studies reported an average of 11.9 hours (range ± 1.96 SD: 9.9 – 13.8 hours) sleep duration across 24 hours for 2 to 5 year olds (2 – 3 years: 12.0 [9.7 – 14.2]; 4 – 5 years: 11.5 [9.1 – 13.9]), based on parentally-completed questionnaires and diaries (Galland, Taylor, Elder, & Herbison, 2012). The authors noted that limited data were available for toddlers/preschoolers, with only five studies included for this age group in the meta-analysis. These were from Switzerland (Iglowstein, Jenni, Molinari, & Largo, 2003), China (Xiao-Na et al., 2009), Japan (Iwasaki et al., 2010) and the US (Mindell, Meltzer, Carskadon, & Chervin, 2009; Mindell, Telofski, Wiegand, & Kurtz, 2009), with sample sizes ranging from 47 (Iwasaki et al., 2010) to 14,883 (Xiao-Na et al., 2009).

In the two US studies, the majority of parent/caregiver respondents had at least some college education (Mindell, Meltzer, et al., 2009 = 74%; Mindell, Telofski, et al., 2009 = 91%) and in one study most (89%) were described as Caucasian (Mindell, Meltzer, et al.,

2009) while no race/ethnicity information was provided in the other (Mindell, Telofski, et al., 2009). The Japanese study collected data from families using two private daycare nurseries, but no demographic data were reported (Iwasaki et al., 2010) and the other samples were described as being representative of Chinese and Swiss cities but did not provide a breakdown of ethnicity or SEP (Iglowstein et al., 2003; Xiao-Na et al., 2009). Thus, the generalisability of these data are likely to be limited, as acknowledged by the authors of the review who cautioned that the derived reference values were ‘international norms’ not ‘culture specific norms’ (Galland et al., 2012).

As detailed below, subsequent to the review by Galland et al. (2012) a number of large scale studies have collected data on preschooler sleep durations across 24 hours, thus adding to the body of international normative data. Strengths of these studies include large sample sizes and a range of countries from which data were collected, therefore providing a broader picture of international average preschooler sleep durations. They also highlight that the age range of ‘preschoolers’ in studies vary, thus limiting the ability to compare findings.

In Australia, average sleep durations across 24 hours were 11.7 (SD = 1.6) hours for 3 year olds (n = 1929), and 11.1 (1.4) hours and 11.2 (1.5) hours for 4.5 year olds (2 cohorts: n = 1251 and 1905), based on caregiver-completed time-use diaries (Price et al., 2014). The sample was described as representative of urban and rural communities but children from low-income families were under-represented and those whose mothers had completed high school were over-represented. Compared to 4 year olds in the Australian study, similar sleep durations were reported for 4 year olds from an urban cohort in Brazil, who slept an average of 11.02 (1.28) hours according to maternal report of children’s usual bedtime and wake time in the previous fortnight (Netsi et al., 2017). Shorter average sleep durations were reported in a large, nationwide sample of 4.5 year old children from urban

and rural families in Japan ($n = 39,813$) who slept an average of 10.67 (0.82) hours, based on caregiver report of usual sleep start and end times during the day and at night (Ikeda, Kaneita, Kondo, Itani, & Ohida, 2012). The majority of these children had mothers and fathers with at least high school education (97% and 94% respectively).

Two studies spanning the broader age range of 3 to 6 years reported consistent findings. Preschoolers aged 3 to 6 years ($n = 1610$) from predominantly Chinese, middle-income families in eastern and western China slept an average of 11.02 (0.97) hours, based on parent report of their child's usual sleep duration during the week and weekend (Wu, Wang, Zhu, Jiang, & Jiang, 2018). Similarly, 3 to 6 year olds in 13 countries/regions ($n = 2,590$) slept an average of 11.04 (1.23) hours, ranging from 10.71 (1.41) hours (India; $n = 294$) to 11.65 (1.28) hours (Philippines; $n = 76$), according to maternal report of children's usual daytime and nighttime sleep patterns in the past two weeks (Mindell, Sadeh, Kwon, & Goh, 2013). In the latter study almost all of the parent respondents had at least a high school education (99.5%) and, as data were collected online, access to the internet.

Between-country variation in the distribution and timing of preschoolers' sleep across 24 hours is apparent. For example, in the online survey conducted by Mindell et al. (2013) mean (SD) nighttime sleep duration was 9.93 (1.22) hours for 3 to 6 year olds, which ranged from 8.96 (1.10) hours in India to 10.88 (0.96) hours in the United Kingdom. During the day, children slept an average of 1.11 (1.20) hours, ranging from 0.17 (0.43) hours in the UK to 2.08 (1.16) hours in the Philippines.

In their longitudinal study of sleep across the first 4 years of life, Netsi et al. (2017) reported differences in the timing of children's sleep in Brazil, compared to the sleep of children from higher income countries, but no significant difference in total sleep across 24 hours. Brazilian children ($n = 3842$) had average bedtimes of 22:10 (1:13) and wake times of 08:32 (0:22), whereas children in the United Kingdom (41 – 47 months old; $n =$

9585) went to bed approximately two and a half hours earlier (19:46 [00:51]) and woke approximately an hour and a half earlier (07:02 [00:41]) (Blair et al., 2012). Similarly, 4.5 year old children in Australia (2 cohorts: n = 1251; n = 1905) had average bedtimes that were approximately two hours earlier than children in the Brazilian cohort (20:15 [1:00]; 20:30 [1:00]) and average wake times approximately an hour and a quarter earlier (07:15 [1:00]; 07:15 [1:15]) (Price et al., 2014).

A reasonably large proportion (40%) of 4 year old children in the Brazilian study cohort napped (Netsi et al., 2017), whereas 23% of 3.5 year old children in the UK study slept during the day (Blair et al., 2012). Thus, these differences in napping behaviour contributed to the similar sleep durations despite differences in sleep timing. Similar to those in the UK, the prevalence rate of napping at 4 years of age is approximately 28% in Japan (n = 190; Komada et al., 2012). In contrast, preschooler napping prevalence is 35% in Switzerland (n = 464; Iglowstein et al., 2003) and 57% in the US (n = 172; Weissbluth, 1995) highlighting significant variation in the distribution of sleep across 24 hours in preschoolers.

In addition to these variations in sleep across the day and night, different patterns of sleep timing have been reported across the week, whereby preschoolers have later bedtimes and wake times on the weekend compared to week days (Randler, Fontius, & Vollmer, 2012; Touchette, Mongrain, Petit, Tremblay, & Montplaisir, 2008; Wu et al., 2018). Differences in sleep durations during the week versus the weekend also vary between studies. For example, 3 to 6 year olds in China (n = 1610) were found to sleep less across 24 hours during the week than the weekend (Wu et al., 2018), whereas 4 to 6 year olds in Canada (n = 1083) had longer sleep durations across 24 hours during the week than weekends (Touchette et al., 2008).

A further consideration when examining and comparing normative data on preschoolers' sleep is the method used to measure sleep. For example, a systematic review of studies using actigraphy reported a pooled mean estimate (95% CI) of 9.7 (9.4 – 10.0) hours nighttime sleep duration (i.e. the time elapsed between sleep onset and offset) for 3 to 5 year olds (Galland et al., 2018), which was similar to the subjectively-based average reported by Mindell et al (2013). In contrast, mean (SD) PSG values for total sleep time at night of 3 to 5 year olds were 7.9 (0.7) hours in the US (n = 251) (Montgomery-Downs, O'Brien, Gulliver, & Gozal, 2006) and 7.0 [0.9] hours in China (n = 33) (G. Wang et al., 2016). Higher values were reported for mean (SD) PSG total sleep time of German children aged 2 to 3 years (n = 23; 8.2 [1.5] hours) and 4 to 6 years (n = 25; 9.0 [1.1] hours) (Scholle et al., 2011).

In summary, a growing body of normative data are available on the sleep of preschool-aged children around the globe. They provide the opportunity to gain a better understanding of the range of average preschooler sleep and its variations internationally. However, study samples are not always representative of population demographics and average values do not reflect the sleep of all children. Care must be taken when comparing data between studies, due to differences in the age of children in study samples, sample sizes and methods of data collection. Variations across studies are evident for sleep duration, timing and distribution, highlighting the importance of considering multiple aspects of preschoolers' sleep beyond simply the average duration.

2.8 Preschooler Sleep Problems and Wellbeing

It is estimated that approximately 25% to 40% of children will experience some form of sleep problem during childhood or adolescence, although prevalence varies by age and type of sleep issue (Mindell & Meltzer, 2008; Owens, 2007). Sleep problems in the

preschool years come in many shapes and forms and are associated with multiple aspects of wellbeing, including emotional regulation, executive function, body composition and injuries (Chaput et al., 2017; Mindell & Meltzer, 2008; Mindell & Owens, 2015; Spruyt, 2019; Turnbull, Reid, & Morton, 2013).

2.8.1 Parasomnias

Parasomnias are undesirable events or experiences that occur when entering sleep, during sleep or during arousal from sleep (American Academy of Sleep Medicine, 2005). They include sleep walking (somnambulism), sleep terrors, nightmares, sleep talking (somniloquy), teeth clenching or grinding (sleep bruxism), and rhythmic movements such as body rocking (K. Carter, Hathaway, & Lettieri, 2014; Insana, Gozal, McNeil, & Montgomery-Downs, 2013; Kotagal, 2009). The prevalence of parasomnias in childhood is high, with an estimated 88% of children experiencing at least one parasomnia at some time across the ages of 2.5 – 6 years (Petit, Touchette, Tremblay, Boivin, & Montplaisir, 2007). While parasomnias are usually considered benign they can negatively impact children and families, such as parental/caregiver distress caused by witnessing their child having a sleep terror (Mindell & Owens, 2015; Rosen, 2014).

2.8.2 Dyssomnias

Dyssomnias, characterised by difficulties initiating and/or maintaining sleep (Touchette, Petit, Tremblay, & Montplaisir, 2009), are prevalent in the preschool years as well. Primary insomnia was reported in 16.6% of 4 year olds (n = 2475), and associated with increased odds of symptoms of depression (OR = 1.78; 95% CI = 1.46 – 2.17), generalised anxiety (OR = 1.87; 95% CI = 1.54 – 2.28) and separation anxiety (OR = 1.23; 95% CI = 1.01 – 1.48) (Steinsbekk, Berg-Nielsen, & Wichstrom, 2013). One third (35.6%) of preschoolers in the US National Sleep Foundation Sleep in America Poll (n = 387) woke at

least once during the night (Mindell, Meltzer, et al., 2009), and Australian population prevalence estimates were 12.8% (95% CI: 11.7 – 14.0) for difficulties getting to sleep and 18.1 % (95% CI: 16.8 – 19.3) for night wakings in 4 to 5 year old children (Hiscock et al., 2007). In the Australian study, difficulties getting to sleep and waking during the night were negatively associated with children's health related quality of life and greater odds of receiving a diagnosis of attention deficit disorder. Nighttime fears are also common in this age group, with 59% of 4 to 6 year olds in the Netherlands (n = 68) experiencing nighttime fears (Muris, Merckelbach, Ollendick, King, & Bogie, 2001). Highlighting the link between preschoolers' sleep and mental health, these were associated with moderate levels of child anxiety.

2.8.3 Sleep Disordered Breathing

Sleep disordered breathing (SDB) comprises a spectrum of breathing problems during sleep, ranging from habitual snoring through to obstructive sleep apnoea (OSA) (Boss, Smith, & Ishman, 2011; Tal, 2014). OSA is characterised by prolonged partial upper airway obstruction, intermittent complete obstruction or partial obstruction, or a combination of prolonged and intermittent obstruction during sleep which disrupts ventilation and sleep patterns (American Academy of Sleep Medicine, 2005). Approximately 8% of preschoolers regularly snore and 2% regularly experience apnoeas during sleep (Bonuck et al., 2011). SDB is negatively associated with preschoolers' quality of life as well as that of their families (Baldassari, Mitchell, Schubert, & Rudnick, 2008), including child hyperactivity, depression, attention problems (Beebe, Rausch, Byars, Lanphear, & Yolton, 2012) and poorer parent-rated quality of life, as well as parental stress and worry (Jackman et al., 2013).

2.8.4 Global Sleep Problems

Estimates of preschooler 'global' sleep problems vary depending on definitions and measures. Parentally-reported sleep problems based on a single question about whether or not children are considered to have a 'sleep problem' are reported in at least ten percent of preschoolers, although prevalence estimates vary across studies. In the US Sleep in America Poll, 10.2% of preschoolers (3 – 6 year olds; n = 387) were reported by parents to have 'any sleep problem' (Mindell, Meltzer, et al., 2009), whereas one third of 4 to 5 year olds in Australia had a parentally reported sleep problem ranging from mild to severe (estimated population prevalence [95% CI]: mild problem = 19.8 [18.6 – 21.0]; moderate/severe problem = 13.8 [12.7 – 14.8]) (Hiscock et al., 2007). Small to serious sleep problems were reported by 21.7% of parents of preschoolers (n = 2590) in the multi-national online survey by Mindell et al (2013), although estimates varied widely by country, from 14.9% in Japan to 43.7% in China.

In contrast, higher estimates have been reported when the CSHQ was used to measure preschooler sleep problems (Owens, Spirito, & McGuinn, 2000). For example, approximately 80% of preschoolers from samples in Japan (n = 438) and China (n = 1020; n = 513) scored above the original recommended CSHQ cut-off for sleep disturbance which is indicative of a sleep problem (Liu et al., 2016; Takahashi et al., 2017; Takahashi et al., 2018). Given that the CSHQ is a composite measure of sleep disturbance, the much higher prevalence reported in these studies is likely to reflect a broad range of issues associated with sleep compared to single item measures.

2.8.5 Sleep and Behaviour and Cognition

Highlighting the importance of identifying and addressing sleep problems, and supporting multiple aspects of good sleep health, a systematic literature review found relationships

between sleep and preschool-aged children's behaviour and cognition (Reynaud et al., 2018). The authors noted that the number of published studies were limited ($n = 26$), half of the studies had small sample sizes (<500 children), definitions and measures of exposure and outcome variables differed across studies and strengths of associations were relatively small. Nonetheless, the results indicated that sleep duration and quality were associated with behavioural, and to a lesser extent cognitive, outcomes in 2 to 6 year olds.

Sleep problems, based on parental report (Armstrong, Ruttle, Klein, Essex, & Benca, 2014; Hall, Zubrick, Silburn, Parsons, & Kurinczuk, 2007) and actigraphy (Hatzinger et al., 2010), were associated with aggressive behaviour in 3 to 5 year olds, as were later and more irregular bedtimes in 2 to 5 year olds and 4 to 5 year olds respectively (Komada et al., 2011). However, results were inconsistent in regards to nighttime sleep duration and aggressiveness. In one study the odds of behaving aggressively were higher for 4 year olds ($n = 8950$) who slept less than 9.4 hours per night (OR [95% CI] = 1.81 [1.36 - 2.41]) (Scharf, Demmer, Silver, & Stein, 2013). Whereas in other studies, shorter nighttime sleep was associated with aggressive behaviour in 2 to 3 year olds (Komada et al., 2011) but not in 4 to 5 year olds (Hatzinger et al., 2010; Komada et al., 2011).

Inconsistencies were also reported across studies that investigated conduct, attention and hyperactivity problems in relation to preschoolers' sleep. Sleep problems, night wakings and difficulties getting to sleep were associated with higher scores on the Strengths and Difficulties Questionnaire conduct problem scale in 4,983 Australian 4 to 5 year olds (Hiscock et al., 2007), whereas no associations were found between conduct problems and sleep duration, quality or timing in smaller scale studies of 3 to 6 year olds (Hatzinger et al., 2010, $n = 82$; Wada et al., 2013, $n = 431$).

Global sleep problems (O'Callaghan et al., 2010) and later bedtimes (Komada et al., 2011) were associated with attention problems, whereas night wakings (Hall, Scher, Zaidman-

Zait, Espezel, & Warnock, 2012), sleep onset latencies and variability in wake times (Vaughn, Elmore-Staton, Shin, & El-Sheikh, 2015) were not. Nighttime sleep duration was generally not associated with attention difficulties in 2 to 6 year olds (Komada et al., 2011; J. Lam, Mahone, Mason, & Scharf, 2011b; Touchette et al., 2007; Vaughn et al., 2015).

Parentally reported sleep problems were associated with hyperactivity (Armstrong et al., 2014; Hiscock et al., 2007; Quach, Hiscock, & Wake, 2012), whereas no significant associations were reported for sleep duration in 24 hours (Wada et al., 2013), sleep efficiency (Hatzinger et al., 2010) or bedtime (Wada et al., 2013). Evidence was mixed in regards to night sleep duration and hyperactivity, with some studies reporting significant associations (Scharf et al., 2013; Touchette, Cote, et al., 2009; Touchette et al., 2007) and others not (Hatzinger et al., 2010; J. Lam et al., 2011b; Wada et al., 2013).

In regards to sleep and internalising behaviours, weeknight bedtime was significantly correlated with symptoms of anxiety and depression in 2 to 3 year olds ($n = 905$; $r = 0.09$, $p < .01$) and 4 to 5 year olds ($n = 841$; $r = 0.14$, $p < .01$) (Komada et al., 2011). No associations were found, however, between anxiety or depressive symptoms and nighttime sleep durations (Komada et al., 2011) or insomnia (Armstrong et al., 2014). In the studies with larger sample sizes, significant positive associations were found between preschooler night wakings, SOL and sleep problems, and emotional problems (Hiscock et al., 2007; Lehmkuhl, Wiater, Mitschke, & Fricke-Oerkermann, 2008; Quach et al., 2012). In contrast, studies with smaller sample sizes reported non-significant results in a host of sleep domains in relation to emotional symptoms in preschoolers (Hall et al., 2012; Hatzinger et al., 2010; Wada et al., 2013). Sleep problems (Hiscock et al., 2007; Quach et al., 2012) and shorter sleep at night (Vaughn et al., 2015; Wada et al., 2013) were negatively associated with prosocial behaviour.

Fewer studies examined sleep and cognition than sleep and behaviour in preschoolers. Sleep problems were negatively associated with numeracy and literacy skills (Hiscock et al., 2007) and nighttime sleep duration was positively associated with receptive vocabulary in most (J. Lam et al., 2011b; Touchette et al., 2007; Vaughn et al., 2015) but not all (Dionne et al., 2011) studies reviewed. No significant associations were found between sleep duration in 24 hours, night waking, SOL or sleep efficiency and cognitive outcomes in preschoolers.

The consistency of children's sleep patterns also appears to play a role in waking functioning within the preschool learning environment, although data are limited in this area. In a predominantly American European, low-income community sample of 4 to 5 year olds in the US ($n = 202$) variability in sleep pattern was associated with teacher-rated behaviour and adjustment (Bates et al., 2002). Greater night-to-night variability in sleep duration and bedtime was negatively correlated with preschool adjustment ($-.09, p < .01$) and daily positive behaviour ($-.18, p = .05$), and positively associated with problematic adjustment ($.25, p < .0001$) and daily negative behaviour ($.15, p < .05$) at preschool. Thus, sleep problems and short and inconsistent sleep in early childhood may disadvantage children socially and cognitively within early learning environments which may, in turn, have longer term detrimental effects.

2.8.6 Sleep and Injury Risk

Relationships have also been found between short or disturbed sleep and injuries in young children (Chaput et al., 2017; Hiscock et al., 2007; Owens, Fernando, & McGuinn, 2005). In a sample of 278 preschoolers in the US, maternally reported inadequate sleep at the age of 4 was associated with a greater number of medically attended, unintentional injuries between 18 months to 4 years ($\beta = .1759, p < .05$), after controlling for maternal age, education and child temperament (Koulouglioti, Cole, & Kitzman, 2008). In a sample of 2

to 14 year olds in Portugal, a univariate association was found between accidental falls and shorter than usual sleep duration in the preceding 24 hours ($p = .02$) for 3 to 5 year olds ($n = 290$), but not for younger ($n = 296$) or older ($n = 500$) children (Boto et al., 2012).

However in contrast, nighttime sleep duration was not associated with injury risk in a group of 3 to 7 year olds ($n = 71$) in the US, although total sleep including naps was not measured and may therefore have influenced these results (Owens et al., 2005). The authors did, however, report a significant relationship between children's sleep disturbances and injury-prone behaviour based on CSHQ scores, indicating that sleep problems may increase the risk of young children injuring themselves. Supporting this interpretation, associations were found between injuries and difficulties initiating sleep ≥ 4 nights per week (OR = 1.61, 95% CI = 1.30 – 1.99) and night waking ≥ 4 nights per week (OR = 1.54, 95% CI = 1.26 – 1.87) in Australian preschoolers ($n = 4,983$) (Hiscock et al., 2007). As the number of studies in this area are limited, further research is required to test whether short and/or disturbed sleep places preschoolers at greater risk of injury. Nonetheless, the available studies demonstrate the importance of supporting preschoolers to obtain sufficient, good quality sleep.

2.8.7 Sleep and Obesity Risk

An area of research that has received far more attention is the relationship between sleep and obesity, with results indicating that short sleep duration in childhood is associated with an increased risk of overweight and obesity, both concurrently and longitudinally (Cappuccio et al., 2008; Chen, Beydoun, & Wang, 2008; Fatima, Doi, & Mamun, 2015; Li, Zhang, Huang, & Chen, 2017; Marshall, Glozier, & Grunstein, 2008; M. Miller et al., 2018; Monasta et al., 2010; Patel & Hu, 2008). A potential mechanism involved in this relationship is changes in the levels of appetite-regulating hormones leptin, which induces satiation, and ghrelin, which stimulates appetite. Laboratory-based adult studies have

reported associations between short sleep durations and reduced leptin levels, increased ghrelin levels and increased hunger (Spiegel, Tasali, Penev, & Van Cauter, 2004; Taheri, Lin, Austin, Young, & Mignot, 2004), although findings have not been replicated in recent adult studies (Chaput & St-Onge, 2014).

While debate continues over the processes involved, the link between short sleep duration and obesity is evident in early childhood. For example, short sleep duration (9 – 10 hrs, including naps) was associated with higher odds of obesity (OR [95% CI], reference = ≥ 11 hrs: 1.34 [1.05 – 1.72]) in a sample of preschoolers in Japan ($n = 8491$; 2.5 – 4.3 years), after controlling for age, sex, parental obesity and hours of outdoor play (Sekine et al., 2002). Similarly, a large scale study of preschoolers in China ($n = 48,922$) found cross-sectional associations between short sleep (≤ 10 hrs vs 11-12hrs) and overweight (PR [95% CI] = 1.13 [1.06 – 1.20]) and obesity (1.25 [1.11 – 1.40]) at 3 years of age, after adjusting for child and maternal demographic and lifestyle factors (F. Wang et al., 2016). Indicating potential longitudinal repercussions of insufficient sleep in the preschool years, relationships were also found between short sleep at the age of 3 and overweight (1.48 [1.26 – 1.74]) and obesity (1.77 [1.30 – 2.40]) at the age of 5.

The role of daytime nap versus nighttime sleep in obesity risk is unclear, as results from studies are mixed. Short nighttime sleep durations ($< 25^{\text{th}}$ percentile for age) of children aged 0 to 4 years ($n = 822$) at baseline were associated with an increased risk of overweight or obesity (OR [95% CI] = 1.80 [1.16 – 2.80]) at follow-up five years later (Bell & Zimmerman, 2010). However, there was no association between daytime sleep duration at baseline and later obesity. The authors concluded that napping had no effect on the development of obesity and that nap sleep is not a substitute for sufficient nocturnal sleep. In contrast, a prospective study of children from birth to 9.5 years of age ($n = 150$) found an independent association between sleep duration at ages 3 to 4 years and overweight at

9.5 years ($W = 6.6, p <.01$), but that this was predominantly due to less daytime sleep in children with higher body mass index (BMI) (Agras, Hammer, McNicholas, & Kraemer, 2004). Therefore, daytime sleep may have a protective role to play in obesity prevention.

The timing and consistency of preschoolers' sleep may also play a role in obesity risk, although the number of studies in this area are limited (A. Miller, Lumeng, & Le Bourgeois, 2015). In a sample of US preschoolers ($n = 10,700$), bedtimes at 9pm or later when children were 5 years old were cross-sectionally associated with higher odds of obesity (OR [95% CI] = 1.49 [1.16 - 1.91]), after adjusting for sex, race/ethnicity, SES and television viewing (Scharf & DeBoer, 2015). Longitudinally, short sleep duration and later bedtime at age 4 were each associated with an increase in BMI-z-score from 4 to 5 years in this study. Indicating potential longer term protection against weight gain, earlier preschooler bedtimes were negatively associated with obesity in adolescence in the Study of Early Child Care and Youth Development in the US (Anderson et al., 2016). Having an early bedtime (≤ 8 pm) as a preschooler ($n = 977$; mean [SD] age = 4.7 [0.09] years) was associated with a decreased likelihood of being obese at the age of 15 (RR [95% CI] = 0.48 [0.29 - 0.82]), after adjusting for child and maternal demographic characteristics, maternal sensitivity at preschool age and maternal obesity. However, whether early bedtimes per se decreased the risk of obesity or early bedtimes were a proxy measure of longer sleep durations and associated reduced obesity risk is unclear, as sleep duration was not measured.

Miller et al (2014) found evidence of interactions between sleep duration and timing and the BMI of preschoolers (mean [SD] age = 4.11 [0.54] years) from low income families in the US ($n = 366$; longitudinal subsample $n = 273$). Shorter nocturnal sleep duration was associated with higher concurrent BMI-z-scores, but only for children with bedtimes at or later than 9pm ($\beta = -0.44, 95\% \text{ CI} = -0.69, -0.18$), after adjusting for SDB, soda intake and

home chaos. Longitudinally, longer nocturnal sleep duration at age 4 was associated with lesser increases in BMI-z-score per year, but only for preschoolers whose bedtimes shifted by less than 45 minutes between the week and weekend ($\beta = -0.12$, 95% CI = -0.23, -0.01), after controlling for the same covariates as the cross-sectional analyses. Therefore, bedtimes before 9pm that are consistent throughout the week and weekend may support preschoolers to obtain sufficient nighttime sleep and reduce the risk of overweight or obesity. However, further research is required to examine the generalisability of these findings in other populations and over longer periods of time to determine causality.

Supporting the importance of consistent sleep timing for preschoolers, social jetlag was associated with greater caloric intake in a sample of 51 ethnically-diverse preschoolers (2 – 4 year olds) with obesity, from low income families in the US (Petrov et al., 2017). Social jetlag is the misalignment between biological and social time and is measured by calculating the difference between the midpoint of sleep start and end times on free days (e.g. weekends) and scheduled days (e.g. week days when children attend preschool or some other form of early childhood education service) (Roenneberg, Allebrandt, Mero, & Vetter, 2012; Wittmann, Dinich, Mero, & Roenneberg, 2006). Petrov and colleagues (2017) found that 15 minutes delay in midsleep time from weeknights to weekends was associated with increased caloric intake predominantly via fats and social jetlag accounted for 26% of the variability in caloric intake, after adjusting for age, gender and maternal education.

2.8.8 Persistent Sleep Problems

Paediatric sleep difficulties have the potential to become chronic if left unaddressed (Mindell & Owens, 2015) which can have significant long-term repercussions. Sleep problems in early childhood that persist over time are negatively associated with physical, emotional and behavioural outcomes in later childhood, adolescence and adulthood

(Armstrong et al., 2014; Gregory et al., 2005; C. Magee, Gordon, & Caputi, 2014; Quach, Hiscock, Canterford, & Wake, 2009; Simola, Liukkonen, Pitkaranta, Pirinen, & Aronen, 2014; K. Williams, Berthelsen, Walker, & Nicholson, 2017).

For example, in the Longitudinal Study of Australian Children, the prevalence of parentally-reported moderate/severe child sleep problems was measured when children (n = 4460) were 4 to 5 years old (13.0%) and 6 to 7 years old (5.7%) (Quach et al., 2009). While the percentage of children with sleep problems at both time points was small (2.9%), persistent sleep problems were significantly negatively associated with mean scores on measures of language, behaviour and learning. Similarly, a population based study of Finnish children (n = 470) examined relationships between sleep disturbances and psychosocial and somatic complaints across two time points, when children were 3 to 6 years old and 4 years later (Simola et al., 2014). Children who had sleep problems, based on Sleep Disturbance Scale for Children scores (Bruni et al., 1996), at both preschool age and at follow up (8.5%) had significantly greater odds (OR = 15.3; 95% CI = 6.9 – 34.7) of experiencing sub-clinical or clinical difficulties with internalising, externalising, social and attention problems, after adjusting for socioeconomic status, gender, age and medical conditions.

A prospective study of children in the US (n = 396) found that insomnia that persisted from the age of 4.5 to 9 years (10%) was associated with anxiety and externalising behaviour at the age of 18 years (Armstrong et al., 2014). In the longitudinal Dunedin Multidisciplinary Health and Development Study in NZ (n = 943), sleep problems that persisted across early childhood (ages 5, 7 and 9 years) were associated with anxiety in early adulthood (OR = 1.60; 95% CI = 1.05 – 2.45) (Gregory et al., 2005). Thus, the impact of persistent sleep problems in early childhood may extend well across the life course.

In summary, sufficient, consistent and good quality sleep is important for preschoolers' wellbeing. A raft of sleep problems, common in early childhood, are associated with short- and longer-term poor health. Therefore, identifying children at the greatest risk of experiencing poor sleep health in early childhood, and intervening early to address sleep issues, is crucial for preventing chronic sleep problems and associated poor health and wellbeing in childhood and beyond.

2.9 Sleep Supporting Strategies

To help children obtain sufficient, good quality sleep, a number of sleep supporting strategies, sometimes referred to as 'sleep hygiene' practices, are widely recommended to families. Broadly speaking, these entail consistent daytime and nighttime activities to support sleep and the provision of sleep conducive bedroom environments (Allen, Howlett, Coulombe, & Corkum, 2016; Galland & Mitchell, 2010). Galland and Mitchell (2010) suggest that sleep hygiene activities may support children to sleep well via individual or combined effects of entraining circadian rhythms, conditioning behaviour, alleviating anxiety, minimising environmental stimulation and promoting relaxation.

A recent review of common sleep hygiene recommendations found varying degrees of empirical evidence to support their use (Allen et al., 2016). Recommendations backed by strong¹ evidence were that children go to bed, wake up and nap at times that enable age-appropriate amounts of sleep to be obtained; bedtime routines be established; electronics be removed from bedrooms to limit their use during and after bedtime; and that children learn to settle to sleep independently.

¹ 'Strong' was defined as support stemming from at least three studies, including at least one well designed trial targeting the recommendation in question, or corroboration from a recent and well-designed systematic review. Where more than three studies were reviewed, the majority of findings were in support of the recommendation with no findings clearly contradicting the recommendation.

Recommendations with moderately² strong empirical evidence were that children go to bed no later than 9pm; a regular, consistently timed sleep schedule be maintained; a positive atmosphere be established in children's living environments; and that children's emotional needs are met during the day. Limited³ evidence was available for bedrooms needing to be dark; limiting caffeine; eating a healthy balanced diet; not going to bed hungry or eating a large meal immediately before bedtime; positive parental attitudes towards sleep; children being calm and relaxed before bed; and for children avoiding fun, exciting or frustrating activities before bedtime (Allen et al., 2016).

Equivocal⁴ or insufficient⁵ evidence was available for sleep schedules not varying by more than 30 to 60 minutes; waketime routines; consistent daytime routines; avoiding sounds (e.g. music) as children fall asleep; children having their own bedroom; a comfortable bed in a familiar bedroom; limiting electronic use within 1 hour of bedtime; engaging in daily physical activity; not eating too much, close to bedtime; and for children's physiological needs (e.g. thirst, hunger) being met during the day. Children avoiding exercise within 1 to 4 hours of bedtime was not supported⁶ by current research (Allen et al., 2016).

Particularly in those areas with little or no backing from empirical studies, further research is required to better understand the influence that recommended sleep supporting strategies have on children's sleep, and what, when and how 'sleep hygiene' practices may be best used to support children to sleep well. Most studies relating to

² 'Moderate' was defined as support stemming from at least three studies, though studies may have been limited to cross-sectional or longitudinal designs. Where more than three studies were reviewed, the majority of findings reviewed were in support of the recommendation and no findings clearly contradicted the existing recommendation.

³ 'Limited' was defined as support stemming from less than three studies, with no findings clearly contradicting the recommendation.

⁴ 'Equivocal' was defined as, regardless of the number of studies reviewed, findings across studies were too mixed or open to interpretation to provide clear support.

⁵ 'Insufficient' was defined as no findings directly addressing the recommendation.

⁶ 'Non-supportive' was defined as, regardless of number of studies reviewed, the majority of findings were contradictory or inconsistent with what would be expected based on the recommendation.

preschoolers in the review by Allen et al (2016) were conducted in the US (22 out of 34 articles [65%]) and of those, the majority of samples consisted of children or parents who were predominantly from White/Caucasian racial/ethnic groups (14 out of 22 studies [64%]). Thus, whether these sleep support strategies meet the needs of preschoolers from other countries and ethnic groups warrants further investigation.

2.10 Social Patterning of Preschooler Sleep

While sleep is a biological imperative regulated by physiological processes (Section 2.3) it is also embedded within, and influenced by, society (Grandner, 2017). There is growing evidence that sleep is a socially patterned phenomenon in which members of minoritised ethnic⁷ groups, low-income households and disadvantaged neighbourhoods are at a greater risk of poor sleep health than people from predominant ethnic groups and more socioeconomically advantaged households (L. Hale et al., 2015; L. Hale, Parente, & Phillips, 2013; Knutson, 2013).

2.10.1 Ethnicity and Sleep

Regarding preschoolers, a recent systematic literature review of US studies investigating the relationship between race/ethnicity and sleep among 2 to 5 year olds concluded that White children were more likely to have earlier and more regular bedtimes, longer nighttime sleep durations and less daytime nap sleep than children from racial/ethnic minority groups (J. Smith, Hardy, Hale, & Gazmararian, 2018). Due to the small number of studies that met review criteria (n = 9), the authors were unable to investigate relationships between race/ethnicity and preschooler sleep quality or sleep problems. In contrast, a systematic review that was conducted using a similar process for US research on school-aged children and adolescents identified a greater number of studies (n = 23)

⁷ 'racial' or 'racial/ethnic' in US terminology

and evidence that racial/ethnic minority children and adolescents experience shorter and poorer quality sleep than White, non-Hispanic youth (Guglielmo, Gazmararian, Chung, Rogers, & Hale, 2018). This highlights the need for high quality research with preschoolers that collects and reports child race/ethnicity and for study designs that enable relationships between race/ethnicity and multiple facets of preschooler sleep to be examined.

Studies that were included in Smith's review (Crosby, LeBourgeois, & Harsh, 2005; Patrick, Millet, & Mindell, 2016; Vaughn et al., 2015; Wilson, Miller, Lumeng, & Chervin, 2014), as well as other research articles (McLaughlin Crabtree et al., 2005; Parsons, Ollberding, Smith, & Copeland, 2018; Scharf & DeBoer, 2015) show that, in the US, White preschoolers are more likely to sleep longer at night and sleep less during the day than Black, Hispanic, Asian and preschoolers from 'Other' racial/ethnic groups. However, whether or not these differences in napping and nighttime sleep equate to shorter total sleep duration across 24 hours between racial/ethnic groups is less clear.

When sleep was considered across the entire week (i.e. total nocturnal and diurnal sleep duration on week days and weekends), there was no difference in the sleep duration of 2 to 8 year olds ($n = 1043$; 26.5% Black, 73.5% non-Hispanic White) by race/ethnicity (Crosby et al., 2005). In two other US studies, racial/ethnic differences were observed in preschoolers' nighttime and daytime sleep durations (with racial/ethnic minority children sleeping less at night and more during the day compared with White children), but no significant difference was found in total sleep across 24 hours (Lavigne, Arend, Rosenbaum, Smith, & Weissbluth, 1999; Parsons et al., 2018).

Contrasting these results, in a sample of 191 preschoolers (22.5% Black/African American, 77.5% White/Caucasian) average sleep durations across 24 hours were almost 1 hour shorter for Black/African American children (mean [SD]: Black = 10.14 [1.59]

hours, White = 11.07 [1.04] hours, $t = -3.35$, $p \leq .01$) (Patrick et al., 2016). In addition, data from three survey waves of US children aged from birth to 18 years ($n = 6,776$) highlighted the complexities of relationships between race/ethnicity and sleep duration over time (J. Williams, Zimmerman, & Bell, 2013). Median total sleep duration (across 24 hours) was similar for Black and White children until the age of 5 years, then shorter for Black children until adolescence. Hispanic children had slightly higher median sleep duration than both Black and White children, except between the ages of 5 and 8 years, although precise figures were not reported.

The few studies that have examined the relationship between ethnicity and sleep duration in preschoolers in countries other than the US yield mixed findings. In the UK 'Born in Bradford' cohort ($n = 1,338$), there was no difference in the average sleep duration (per 24 hours) of South Asian (58% of sample) and White (42% of sample) children across the ages of 12 to 36 months, however at 36 months South Asian children had longer average sleep durations (mean [SD]: 11.9 [1.2] hours) than White children (11.7 [1.2] hours) (Collings et al., 2017). In contrast, non-White (predominantly Black Caribbean and Asian) children in the UK 'Avon Longitudinal Study of Parents and Children' (ALSPAC) had shorter average total sleep duration (across 24 hours) than White children at 69 months ($n = 7,983$; non-White = 11.19 hours, White = 11.31, $p = .01$), although not at 42 months ($n = 9,267$; non-White = 11.47 hours, White = 11.51, $p > .05$), after controlling for child and maternal sociodemographic characteristics (Blair et al., 2012).

Whereas in the Netherlands, differences were found in the sleep duration of 5 year olds by ethnicity ($n = 2,384$; 5.6 – 6.1 years; 84.9% Dutch) (Anujuo, Vrijkotte, Stronks, Jean-Louis, & Agyemang, 2016). Children from minoritised ethnic groups were more likely to have short sleep (<10 hours/24 hours; PR [95% CI]: Turkish 2.37 [1.68 – 3.35], Moroccan 2.47 [1.82 – 3.34], African Surinamese 2.79 [2.05 – 3.81], Ghanaian 3.56 [2.44 – 5.19])

compared to Dutch children, independent of age, gender and education. As ethnicity was based on the country of birth of the child's mother or maternal grandmother, results may have reflected experiences of migration and acculturation.

2.10.2 Socioeconomic Position and Sleep

Findings differ regarding the relationship between SEP and daytime, nighttime and total sleep duration in preschoolers, potentially due to different patterning of sleep timing and degree of sleep consolidation among children. One US study found that, independent of race, preschoolers ($n = 973$ African American, $n = 2398$ Caucasian; 2 – 7 years) residing in lower income zip codes slept less at night than children from higher income areas ($F = 19.4, p < .001$) (McLaughlin Crabtree et al., 2005). However, as naps were not measured it is unclear if daytime sleeping patterns differed by SEP.

Daytime sleep did differ in a study of 2 to 5 year olds in the US ($n = 510$; 18.8% African American, 7.2% Hispanic, 6.8% 'Other', 67.1% non-Hispanic White) in which children from families with low socioeconomic status (Hollingshead social class) napped longer (lowest 1:27 hr vs higher 1:10 hr, $t = 2.34, p = .022$) and more often throughout the week (lowest 4.3 vs higher 3.0, $t = 3.80, p = .001$) than preschoolers from families with higher socioeconomic status (Lavigne et al., 1999). Interestingly, average sleep duration at night and across 24 hours did not differ by socioeconomic status (nighttime: lowest 10:22 hr vs higher 10:23 hr, $t = .27, p = .787$; 24 hours: lowest 11:26 hr vs higher 11:12 hr, $t = 1.69, p = .094$). Similarly, in a more recent US study sleep duration at night ($p = .75$) and across 24 hours ($p = .96$) did not differ by socioeconomic status in a sample of preschoolers ($n = 359$; mean [SD] age = 4.4 [0.7] years; 39.6% Black, 16.2% Other, 44.3% White) (Parsons et al., 2018).

In the UK, Jones and Ball (2013, 2014) found no difference in the average total sleep durations of 3 year olds ($n = 84$) from nursery schools in areas with greater and lesser socioeconomic deprivation, although children from lower socioeconomic areas had longer daytime nap durations. Two other UK studies also reported no differences in preschoolers' average sleep durations across 24 hours by socioeconomic factors of family income and socioeconomic deprivation (Barazzetta & Ghislandi, 2017; Blair et al., 2012). In contrast, studies in Hong Kong (Tso et al., 2016), mainland China (F. Wang et al., 2016) and Australia (C. Magee et al., 2014) have reported associations between lower maternal education and fewer family socioeconomic resources, and shorter sleep durations across 24 hours in preschoolers.

2.10.3 Ethnicity, Socioeconomic Position and Sleep Duration

A recent US longitudinal study provides clearer evidence of persistent and independent racial/ethnic, and socioeconomic, inequities in sleep duration (across 24 hours) from infancy to middle childhood (Pena, Rifas-Shiman, Gillman, Redline, & Taveras, 2016). In a sample of 1,288 children (13% Black, 3% Hispanic, 3% Asian, 12% 'Other', 68% White), usual sleep duration across a 24 hour period was measured using maternal report, initially at 6 months and annually at ages 1 to 7 years. A sleep curtailment score was calculated using age-related sleep duration categories at each of the eight measurement times. Scores ranged from 0 to 13, with 0 representing maximum sleep curtailment i.e. short sleep at each time point and 13 representing no curtailed sleep at any time. Cross-sectionally at 3 to 4 years of age, short sleep (<10 hours/day) was more prevalent for Black (28%), Hispanic or Latino (19%), Asian (19%) and 'Other' (18%) preschoolers than White (6%) preschoolers. Chronic sleep curtailment (score of 0 - 4) was also more prevalent longitudinally for Black (12%), Hispanic (10%) and Asian (5%) children than for White children (1%). In multivariate analyses (β [95% CI]) sleep curtailment scores were lower

(indicative of greater curtailment) for Black (-1.92 [-2.39, -1.45]), Hispanic (-1.58 [-2.43, -0.72]), Asian (-1.71 [-2.55, -0.86]) and 'Other' (-1.08 [-1.52, -0.64]) children compared to White children, after controlling for sociodemographic, environmental and behavioural characteristics. Associations were also found between lower maternal education (< college graduate vs ≥college graduate: -0.57 [-0.93, -0.22]), lower household income (<\$40,000 vs ≥\$70,000: -1.01 [-1.55, -0.48]; \$40,000 - \$\$69,999 vs \$70,000: -0.44 [-0.77, -0.11]) and more curtailed sleep, independent of race/ethnicity and other sociodemographic, environmental and behavioural factors.

2.10.4 Ethnicity, Socioeconomic Position and Sleep Timing

In regards to the timing of preschoolers' sleep at night, Black, Hispanic and children of mothers of 'Other' race/ethnicity have been shown to go to bed later at night than White children (L. Hale, Berger, LeBourgeois, & Brooks-Gunn, 2009; Patrick et al., 2016; Scharf & DeBoer, 2015; Wilson et al., 2014). Lower household income and social class has also been associated with later bedtimes, independent of race/ethnicity (L. Hale et al., 2009; Lavigne et al., 1999). While few studies have examined the influence of later bedtimes on other aspects of sleep, Patrick et al (2016) reported that bedtimes mediated relationships between child race and sleep duration. Bedtimes were later, by an average of 27 minutes, for Black preschoolers (mean [SD] = 20:49 [42.5 minutes]) than White preschoolers (20:22 [41.3 minutes]; $t = 3.74$, $p < .001$), and partially explained relationships between Black race and decreased nighttime sleep duration, increased daytime sleep duration and decreased total sleep duration across 24 hours. Results highlight the need to investigate the causes underlying later bedtimes for different populations.

Black and Hispanic preschoolers in the US are more likely to have inconsistent bedtimes and bedtime routines than White preschoolers (Burnham, Gaylor, & Wei, 2016; L. Hale et al., 2009; Patrick et al., 2016; Schlieber & Han, 2018). In the US and UK, irregular bedtimes

are more prevalent for preschoolers from families who live in lower socioeconomic areas and have low incomes (de Jong et al., 2016; Jones & Ball, 2014). Bedtime inconsistency is negatively associated with cognitive (expressive vocabulary and literacy) and behavioural (parent-reported social skills and problematic behaviours) outcomes in preschoolers in the US ($n = 2,868$), independent of sociodemographic and other sleep-related factors (Schlieber & Han, 2018). Irregular bedtimes have also been associated with shorter nighttime, but not 24 hour, sleep durations in 3 year olds (Jones & Ball, 2014). The use of bedtime routines at the age of 3, particularly those that incorporate elements of language such as singing, prayers and storytelling, have been positively associated with nighttime sleep duration and verbal test scores at the age of 5 (L. Hale, Berger, LeBourgeois, & Brooks-Gunn, 2011). Therefore, inconsistent bedtimes and bedtime routines may increase the risk of variable sleep duration and timing, and associated learning and behavioural challenges, for preschoolers. Understanding the barriers to consistent bedtimes and bedtime routines that families experience is therefore imperative so that action can be taken to address these.

2.10.5 Ethnicity, Socioeconomic Position and Sleep Problems

Studies examining relationships between race/ethnicity and preschooler sleep problems are limited in number, and have been predominantly conducted in the US. Some, but not all, results indicate that children from minoritised racial/ethnic groups are at a greater risk of sleep problems. African American preschoolers have been reported to experience greater daytime sleepiness than White preschoolers, independent of socioeconomic status and age ($F = 4.4, p < .05$) (McLaughlin Crabtree et al., 2005). African American preschoolers have also been shown to have poorer sleep quality, as measured by actigraphic sleep efficiency (Vaughn et al., 2015), longer sleep onset latencies and more bedtime difficulties (Patrick et al., 2016). The prevalence of sleep problems, as measured by CSHQ total scores

above the cut-off of 41 (Owens, Spirito, & McGuinn, 2000), is high in preschoolers from minority racial/ethnic groups and from families who hold low SEP. In a small sample of 21 preschoolers (3 – 4 years; 66.7% African American, 33.3% Hispanic; maternal welfare receipt 61.9%) 90.5% of children had CSHQ scores indicative of sleep problems (Caldwell & Redeker, 2015). In a larger and slightly older, urban, minority sample (n = 160; 5 – 6 years; 90% Latino, 10% African American; 73% maternal education \geq high school graduate), 94% of children scored ≥ 41 on the CSHQ, which is significantly higher than the 23.2% ($p < .001$) of children with high scores in the original community sample of 469 children from a predominantly White, middle-income suburban school district with which the CSHQ was tested (Sheares et al., 2013).

In terms of parental perception of sleep problems and ethnicity, one study of 3 year olds (n = 3,068) found a greater proportion of White mothers reported concerns about their preschooler seeming overly tired during the day and having difficulty falling asleep than African American mothers (Milan, Snow, & Belay, 2007). In contrast, Patrick et al (2016) found no significant difference between African American and White mothers' perceptions of their preschooler's sleep being problematic despite the African American mothers reporting lower confidence in "managing" their child's sleep (Patrick et al., 2016).

Studies conducted in the US, UK, Canada and Sweden also indicate that children from minoritised racial/ethnic groups and those from families who hold lower SEP, based on parental education, income, occupation and socioeconomic deprivation, are at an increased risk of persistent snoring and sleep disordered breathing (Beebe et al., 2012; Bonuck et al., 2011; Boss et al., 2011; Brouillette, Horwood, Constantin, Brown, & Ross, 2011; Friberg, Lundkvist, Li, & Sundquist, 2015; Goldstein et al., 2011; Montgomery-Downs, Jones, Molfese, & Gozal, 2003). In addition, in the US, ethnic disparities have been observed in access to care and treatment for SDB, with White children and those from

families with private insurance more likely to receive adenotonsillectomy than children from minority racial/ethnic groups and families with lower socioeconomic status (Boss et al., 2011).

Most, but not all, studies that have examined relationships between socioeconomic factors and preschooler sleep indicate that lower SEP is associated with a greater likelihood of children experiencing poorer quality or more problematic sleep. For example in the US, young children in Kentucky who lived in lower income neighbourhoods were more likely to feel excessively sleepy during the day ($F = 32.0, p < .0001$) and have parentally reported problematic sleep behaviour ($F = 4.5, p < .05$), independent of race and age (McLaughlin Crabtree et al., 2005). In one of the few studies in this area using objective measures of sleep, cross-sectional analysis of actigraphy data from a sample of 1 to 5 year olds in the US ($n = 169$; 9% African American, Hispanic, Asian American and mixed racial descent; 91% Caucasian) indicated that decreasing socioeconomic status (Hollingshead Social Class Index based on parental education and occupation) was associated with poorer sleep quality (lower sleep efficiency; R^2 increment = .05, $p = .002$) (Acebo et al., 2005).

In Australia, children with persistently poor sleep across the first seven years of life were more likely to come from households with more financial difficulties ($OR = 2.44, p = .002$) than typical sleepers (C. Magee et al., 2014). A social gradient was observed for parentally-reported sleep problems in Australian children longitudinally, from infancy to age 7, whereby lower SEP was associated with greater odds of children experiencing two or more sleep problems ≥ 4 nights per week, independent of parent/caregiver age and child gender (Nicholson, Lucas, Berthelsen, & Wake, 2012). Lower SEP was also associated with increased odds of young children experiencing parentally-reported sleep problems, in the UK (Barazzetta & Ghislandi, 2017), Canada (Petit et al., 2007) and Hong Kong (C. Lam & Chung, 2017).

While less is known about the mechanisms involved in ethnic and socioeconomic inequities in preschoolers' sleep, current research indicates that both psychological and physical environmental factors may mediate the relationship between ethnicity, SEP and child sleep health. Relationships have been found between school children's experiences of racism and difficulties with initiating and maintaining sleep (Shepherd, Li, Cooper, Hopkins, & Farrant, 2017). Low socioeconomic status is associated with an increased likelihood of pre-sleep worries in children (Bagley, Kelly, Buckhalt, & El-Sheikh, 2015) and life stress experienced by mothers is associated with shorter sleep durations of preschoolers from minoritised ethnic, low income families (Caldwell & Redeker, 2015). Preschoolers from low income families are also more likely to have sub-optimal sleep environments, such as being too hot or too cold, which are associated with shorter sleep durations (Wilson et al., 2014).

2.10.6 Between-Country Comparisons of Sleep

In addition to the research on social patterning of sleep by ethnicity and SEP, broadly defined 'cross-cultural' differences in preschool-aged children's sleep patterns have also been examined in a small number of studies, using between-country comparisons. In their systematic review of observational studies, Galland et al (2012) conducted a meta-analysis for sleep duration of 0 – 12 year olds and found that sleep was shorter by almost an hour (59.4 minutes; 95% CI 7 – 111, $p = .025$) in children described as being from 'predominantly Asian' countries compared to those from 'predominantly Caucasian/non-Asian' countries. In contrast, Mindell et al (2013) compared online survey sleep data from countries categorised as 'predominantly Asian' (China, Hong Kong, India, Indonesia, Japan, Korea, Singapore, Malaysia, Philippines, Taiwan, Thailand and Vietnam) with 'predominantly Caucasian' countries (Australia, Canada, New Zealand, United Kingdom, United States) and found no difference in preschoolers' sleep durations across 24 hours.

Mindell et al (2013) did, however, find significant differences in the timing and distribution of sleep across the day and night. Children from 'predominantly Asian' countries had later bedtimes and wake times, and obtained less sleep at night and more sleep during the day, compared to preschoolers in 'predominantly Caucasian' countries. Similarly, Wu et al (2018) compared the sleep of Chinese preschoolers in their study (n = 1,610) to preschoolers from 'predominantly Caucasian' countries in the study by Mindell et al (2013) and found no difference in total sleep durations but later and shorter nighttime sleep and longer daytime naps.

However, the definition of 'cross-cultural' must be interpreted with caution as comparisons do not take into account the heterogeneity of cultures and ethnic groupings within countries. In regards to the meta-analysis by Galland et al (2012), it may be that sleep durations differed between the country groupings at some developmental stages but not others, given the sample spanned infancy to pre-adolescence. Nevertheless, findings from these studies do highlight the importance of not assuming 'normal' sleep patterns are the same in all countries or cultures. Illustrating this point is the normative practice of daytime napping throughout the life course in napping or siesta cultures, compared with monophasic sleep patterns from early childhood that are common in many 'western' cultures (Jenni & O'Connor, 2005; Worthman & Brown, 2013). Therefore, children must be supported to obtain sufficient, good quality sleep in ways that are sensitive and responsive to children's and families' needs and worldviews, recognising that sleep patterns are not a 'one-size-fits-all' scenario.

In summary, research on the social patterning of, and inequities in, preschool-aged children's sleep health is less comprehensive than in older children and adolescents. To date, the majority of this research has been conducted in the US. While not all findings are consistent, there is evidence that young children from minoritised racial/ethnic and lower

socioeconomic groups are at a greater risk of obtaining insufficient, poor quality or problematic sleep. Further research is required to better understand sleep health inequities in early childhood.

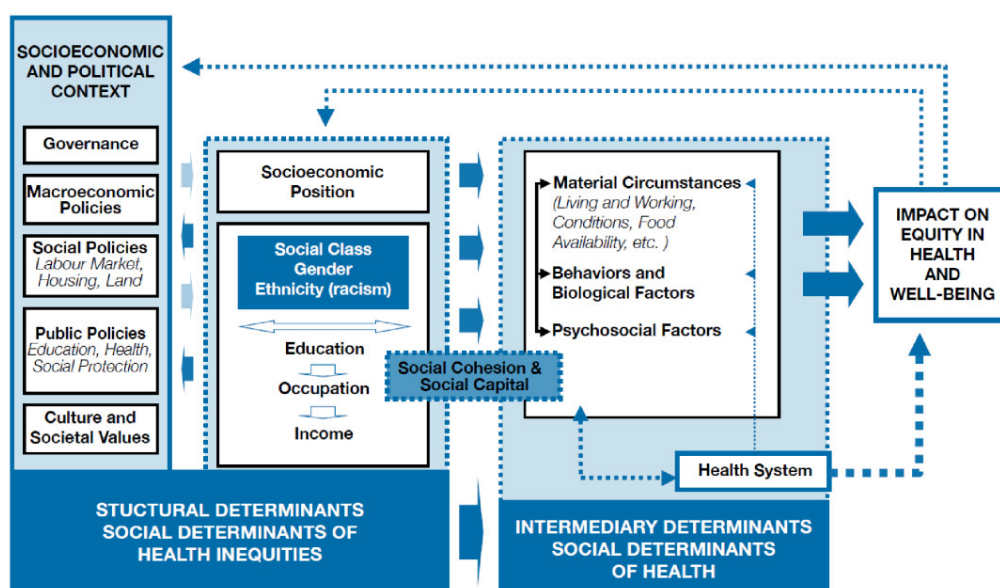
2.11 Contextualising Sleep within Society: Theoretical Models

The social patterning of paediatric sleep outlined in the previous section aligns with a social determinants of health theoretical framework (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010). The World Health Organization defines the social determinants of health as the conditions in which people are born, grow, live, work and age which, in turn, are shaped by the distribution of power, prestige and resources (Solar & Irwin, 2010; World Health Organisation, n.d.).

As illustrated in Figure 4, the social determinants of health are intermediary factors that link the socio-political context and societal structures with health outcomes (Solar & Irwin, 2010). They include material circumstances and physical environments in which people live, such as housing quality and location, physical neighbourhood and work/education environments, and consumption potential such as the financial means to purchase healthy food and warm clothing. Social determinants of (poor) health also encompass social-environmental circumstances, including psychosocial stressors such as from negative life events or job strain, stressful living circumstances such as experiencing high financial debt, and lack of social support. People's material and psychosocial living conditions, in turn, influence behaviours that are either health promoting or health damaging, such as exercise, diet and smoking (Howden-Chapman & Tobias, 2000; Ministry of Health, 2002; Solar & Irwin, 2010).

Social determinants of health inequities (structural determinants) are social, economic and political mechanisms that drive the inequitable distribution of power, privilege and

resources (Figure 4; CSDH, 2008a; Solar & Irwin, 2010). This results in social stratification, whereby social groups (such as those identified by ethnicity, gender, income, education and occupation) hold differential positions within society, and thus experience inequities in daily living conditions, life opportunities and associated inequities in health (Solar & Irwin, 2010). This is evident in social gradients of health, whereby a stepwise association is found between each socioeconomic level and health (Marmot, 2005). The ‘causes of the causes’ (Rose, 2008), that is the socioeconomic-political context and structural mechanisms that create and maintain social hierarchies of power, prestige and resource accessibility, must therefore be addressed if health inequities are to be eliminated (Solar & Irwin, 2010). In other words, without political action inequities remain.



Source: Solar & Irwin (2010, p.6)

Figure 4. The Commission on Social Determinants of Health (CSDH) conceptual framework for action on the social determinants of health, illustrating social determinants of health and structural determinants of health inequities.

The social determinants of health model encompasses a number of perspectives, including ecosocial and life course theory, and ethical elements of social justice and human rights (Solar & Irwin, 2010). One of the key constructs of ecosocial theory is ‘embodiment’ which refers to “how we literally incorporate, biologically, the material and social world in which we live, from conception to death; a corollary is that no aspect of our biology can be understood absent knowledge of history and individual and societal ways of living” (Krieger, 2001b, p. 671). Put simply, embodiment describes how the historical and contemporary societal context ‘gets under the skin’ to produce a state of (un)healthiness (Spencer, 2010). This aligns with a life course approach which recognises that early life experiences influence health across the lifespan and across generations (Braveman & Barclay, 2009).

Thus, considering sleep through a social determinants of health lens recognises that good sleep health is a basic human right (C. Lee, 2016), a basic right of all children (United Nations General Assembly, 1989), that sleep health inequities are socially driven and that eliminating such inequities is a matter of social justice (Daniels, Kennedy, & Kawachi, 1999; B. Hale & Hale, 2009; Marmot, 2005, 2007).

Complementary to the social determinants of health framework, sleep can also be conceptualised using a socioecological model (Bonuck, Blank, True-Felt, & Chervin, 2016; Grandner, 2014, 2017; Grandner, Hale, Moore, & Patel, 2010; Grandner & Mian, 2017; C. Jackson, Redline, & Emmons, 2015; Salm Ward & Doering, 2014). Based on developmental theory of Bronfenbrenner (Bronfenbrenner, 1977, 1986), a socioecological model situates the developing child (and their sleep) within a set of nested systems ranging from the microsystem to the macrosystem (Bronfenbrenner, 1999). The microsystem represents the child’s immediate social and physical environments that they exist in and directly interact with, such as mother-child interactions, the family home and early childhood

education service. The mesosystem encompasses interrelations between microsystems, such as interactions between a child's family, early childhood education service and peer group. The exosystem is an extension of the mesosystem that incorporates settings that do not directly contain the child but that influence or encompass their immediate settings, such as parent/caregiver workplaces, transportation facilities and local government institutions. The macrosystem is the overarching system within which the other systems exist, including economic, social, educational, legal and political systems (Bronfenbrenner, 1977). Later versions of Bronfenbrenner's model also incorporated the chronosystem, recognising that child development is influenced by socio-historical conditions and events and transitions over the life course (Hayes, O'Toole, & Halpenny, 2017).

An example of a socioecological model of sleep is presented in Figure 5, which is a simplified representation of the 'upstream' influences on sleep duration and quality (Grandner, 2017). The 'social' level incorporates aspects of the microsystem, mesosystem and exosystem, and the 'societal' level includes the overarching macrosystem (Grandner et al., 2010; Grandner & Mian, 2017). Aligning with a social determinants of health framework, this model highlights how the societal context/macrosystem ultimately influences sleep. Therefore, changes in sleep inequities require changes in society.

Considering preschool-aged children's sleep through these theoretical lenses points to the importance of investigating sleep within the broader context of society and the ethical imperative of measuring sleep health inequities. It also indicates that interventions to support preschoolers to sleep well need to not only be implemented at the child, mother, family, and community level, but that action must be taken at the broad, socio-political level in order to address sleep health inequities.

Source: Grandner (2017, p.2)

Figure 5. Socioecological model of sleep

2.12 Preschool-Aged Children’s Sleep in Aotearoa/New Zealand

NZ sleep duration guidelines are based on US National Sleep Foundation recommendations (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015). Therefore, it is recommended that preschool-aged children (3 – 4 year olds, as most children start school at 5 in NZ) sleep for 10 to 13 hours per 24 hours (Ministry of Health, 2017b). Current Ministry of Health figures indicate that most (84%) preschoolers are obtaining the recommended amount of sleep (Ministry of Health, 2017b) and average sleep durations reported in other studies of preschoolers in NZ sit within the recommended range (P. Carter, Taylor, Williams, & Taylor, 2011; McDowall, Elder, & Campbell, 2017; Mindell et al., 2013; Teng, Bartle, Sadeh, & Mindell, 2012; S. Williams, Farmer, Taylor, & Taylor, 2014).

Data from the Growing Up in New Zealand longitudinal birth cohort study (n = 6,156; 25% Māori, 21% Pacific, 18% Asian, 16% New Zealander, 3% other, 68% New Zealand European [NB: 47% of children were identified with more than one ethnic group]) also indicate that most (90%) children are meeting these guidelines at the age of 4 (Morton et al., 2017). The average sleep duration of 4 year olds in the study was 10 hours 45 minutes and average bedtime was 7.45pm. The majority (91%) of preschoolers went to bed at a similar time each night and bedtime consistency was associated with longer sleep duration (mean [95% CI], regular bedtime: usually/always 10hr 46min [10hr 44min – 10hr 48min], sometimes 9hr 58min [9hr 50min – 10hr 6min, rarely/never 9hr 19min [9hr 1min – 9hr 36min]). A third (35%) of children napped during the day, for an average of 1.5 hours, woke at least once during the night (37%) on a regular basis and had sleep habits or patterns that were considered by parents to be a problem (29%; small problem 21.0%, moderate problem 5.7%, large problem 1.5%).

While these studies provide a broad overview of preschooler sleep patterns in NZ, they do not identify which children in NZ are at the greatest risk of having sleep durations outside of the recommended range, inconsistent or problematic sleep. It is therefore unclear whether or not ethnic and socioeconomic inequities in preschooler sleep health parallel the inequities that exist in preschool-aged children's physical and mental health in NZ (Section 1.1.1).

One study that did examine relationships between ethnicity, SEP and preschooler sleep found that habitual snoring in 3 year olds (n = 823; 11% Māori, 2% Pacific, 4% other, 83% New Zealand European) was more prevalent for Māori ($p = .04$) and children living in neighbourhoods with greater socioeconomic deprivation ($p < .01$) at the univariate level (Gill, Schaughency, & Galland, 2012). Another focused on associations between ethnicity and the sleep of children in NZ but in a broad age range of children (4 – 12 years at

baseline; n = 939; 18.7% Māori, 11.8% Pacific, 8.0% Asian, 60.9% European), thus making it difficult to ascertain patterns of association in the preschool years (Vaipuna et al., 2018). They found that, across a two year period, Pacific children had shorter sleep (difference [95% CI] -15.9 minutes [-24.6, -7.2]) and Māori children had similar sleep duration difference (-0.7 minutes [-7.0, 5.6]) to European children, after controlling for socioeconomic deprivation, sex, weight status and age. There was no difference by ethnicity in sleep quality, as measured by actigraphic sleep efficiency. However, there was an independent association between ethnicity and sleep timing, with children from all other ethnic groups going to bed later (Māori 9 minutes [2 – 11]; Pacific 29 minutes [20 – 38]; Asian 22 minutes [12 – 32]), and waking up later (Māori 5 minutes [0 – 11]; Pacific 11 minutes [4 – 18]; Asian 18 minutes [10 – 25]), than European children.

In contrast, a comprehensive body of social epidemiological research indicates that ethnic and socioeconomic sleep health inequities exist in the NZ adult population. Short (<7 hours), long (≥9 hours) and insufficient (≥2 hours difference in average sleep duration on free versus scheduled days) sleep duration, daytime sleepiness, insomnia symptoms, self-reported sleep problems and obstructive sleep apnoea are more prevalent for Māori than non-Māori adults (Gander, Marshall, Harris, & Reid, 2005; Mihaere et al., 2009; Paine & Gander, 2013, 2016; Paine, Gander, Harris, & Reid, 2004, 2005; Paine, Harris, Cormack, & Stanley, 2016, 2017). In contrast, circadian rhythm disorders (delayed and advanced sleep phase disorders) (Paine, Fink, Gander, & Warman, 2014) and sleep timing preference (Paine, Gander, & Travier, 2006) do not differ by ethnicity.

Area-level socioeconomic deprivation is, however, a risk factor for delayed sleep phase disorder, after controlling for ethnicity, gender, age, unemployment and night work (Paine et al., 2014). Area-level socioeconomic deprivation is also an independent risk factor for short, long and insufficient sleep (Paine & Gander, 2016), insomnia symptoms and sleep

problems (Paine et al., 2004; Paine et al., 2016), excessive daytime sleepiness (Gander et al., 2005) and witnessed apnoea during sleep (Mihaere et al., 2009).

Other aspects of SEP are associated with poor adult sleep health. Being unemployed and working at night is associated with increased odds of insomnia symptoms and having either a current or chronic sleep problem (Paine et al., 2004) and short sleep (<7 hours) (Paine & Gander, 2016). Adults with no secondary school qualification have greater odds of experiencing difficulties falling asleep (OR [95% CI] 1.41 [1.07 – 1.86]) or frequently waking during the night (1.27 [1.00 – 1.61]) compared to adults with a tertiary qualification (Paine et al., 2016). In addition, adults who live in a high-income household have reduced odds of waking during the night (0.91 [0.65 – 1.00]) or waking early in the morning (0.73 [0.58 – 0.92]) compared with those in middle income households (Paine et al., 2016).

In NZ disturbed and problematic sleep is associated with a raft of poor mental health, physical health and quality of life outcomes in adults (Paine et al., 2005; Paine et al., 2017). Therefore, ethnic and socioeconomic inequities in sleep health may play a role in the ethnic and socioeconomic inequities that exist in adult health (Section 1.1.1). Racial discrimination, in the form of individually experienced personal racism and structural racism resulting in ethnic inequities in SEP in NZ, explains a significant proportion of inequities in the prevalence of sleep disturbances between Māori and European adults (Paine et al., 2016). Thus, tackling racism in NZ is vital for eliminating ethnic inequities in adult sleep health.

These findings also raise a number of questions. When do ethnic and socioeconomic inequities in sleep health that are observed in the adult population first present in the life course? Does the increased risk of poor sleep health that is experienced by Māori adults

and adults who hold low SEP in NZ society translate as increased risk of poor sleep health for young children within the same households?

Taking into consideration the body of literature outlined above, I posit that the ethnic and socioeconomic inequities that exist in adult sleep in NZ will also be evident in preschoolers' sleep health and that two potential pathways may be involved in determining how well preschool-aged children sleep. Preschoolers' own position in society, indicated by child ethnicity and SEP, and their associated experiences and living conditions will influence their opportunity to obtain sufficient, good quality sleep. Therefore, Māori preschoolers and children who experience greater socioeconomic deprivation will have poorer sleep health than non-Māori children and children from families with greater socioeconomic resources. Alternatively, given young children's maternal dependence, it may be that a child's mother's social location, indicated by maternal ethnicity and SEP, influences children's opportunities to obtain sufficient, good quality sleep. Therefore, preschoolers of Māori mothers and mothers who hold low SEP will have poorer sleep health than children of non-Māori mothers and preschoolers of mothers with greater socioeconomic resources.

Using data from participants in the *Moe Kura* study (Section 1.1.2), this thesis aims to investigate the social determinants of preschoolers' sleep health in NZ, with a particular focus on ethnicity and indicators of SEP, by addressing the following questions:

2.13 Research Questions

2.13.1 Mixed Methods Research Question

What are the social determinants of preschoolers' sleep health in NZ, based on the combination of maternal quantitative survey data and qualitative interview data?

2.13.2 Quantitative Research Questions

1. How long, when and how well do Māori and non-Māori preschoolers sleep?
2. Does the prevalence of poor sleep health in preschoolers differ by ethnicity and SEP?
3. What is the association between ethnicity, SEP and poor sleep health in preschoolers?

2.13.3 Qualitative Research Questions

1. Central qualitative research question:
What are Māori and non-Māori mothers' experiences of preschoolers' sleep, within diverse socioeconomic contexts?
2. Qualitative research sub-questions:
 - a) How is good and poor preschooler sleep health perceived and experienced by mothers?
 - b) What facilitators and barriers to preschoolers sleeping well are experienced by mothers?

CHAPTER 3 METHODOLOGY

This chapter outlines the philosophical, theoretical and design elements of the mixed methods approach of this thesis. As quantitative and qualitative study results were reported in journal manuscripts (Chapters 4 to 7), there was limited scope to describe the methods used due to journals' word limits. Therefore, details of quantitative and qualitative study processes and methods are also provided.

3.1 Pragmatic Paradigm

The term 'paradigm' has been defined in a multitude of ways including worldview, epistemological stance and shared beliefs (Morgan, 2007). A pragmatic paradigm is often partnered with mixed methods research (Johnson, Onwuegbuzie, & Turner, 2007) and asserts that there is both a single 'real world' and that everyone has their own unique interpretation of that world (Morgan, 2007). A pragmatic approach enables researchers to choose methods that are most appropriate to the research scenario and to use knowledge obtained from multiple methods to inform solutions, while being aware of the influence of their own worldviews and assumptions (Greene & Hall, 2010; Johnson & Onwuegbuzie, 2004). Pragmatism also recognises that research is influenced by the historical, political and cultural contexts in which it is conducted (Morgan, 2014b).

Pragmatism encompasses abductive reasoning, moving between deductive and inductive approaches to theory and data assimilation that are usually used with quantitative and qualitative approaches respectively (Morgan, 2007). During the research process, knowledge is usually constructed using objectivity in quantitative research and subjectivity in qualitative research. In contrast, a pragmatic paradigm supports intersubjectivity, moving away from the notion that quantitative and qualitative research

is incompatible (Morgan, 2007). Thus, this applied research philosophy incorporates a practical process of duality, as opposed to an all or nothing approach (Greene & Hall, 2010; Morgan, 2007), and is oriented towards examining real world questions within real world contexts and focusing on solutions (Cresswell & Plano Clark, 2011; Morgan, 2014b). Pragmatism was therefore deemed an appropriate paradigm to guide this thesis.

3.2 Theoretical Lenses

In conjunction with the pragmatic paradigm, Kaupapa Māori epidemiology research principles (Paine et al., 2013) (Section 1.1.2), and social determinants of health (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010) and socioecological (Grandner, 2017; Grandner et al., 2010; C. Jackson et al., 2015) perspectives of sleep (Section 2.11), informed the research process.

As outlined in the Introduction (Section 1.1.2), Kaupapa Māori epidemiological research principles of the wider *Moe Kura* research programme brought Māori children and mothers to the centre of the research, prioritised equal explanatory power for Māori and non-Māori participants (Paine et al., 2013; Reid et al., 2017) and therefore influenced how data were collected and analysed. Considering sleep through a social determinants (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010) and complementary socioecological (Grandner, 2017; Grandner et al., 2010; C. Jackson et al., 2015) theoretical lens situated children and their sleep within the broader societal context and recognised that inequities reflect differential power within society, as opposed to biological or behavioural differences (see Background, Section 2.11). This influenced the focus of the research questions and the analysis of data. These theoretical perspectives share a common construct of social justice and human rights thus placing the rights of the child,

including the right of all children in NZ to have good sleep health, at the centre of this thesis research.

3.3 Mixed Methods Methodology

Mixed methods research has been described as the ‘third methodological movement’ (Johnson et al., 2007; Tashakkori & Teddlie, 2003). It is a methodology, rather than simply a ‘method’ of data collection or analysis, as it has its own unique worldview, language and techniques (Tashakkori & Teddlie, 2003). The fundamental principle of mixed methods research is that the use of both quantitative and qualitative approaches to collect, analyse and integrate data enables research questions to be answered in a unique way (Tashakkori & Teddlie, 2003). The resulting combination provides complementary strengths, rather than overlapping weaknesses. Therefore, the use of multiple approaches enables ‘additional coverage’ that is greater than the sum of parts and the understanding of multiple aspects of a complex phenomenon (Morgan, 2014a). This pluralistic approach encourages the selection of research methods that provide the best opportunity to obtain useful answers to the research questions (Johnson & Onwuegbuzie, 2004).

Thus, the aim of using mixed methods research methodology was to gain a more comprehensive understanding of social determinants of preschoolers’ sleep than could be achieved by using only a quantitative or a qualitative approach. The rationale for quantitatively analysing *Moe Kura* questionnaire data was to understand the social patterns of children’s sleep from a broad perspective and the rationale for qualitatively analysing interview data collected from a sub-sample of *Moe Kura* mothers was to gain a more in-depth understanding of children’s sleep within a range of family contexts.

A convergent parallel mixed methods study design (Cresswell & Plano Clark, 2011) was used whereby quantitative and qualitative studies were conducted concurrently, with

equal weighting given to data from both types of studies (Figure 6). Results were integrated in the final stage of the study process using text and a schematic depiction of findings and their practical application, guided by the theoretical lenses and pragmatic paradigm of the thesis (Chapter 8).

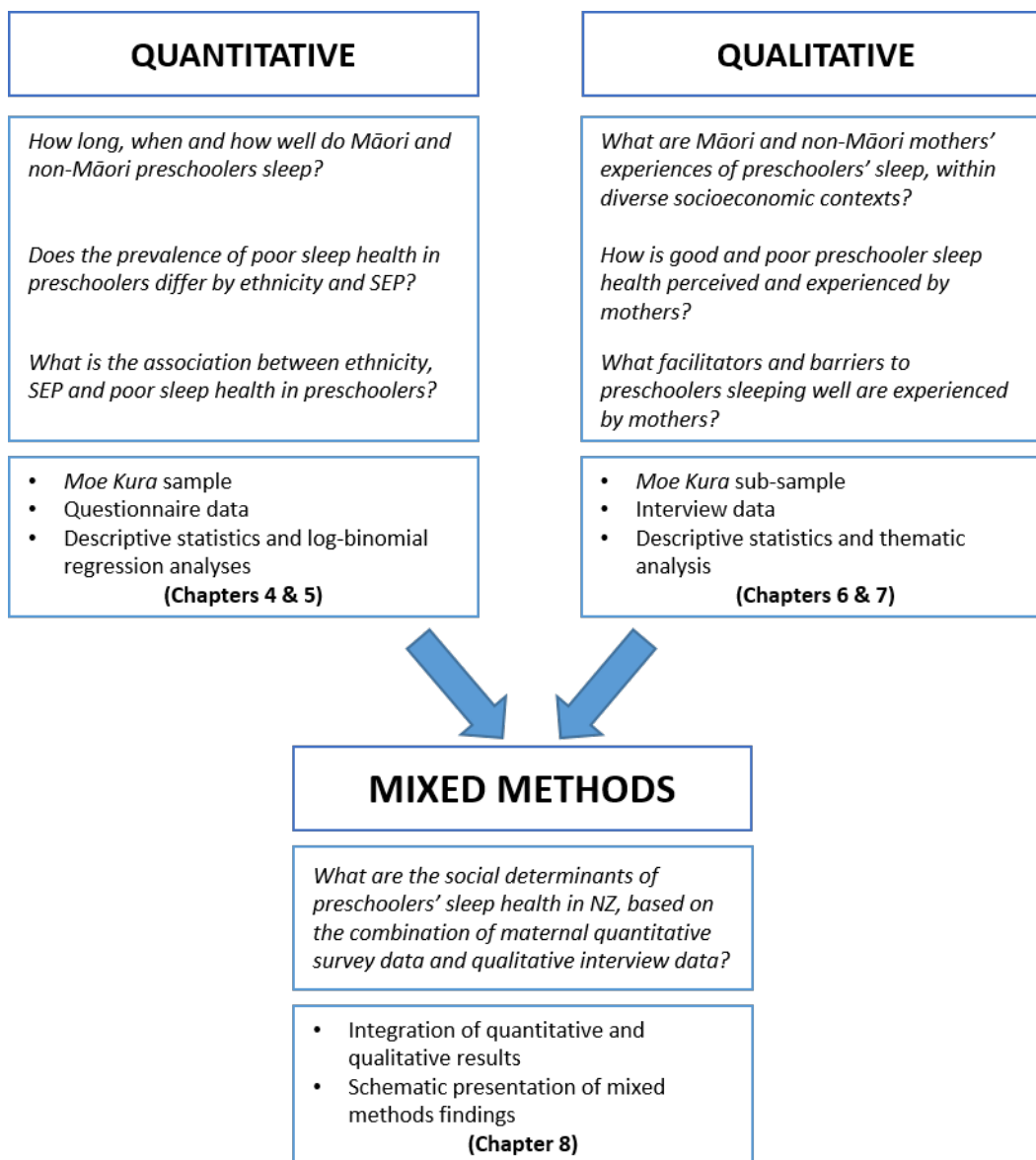


Figure 6. Diagram of the convergent parallel mixed methods study design of the thesis

3.4 Quantitative Study Methods

As data were drawn from the *Moe Kura* study (see Chapter 1), information is provided below about the development, data collection, response rates and data management of *Moe Kura*. This is followed by details of the quantitative analyses conducted for this thesis, including consultation, measures and analytical techniques.

3.4.1 Moe Kura Study Development

The *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura)* study was preceded by the *E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand (E Moe, Māmā)* study (Howe et al., 2015; Paine et al., 2013; Signal et al., 2016). Informed by Kaupapa Māori methodology (see Section 1.1.2), *E Moe, Māmā* was a large scale, community based, longitudinal survey study of 418 Māori and 768 non-Māori women (see Figure 7). The main aims of *E Moe, Māmā* were to investigate the relationship between sleep in late pregnancy and birth outcomes, and sleep across the perinatal period and maternal mood, for Māori and non-Māori women. Mothers completed a paper questionnaire in late pregnancy and at 12 weeks postpartum on their pregnancy, sleep, health and birth experience and their infant's sleep and wellbeing, and a brief telephone interview at 4 to 6 weeks postpartum about their sleep and mood.

E Moe, Māmā recruitment and data collection occurred between October 2009 and September 2011. Pregnant women were initially recruited from the lower North Island of NZ however in order to obtain a sufficient number of Māori participants, in line with the Kaupapa Māori methodology, recruitment was subsequently conducted nationwide and closed to non-Māori women in the latter stages of the recruitment process (Paine et al., 2013).

In 2012, *E Moe, Māmā* Principal Investigators Associate Professor Signal and Dr Paine invited women who were enrolled in *E Moe, Māmā* to participate in further research focussed on child and maternal sleep and the relationship to health, wellbeing and child development. A data collection round when children were 3 years of age (*Moe Kura* Age 3) was the initial goal, due to the age of children in *E, Moe Māmā* and available funding. *E Moe, Māmā* participants were advised in writing that future research was being proposed and women were given the option to opt out of being sent study information.

3.4.1.1 Ethics

Ethics approval for the *Moe Kura* Age 3 data collection was granted by the Central Health and Disability Ethics Committee (HDEC) of NZ on 16th November 2012 (CEN/09/09/070/AM02), as an amendment to the original *E Moe, Māmā* study which was granted ethics approval in October 2009 (CEN/09/09/070).

3.4.1.2 The Moe Kura Name

In 2013, Dr Te Huirangi Waikerepuru (Taranaki) from Te Matahiapo gifted the name ‘Moe Kura’ to the study. He described ‘Moe Kura’ as being “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” (Moe Kura, n.d.).

3.4.1.3 Moe Kura Study Team

Paralleling the design used in *E Moe, Māmā*, the *Moe Kura* study model incorporated a team of researchers based at the Sleep/Wake Research Centre, Massey University Wellington in collaboration with researchers from other institutions and a panel of Māori and non-Māori advisors with a range of expertise including maternal and child sleep, health and development.

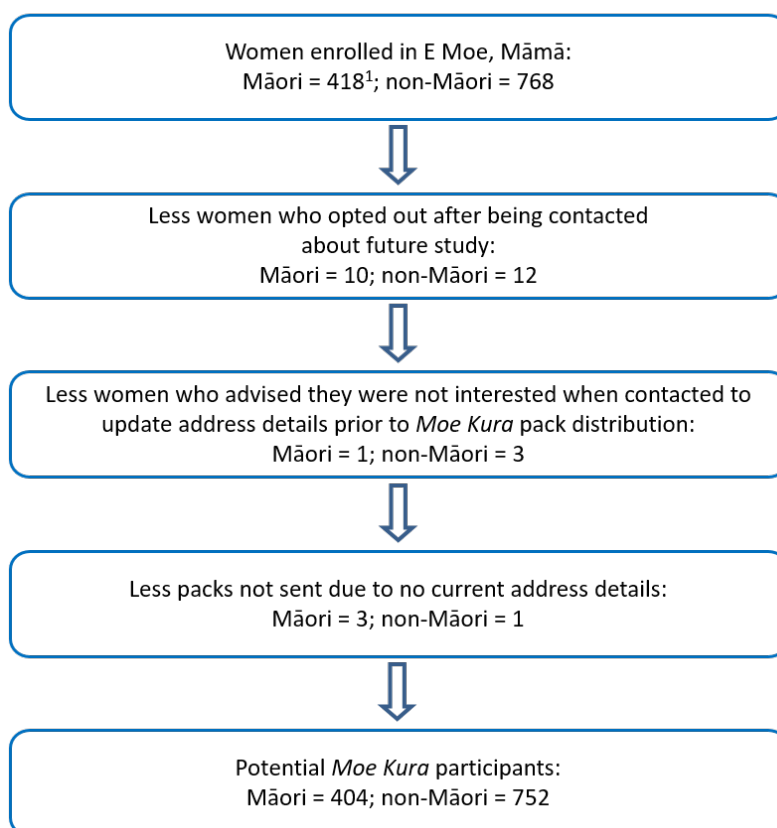
3.4.2 Researcher's Roles

I joined the *E Moe, Māmā* study team at the Sleep/Wake Research Centre in 2010, prior to commencing my doctoral thesis in May 2014. I assisted with recruitment and study pack distribution, conducted 4 to 6 week interviews with participants and followed up women with elevated Edinburgh Postnatal Depression Scale scores (Cox, Holden, & Sagovsky, 1987), as per the *E Moe, Māmā* study protocol (Paine et al., 2013).

At the inception of *Moe Kura*, I participated in discussions with the wider research team regarding study design. I engaged in activities to ensure contact details of potential participants were correct, including telephoning and emailing women and checking NZ electoral rolls. I also led the development of the *Moe Kura* Child Sleep and Health questionnaire (Appendix 1). Questionnaire development involved discussions in research team meetings and in a meeting with the *Moe Kura* advisory group about potential questions to be included in the survey, in conjunction with a review of the literature. Thus, decisions were made about questionnaire content based on consensus, informed by questions previously included in *E Moe, Māmā* questionnaires, international literature and expert knowledge in child and maternal health in NZ. As part of the questionnaire development process, I participated in meetings with the creative group who visually designed the *Moe Kura* Child Sleep and Health questionnaire and the *Moe Kura* Maternal Sleep and Health questionnaire (Appendix 2). I also took on the role of liaising between the *Moe Kura* research team and designers to manage the editing process. Once data collection started, I assisted with distributing study packs, tracking the receipt of questionnaires and following up women (see Section 3.4.3.1).

3.4.3 Moe Kura Data Collection

Moe Kura Age 3 recruitment and data collection commenced on 21st December 2012 and finished on 30th April 2015. Potential *Moe Kura* participants (Māori: n = 404, non-Māori: n = 752; Figure 7) were posted a study pack no earlier than five weeks before and up until their child's third birthday. Packs contained a letter of invitation (Māori or non-Māori version), an information sheet, consent form, Child Sleep and Health Questionnaire (Age 3 Child Questionnaire) and Maternal Sleep and Health Questionnaire (Age 3 Maternal Questionnaire) (Appendices 1 - 3).



¹The original number was 421 (Paine et al., 2013) however 3 women had twins and therefore did not meet study criteria. As ethnicity data were collected in questionnaires and not all women who were enrolled (had completed a consent form) completed questionnaires, the number of Māori women may have been greater.

Figure 7. Potential *Moe Kura* participants

Women were invited to participate by filling in the consent form, completing both questionnaires (within a one month window either side of their child's third birthday) and returning the documentation in a pre-addressed, postage-paid envelope that was included in the study pack. Upon receipt of completed study documents, participants were posted koha⁸ of a \$40 gift voucher of their choice (options were included in the questionnaires of receiving a petrol, supermarket or department store voucher).

3.4.3.1 Follow Up Process

Over the one month period following their child's third birthday, mothers were followed up with weekly messages either via email, text or letter (in order of preference) asking them to complete the consent form and questionnaires if they had decided to participate. If there was no response by the end of this period, a member of the study team telephoned women (or emailed if no phone number was available) and asked them to complete the study consent form and surveys if they wanted to take part and offered assistance if it was required, such as completing questionnaires over the phone. If still no contact had been made, reminders were sent using two different methods every two working days, either via telephone and email or telephone and text message. This continued until contact was made or recruitment had closed.

3.4.3.2 Moe Kura Response Rates

Approximately 70% of potential Māori participants and 84% of potential non-Māori participants enrolled in the *Moe Kura* Age 3 data collection round and completed Maternal and Child Questionnaires (Table 1). For two participants (Māori: n=1; non-Māori: n=1), only Maternal Questionnaires were usable, as one Child Questionnaire had been completed for a child not born in the *E Moe, Māmā* study and one Child Questionnaire was missing.

⁸ Gift of appreciation.

The dataset used in this thesis contained child and maternal information that was provided in questionnaires by 281 Māori women and 629 non-Māori women, based on ethnicity recorded by mothers in the Age 3 Maternal Questionnaire. As ethnicity is not a ‘fixed’ phenomenon, but rather an indication of the social group or groups which people self-identify as belonging to (Reid et al., 2017), maternal ethnicity at Age 3 differed for some women from self-identified ethnicity at different data collection time points in *E Moe, Māmā*.

Table 1. *Moe Kura* Response Rates

	n (% of potential participants)	
	Māori women (n=404)	Non-Māori women (n=752)
Completed consent form and both the Maternal and Child Age 3 questionnaires	281 (69.6%)	629 (83.6%)
Completed consent form and only Maternal Age 3 questionnaire able to be used	282 (69.8%)	630 (83.8%)
Completed both questionnaires but not able to be used as no consent form was completed	3 (0.7%)	2 (0.3%)
Declined to participate (advised the study team after the study pack was posted)	22 (5.4%)	51 (6.8%)
Outstanding/ lost to follow up	97 (24.0%)	69 (9.2%)

3.4.4 Data Management and Preparation

Data from *Moe Kura* Age 3 Maternal and Child Questionnaires were entered into databases using LimeSurvey open source software (LimeSurvey Project Team, 2012) by a team of research assistants, guided by data entry rules developed by the study team and documented by the researcher. Over 10% of questionnaires were double-entered (Maternal Questionnaire: n=95; Child Questionnaire: n=119). The researcher checked the accuracy of double-entered data using the PROC COMPARE procedure in SAS statistical

software (Version 9.3) and identified an error rate of $\leq 1\%$ (Maternal Questionnaire = 0.56%, Child Questionnaire = 1.0%), based on the total number of discrepancies found divided by the total number of variables checked. Discrepant entries were cross-checked against the original paper questionnaires and amended accordingly. The low error rate, coupled with budgetary considerations, resulted in a decision to not conduct further double-entry.

Additional checking and cleaning of data, using R (version 3.3; R Core Team, 2013), was conducted by the researchers' supervisor Dr Wu, fellow PhD candidate Ms Clare Ladyman and the researcher. Data were screened by creating and reviewing descriptive statistics and histograms and identifying extreme values. Potential anomalies were cross-checked against original paper questionnaires, discussed with the study team and amended on a case-by-case basis.

Statistical support was provided by Dr Edgar Santos Fernández, Institute of Fundamental Sciences, Massey University Manawatu. Dr Santos Fernández imported address-matched NZDep2013 values (Atkinson et al., 2014) (see Section 3.4.5.2) and created a number of new variables by re-categorising original questionnaire data, as per the request of the researcher. Dr Santos Fernández merged specific variables from maternal and child databases that were relevant to the thesis into one dataset, which was used for analyses.

3.4.5 Quantitative Data Analysis

3.4.5.1 Consultation

Consultation was sought from Māori researchers on the *Moe Kura* advisory panel, Dr Ricci Harris (Ngāti Kahungunu, Ngāti Raukawa, Ngāi Tahu) and Dr Donna Cormack (Kāti Mamoe, Kai Tahu), Te Rōpū Rangahau Hauora a Eru Pōmare, University of Otago Wellington. Drs Harris and Cormack provided guidance on situating ethnicity in the

quantitative study and conceptual relationships between ethnicity and SEP, which helped inform quantitative research questions and associated analyses.

The researcher developed a statistical analysis plan in collaboration with Associate Professor Signal and Dr Paine, as both co-principal investigators of *Moe Kura* and as supervisors. The researcher coded and ran all descriptive, prevalence and regression analyses, which entailed self-directed learning informed by statistical guidance from supervisors, published literature and online SAS statistical software support (<https://support.sas.com>). Statistical advice was also provided by biostatistician Dr Mathangi Shanthakumar, of the Centre for Public Health Research, Massey University Wellington, who reviewed log-binomial regression coding (see Section 3.4.5.3) that the researcher had written and provided guidance on amendments.

3.4.5.2 Measures

Variables that were used in analyses were determined a priori, based on a review of the current literature, the theoretical lenses guiding the thesis and the availability of data. Data sources were the *Moe Kura* Age 3 Child and Maternal Questionnaires (Appendices 1 and 2) and address-matched NZDep2013 deciles (Atkinson et al., 2014). Demographic and sleep measures relevant to the quantitative study are outlined below:

Child Demographic Measures

Child Ethnicity

Child ethnicity was measured in the *Moe Kura* Age 3 Child Questionnaire, using the New Zealand Census 2006 ethnicity question (Statistics New Zealand, 2006). In line with protocol requirements for the collection of ethnicity data in the health and disability sector in NZ, standardised wording of the census question was used and mothers were asked to identify the ethnic group or groups that their *Moe Kura* child belonged to, rather

than children's ethnicity being defaulted to that of their mother (Ministry of Health, 2004). A prioritised output approach was used for categorising responses prior to analysis (Ministry of Health, 2004). Children who were identified by mothers as belonging to the Māori ethnic group (with or without other ethnic groups) were categorised as 'Māori'. Children identified as belonging to an ethnic group or groups not including Māori were categorised as 'non-Māori', as per Kaupapa Māori epidemiology principles of *Moe Kura* (Section 1.1.2).

Child Age

Children's age was measured using mothers' responses to two questions in the *Moe Kura* Age 3 Child Questionnaire: "When was your child born? (DD/MM/YYYY)" and "Date questionnaire completed (DD/MM/YYYY)". Age was calculated by subtracting birth dates from questionnaire completion dates, to produce age in years to one decimal place. A continuous child age variable was used for descriptive purposes, but was not included in additional analyses due to the narrow age range of children in the study (the majority of children were aged between 2.9 and 3.5 years).

Child Gender

Child gender was measured in Age 3 Child Questionnaires using the question "Is your child:" (response options: male/female), which was based on the question used in face-to-face data collection for the 2006/07 New Zealand Health Survey Child Questionnaire (Ministry of Health, 2006). A dichotomous (female/male) variable was prepared.

Child Socioeconomic Position

Due to children's young age, and associated dependence on parents/caregivers, maternal measures of SEP were used as proxy measures of child SEP. All preschoolers in the sample usually resided with their mother for the majority (≥ 4 nights) of the week (based on responses to the Age 3 Child Questionnaire question "During a normal week, how many

nights does your child sleep in the same house as you?”). Therefore, maternal socioeconomic circumstances were viewed as reasonably reflecting those of children.

SEP is a complex, multidimensional phenomenon and a person’s SEP cannot be fully captured using one measure (Galobardes, Shaw, Lawlor, Lynch, & Smith, 2006). The present study used two indicators of SEP in analytical models: a neighbourhood-level index of relative socioeconomic deprivation (NZDep2013) and an individual-level index of socioeconomic deprivation (NZiDep). Both are non-occupational measures of deprivation that focus on social conditions experienced by people, which have been recommended as effective measures of SEP in health research in NZ involving moderate sized surveys (Salmond & Crampton, 2012b; Salmond, Crampton, King, & Waldegrave, 2006).

NZDep2013 is the latest in a series of small area indices of relative socioeconomic deprivation in NZ which were developed for, and have been widely used in, resource allocation, health research and advocacy (Atkinson et al., 2014; Salmond & Crampton, 2012a). NZDep2013 has been validated against census smoking prevalence data, as were 1996 and 2006 versions of the index (Atkinson et al., 2014).

Small areas are based on Statistics New Zealand standard geographical units called meshblocks (*Mdn* = 81 people in 2013), with the majority of NZDep2013 small areas containing at least 100 people and comprising of one (50.5%) or two (30.4%) meshblocks (Atkinson et al., 2014).

NZDep2013 incorporates eight dimensions of social and material deprivation: communication, income, employment, qualifications, home ownership, support, living space and transport. Principal components analysis was used to create the index from nine census variables (in order of decreasing weight): people aged <65 with no access to the internet at home; people aged 18 to 64 receiving a means tested benefit; people living in

equivalised households with income below an income threshold⁹; people aged 18 to 64 unemployed; people aged 18 to 64 without any qualifications; people not living in own home; people aged <65 living in a single parent family; people living in equivalised households below a bedroom occupancy threshold; and people with no access to a car. The resulting NZDep2013 index is an ordinal scale from 1 to 10, whereby a value of 1 (decile 1) represents the 10% of small areas in NZ that have the least deprived NZDep scores and a value of 10 (decile 10) represents the 10% of small areas that have the most deprived NZDep scores (Atkinson et al., 2014).

As NZDep2013 is a relative, rather than absolute, measure of social and material deprivation, there will always be 10% of areas with the most deprived NZDep scores and 10% of areas with the least deprived scores (Atkinson et al., 2014). It is not uncommon for geographical areas in NZ to include a mix of households with varying degrees of deprivation even at the meshblock level, therefore it is important to be mindful of the area, rather than individual, level of measurement that NZDep provides (Atkinson et al., 2014; Salmond & Crampton, 2002, 2012b).

An external, professional service matched addresses provided by women in the *Moe Kura* Age 3 Maternal and Child Questionnaires to NZDep2013 values. Two ordinal variables were prepared, NZDep2013 deciles and NZDep2013 quintiles (i.e. an ordinal variable with five levels, each representing 20% of small areas). When different addresses were recorded for children and mothers in questionnaires, maternal address-matched NZDep2013 values were used in analyses to represent area-level child SEP due to children spending the majority of their time at their mother's house, as outlined above.

⁹ Household income equivalised using the revised Jensen scale (Jensen, 1978, 1988) to enable relative incomes of households of different compositions to be compared, with a two adult family used as the reference household (expenditure = 1.0) (Atkinson et al., 2014).

The individual-level measure of SEP used in analyses, the NZiDep index of socioeconomic deprivation for individuals, is based on responses to eight questions relating to multiple aspects of socioeconomic deprivation experienced in the previous 12 months (Salmond et al., 2006). The questions measure consumption limitations, based on income constraints, the capacity to consume essential goods and dependence on support (Salmond & Crampton, 2012b). Questions include being out of paid work (for people under the age of 65, not including those who are not in paid work due to being in a caregiver or home-make role); receiving a means-tested benefit; having to buy cheaper food; feeling cold to save money on heating costs; wearing worn out shoes due to cost; going without fresh fruit and vegetables in order to pay for other things that are needed; getting help from a community organisation in the form of clothes or money; and seeking help to get food, such as via food grants or food banks. Positive responses are summed and re-coded to produce a score of 1 to 5, where 1 equals no deprivation characteristics, 2 equals one deprivation characteristic, 3 equals two deprivation characteristics, 4 equals three or four deprivation characteristics and 5 equals five or more deprivation characteristics (Salmond et al., 2006).

A strength of NZiDep is that it was developed and validated using a sample of approximately 300 Māori, 300 Pacific and 300 non-Māori, non-Pacific adults in NZ and showed acceptability across ethnic groups. Acceptable construct validity, statistical validity (Cronbach's coefficient alpha = 0.81) and criterion validity (relationship between NZiDep and individual smoking data, test for linear trend $p < 0.0001$) have been demonstrated and NZiDep is simple to administer and score. As it focuses on the deprived end of the continuum, a strength of the index is the ability to decipher people who are singly and multiply deprived, including three levels of multiple deprivation, however it has been described as "only rather crudely" measuring the non-deprived end of the scale (Salmond et al., 2006, p. 1483).

An NZiDep score (ranging 1 - 5) was calculated from maternal responses to NZiDep questions in the *Moe Kura* Age 3 Maternal Questionnaire, to produce an ordinal maternal NZiDep variable that was used as a proxy for child SEP at the individual/household level. Six participants did not answer any of the questions and therefore had NZiDep scores set to missing.

Two additional measures of SEP, maternal education and equivalised household income, were considered for inclusion in analyses. Education questions from the 2006/07 New Zealand Health Survey (Ministry of Health, 2006) were included in the *Moe Kura* Age 3 Maternal Questionnaire. Women were asked to indicate their highest secondary school qualification (“What is your highest secondary school qualification?” with response options: ‘None’, followed by a list of NZ secondary school qualifications) and their highest completed qualification apart from secondary school (“Apart from secondary school qualifications, do you have another completed qualification?” with response options: ‘No qualification beyond secondary school’, followed by a list of qualification options). Two education variables were prepared: a dichotomous variable (no qualification vs at least secondary) and a three-level categorical variable (no qualification vs secondary vs tertiary).

After examining responses, the decision was made to use maternal education to simply describe socioeconomic characteristics of the sample but not to include education in statistical models, due to the majority of Māori and non-Māori women having at least a secondary school qualification. This decision was supported by findings of Salmond and Crampton (2012) who found education and income to have minimal additional explanatory power when used alongside indices of NZDep and NZiDep. For that reason, along with concerns about the data quality of a question in the Age 3 Maternal Questionnaire about the number and age of people living in households (required to

calculate equivalised household income), an income variable was not used in the present study.

Maternal Demographic Measures

Maternal Ethnicity

As per child ethnicity, maternal ethnicity was measured using the New Zealand Census 2006 ethnicity question (Statistics New Zealand, 2006). Women were asked to identify the ethnic group or groups which they belonged to and were subsequently categorised as 'Māori' or 'non-Māori' based on a prioritised output approach (Ministry of Health, 2004).

Maternal Age

A continuous descriptive variable, mother's age when their *Moe Kura* child was born, was calculated by subtracting child age from maternal age (calculated by subtracting women's birth date from the date that the maternal questionnaire was completed), to produce age in years to one decimal place. A categorical maternal age variable was derived from continuous age values (<20yrs/20-<30yrs/30-<40yrs/≥40yrs).

Maternal Socioeconomic Position

The SEP measures outlined in the 'Child socioeconomic position' section above were also used as indicators of maternal SEP in analyses.

Child Sleep Measures

All of the child sleep variables used in the quantitative study were derived from data collected in *Moe Kura* Age 3 Child Questionnaires.

Sleep Durations

Children's typical weeknight and weekend sleep durations across 24 hours, including naps, were measured using a modified version of the Children's Sleep Habits

Questionnaire (CSHQ) sleep duration question (Owens, Spirito, & McGuinn, 2000). Mothers' responses to "What is your child's usual amount of sleep each week day/night, i.e. Sunday to Thursday night? (*combining night time sleep and naps*)" and "What is your child's usual amount of sleep each weekend day/night, i.e. Friday and Saturday? (*combining night time sleep and naps*)" were used to create continuous variables for week and weekend sleep durations across 24 hours. The original CSHQ sleep duration question did not differentiate between week and weekend sleep. The rationale for doing so in the current study was to be able to describe durations across the entire week and to identify whether week-weekend differences in preschool-aged children's sleep durations occur in NZ.

Based on recommendations that preschool-aged children obtain 10 to 13 hours sleep per 24 hour period (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Adams Hillard, et al., 2015; Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015), categorical variables were prepared for weeknight and weekend sleep durations across 24 hours: <10hrs/10 - 13hrs/>13hrs.

Based on mothers' report of their child's usual sleep start and wake times, *nighttime* sleep durations were calculated by subtracting children's usual sleep start times from children's usual wake times, during the week and on weekends, to produce continuous weeknight and weekend nighttime sleep variables. As there are currently no clear guidelines regarding nocturnal sleep durations for preschool-aged children, this variable was not categorised.

Sleep Timing

Sleep timing variables (unit of measure: 24 hour clock time) were prepared based on women's report of the time that their child usually went to bed, went to sleep and woke up, during the week and on the weekend, over the past seven days. Weeknights were

defined as Sunday night to Thursday night; weekend nights as Friday and Saturday night; week day mornings as Monday morning to Friday morning; and weekend mornings as Saturday and Sunday morning.

'Sleep hygiene' recommendations often include that children in this age range go to bed no later than 9pm (Allen et al., 2016; Mindell, Meltzer, et al., 2009) and, in NZ, the Ministry of Health recommends that preschoolers have bedtimes that are ideally earlier than 8pm (Ministry of Health, 2017b). Reflecting these guidelines, dichotomous bedtime variables were prepared for weeknights and weekends: bedtimes $\leq 8\text{pm}/> 8\text{pm}$; and bedtimes $\leq 9\text{pm}/>9\text{pm}$.

Sleep timing was also measured using the midsleep time (unit of measure: 24 hour clock time) of children's usual nighttime sleep period, on both weeknights and weekends. Midsleep time was calculated as the midpoint between children's sleep start and wake times, i.e. $\text{midsleep time} = \text{sleep start} + (\text{wake time} - \text{sleep start})/2$ (Roenneberg et al., 2012).

Children's daytime napping was based on mothers' responses to the question "Is your child transitioning away from napping (now not needing a nap every day)?" (response options: yes [does not nap every day]/no [naps every day]/has stopped napping completely/don't know) (B. Galland, personal communication, October 24, 2012).

Sleep Variability

Two measures of sleep variability were used, differences in sleep duration and differences in midsleep time on weeknights and weekends (social jetlag). Continuous variables were prepared by calculating the absolute difference between week and weekend sleep duration (24hr), and week and weekend midsleep time, in minutes. In line with recommendations that children's sleep schedules should not vary by more than 30 to 60

minutes (Allen et al., 2016), a dichotomous variable indicating a sleep (24hr) difference ≤ 1 hour versus >1 hour was created. A categorical social jetlag variable indicating a <1 hour versus ≥ 1 hour difference in midsleep time was also created.

Sleep Problems: Children's Sleep Habits Questionnaire

The Children's Sleep Habits Questionnaire (CSHQ) (Section 2.6.5) was used as a measure of disturbed or problematic sleep (Owens, Spirito, & McGuinn, 2000; Owens, Spirito, McGuinn, & Nobile, 2000). Respondents (parents) report the frequency of each item in the CSHQ using a 3-point Likert Scale (usually [5-7 nights], sometimes [2-4 nights] and rarely [0-1 nights]), based on the past week, or most recent typical week. Thirty three items are scored to produce a total sleep disturbance score and eight subscale scores: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night waking, parasomnias, sleep disordered breathing and daytime sleepiness. (Owens, Spirito, & McGuinn, 2000).

In a community sample (n=469) and a sleep disordered clinical sample (n=154) of 4 to 10 year olds, the CSHQ demonstrated acceptable internal consistency (community sample = 0.68; clinical sample = 0.78) and test-retest reliability (range 0.62 - 0.79), and a total score ≥ 41 differentiated between community and clinical samples (sensitivity = 0.80, specificity = 0.72) (Owens, Spirito, & McGuinn, 2000).

The utility of the CSHQ for younger children was evaluated by Goodlin-Jones et al (2008) and was found to be an effective sleep screening tool for toddlers and preschoolers (ages 2 to 5 ½ years) with typical development (n=69) and neurodevelopmental diagnoses (autism: n=68; developmental delay without autism: n=57). Total and subscale scores were significantly greater for children who were reported by parents to have a generic sleep problem, compared to those reported not to have a sleep problem. Statistically significant correlations were found between comparable CSHQ, sleep log and actigraphic

sleep measures, including total 24 hour sleep duration ($p < .05$) (Goodlin-Jones et al., 2008).

As with any assessment tool, the CSHQ has its limitations. It is important to note that the CSHQ is designed to screen for potential sleep problems that warrant further investigation, as opposed to being able to diagnose paediatric sleep disorders (Owens, Spirito, & McGuinn, 2000). A recent study conducted by Markovich et al. (2015) compared four CSHQ subscales (sleep onset delay, sleep duration, night wakings and sleep disordered breathing) with objective sleep measures of PSG and actigraphy in a sample of typically developing 6 to 12 year olds ($n=30$). They found no significant correlations between subscale scores and PSG metrics, and only the night wakings subscale was correlated with actigraphy. Overall, the subscale scores demonstrated low sensitivity (range: 0.00–0.50) and high specificity (range: 0.79–1.00) when compared to the objective measures (Markovich et al., 2015). However, a third (33.3%) of the sample had CSHQ total scores above the recommended cut-off, in keeping with expected prevalence of sleep problems in this age group (Owens, 2007), which supports the use of a dichotomised total score as an indicator of sleep disturbance.

In the present study, the CSHQ was scored using an established protocol (Owens, 2008) (Appendix 4). On advice from Dr Owens, one of the authors of the CSHQ, (personal communication, January 19, 2010, in relation to a previous study), non-responses were scored as zero and a note was made of how many occurred. Non-responses were then examined and a conservative approach was taken, whereby children with >20% of missing CSHQ responses had their total scores set to missing. Continuous variables, for CSHQ total sleep disturbance scores and eight subscale scores, and a dichotomous CSHQ total score variable (≥ 41 vs < 41) were produced.

Sleep Problems: Maternal Reports

Maternal perceptions of the frequency and magnitude of child sleep problems were measured using non-standardised questions that were developed by the *Moe Kura* study team. Women were asked to report *how often* (response options: never/occasionally/1 - 3 times per week/4 - 6 times per week/every night) and *how much* (response options: no problem/small problem/moderate problem/large problem) “The time it takes my child to fall asleep” and “My child’s sleeping patterns or habits” was a problem for them. Responses relating to the magnitude of sleep problems were categorised as no problem/small problem/moderate or large problem, and responses relating to the frequency of sleep problems as never a problem/occasionally/at least once a week.

3.4.5.3 Statistical Analyses

An alpha level of .05 was set for analyses. To describe demographic characteristics of Māori and non-Māori children and mothers, and the sleep of Māori and non-Māori children in the sample, IBM SPSS software (Version 23.0) was used to produce descriptive statistics for continuous demographic and sleep variables and to conduct univariate analyses (independent *t*-tests for the comparison of means and Mann Whitney *U* tests for the comparison of medians) (Field, 2013).

Distributions of continuous variables were examined via visual screening of histograms, skewness and kurtosis statistics and the Shapiro-Wilk test of normality, which has been shown to demonstrate good power properties for a range of distributions, compared to other tests of normality such as Kolmogorov-Smirnov and Anderson-Darling tests (Yap & Sim, 2011). Sample sizes were also taken into account when making decisions about the most appropriate statistics to report. Based on central limit theorem, the sampling distribution of the mean is assumed to be normal in large samples, with ‘large’ being

defined as at least 30, 40 or 50 by various authors (Field, 2013; Ghasemi & Zahediasl, 2012; Mordkoff, 2016).

The PROC SURVEYFREQ procedure (SAS software, Version 9.4) was used to calculate unadjusted prevalence estimates and 95% confidence intervals for categorical demographic and sleep variables. Univariate comparisons by ethnicity were conducted using the Pearson's chi-square test (Field & Miles, 2010).

To investigate independent associations between ethnicity, SEP and preschoolers' sleep health, log-binomial regression models were fit using PROC GENMOD (SAS statistical software, Version 9.4) to produce fully adjusted prevalence ratios and 95% confidence intervals (Deddens & Petersen, 2008; Petersen & Deddens, 2008; Spiegelman & Hertzmark, 2005). In cross-sectional studies with binary outcomes, the ratio of probabilities can be modelled by estimating prevalence ratios (Petersen & Deddens, 2008). Alternatively, the ratio of odds can be modelled using logistic regression to calculate odds ratios (Field & Miles, 2010). When outcomes are rare (<10%) odds ratios tend to approximate prevalence ratios, however this is not the case when outcomes are more common (Petersen & Deddens, 2008; Tamhane, Westfall, Burkholder, & Cutter, 2016). A strength of prevalence ratios is the ease with which they can be interpreted, compared to odds ratios (Axelson, Fredriksson, & Ekberg, 1994; J. Lee & Chia, 1993; Petersen & Deddens, 2008).

It was posited that preschoolers' position in society, indicated by child ethnicity and SEP, would influence their sleep health. It was also posited that due to preschoolers' young age and dependence, maternal social position, indicated by maternal ethnicity and SEP, would influence children's sleep health (Section 2.12). Therefore, two statistical models were developed to investigate these propositions – a model with child demographic measures

as independent variables (child model) and a model with maternal demographic measures as independent variables (maternal model) (Table 2).

Table 2. Independent Variables in Child and Maternal Log-binomial Regression Models

Child Model	Maternal Model
Child ethnicity (Māori/non-Māori)	Maternal ethnicity (Māori/non-Māori)
Child gender (female/male)	Maternal age (<20/20 - <30/30 - <40/≥40 yrs)
NZDep2013 quintile (1 – 5)	NZDep2013 quintile (1 – 5)
NZiDep score (1 – 5)	NZiDep score (1 – 5)

Child gender was included as a covariate in child models, in order to control for potential gender differences in preschool-aged children’s sleep (Simola et al., 2010). The reason for including maternal age in maternal models was twofold: to control for the younger age structure of the Māori population compared to the non-Māori population in NZ (Ministry of Health, 2015) and, conceptualising maternal age as an indicator of a mothers’ position in society, to explore the independent relationship between maternal age and child sleep outcomes.

To examine whether or not associations between indicators of SEP and child sleep health outcome variables differed by ethnicity at comparative levels of SEP, models were initially run with all independent variables plus two interaction terms (ethnicity × NZDep2013 and ethnicity × NZiDep). Interactions that were not significant (Wald statistic: $p > .05$) were removed and the model re-run in its final form. A Bonferroni correction was applied to models with significant interactions to control for Type I error (Field, 2013).

Prior to running regression models, PROC REG (SAS software, Version 9.4) was used to check for potential multicollinearity of independent variables, based on the following

values: tolerance <0.1, variance inflation factor (VIF) >10, eigenvalues <0.01, condition index >30 and proportion of variance >0.8 (Field & Miles, 2010).

To avoid sparse data bias (Greenland, Mansournia, & Altman, 2016) an event per variable (EPV) threshold of five, based on recommendations by Vittinghoff and McCulloch (2007), was used to help inform the decision regarding which dichotomous sleep measures could be reliably modelled. EPV was calculated by dividing the number of events by the number of variables, where 'events' were defined as the smaller of the two outcome numbers for the dichotomous sleep variables and 'variables' as the sum of degrees of freedom for all of the independent variables in the model (Austin & Steyerberg, 2017). Results from regression models with EPV <5 (child and maternal models for sleep (24hr) >13hrs vs 10 - 13hrs and weeknight bedtime >9pm vs ≤9pm; maternal model for social jetlag ≥1hr vs <1hr) were therefore not reported and only prevalence estimates for these variables are reported in this thesis (Chapters 4 and 5).

3.5 Qualitative Study Methods

An overview of the qualitative study's processes and methods, including consultation, study design, ethical approval, funding, recruitment, data collection and data analysis, is provided below:

3.5.1 Consultation

The qualitative study design was informed by discussions with doctoral supervisors, Associate Professor Leigh Signal and Dr Sarah-Jane Paine (Tuhoe). The researcher consulted with Māori researchers Dr Ricci Harris (Ngāti Kahungunu, Ngāti Raukawa, Ngāi Tahu) and Dr Donna Cormack (Kāti Mamoe, Kai Tahu) of Te Rōpū Rangahau Hauora a Eru Pōmare, University of Otago Wellington, and Dr Kara Mihaere (Rangitāne, Ngāti

Kahungunu ki Wairoa, Ngāti Rakaipaaka) of Capital and Coast District Health Board, Wellington. She also received guidance from researchers with qualitative research expertise, Professor Chris Stephens of the School of Psychology, Massey University Manawatu, Associate Professor Tim McCreanor of the Whāriki and SHORE Research Centres, Massey University Auckland, and Professor Antonia Lyons of the School of Psychology, Massey University Wellington.

3.5.2 Qualitative Study Design

As the aim was to explore mothers' views and experiences of preschoolers' sleep, an experiential qualitative study was designed and implemented. Experiential qualitative research "seeks to make sense of how the world is seen, understood and experienced from the person's perspective" (Braun & Clarke, 2013, p.24) and is therefore driven by participants' experiences and meanings, as opposed to the researcher's knowledge or pre-conceived ideas. Participants' perspectives are the focus of experiential qualitative research and language is viewed as a means of gaining insight into people's thoughts and experiences via what is reported (Braun & Clarke, 2013).

A study process was developed (Figure 8) which incorporated the practical steps required for systematic recruitment, data collection, analysis and dissemination. It also included processes to address ethical and safety issues that were identified during the study design development phase.

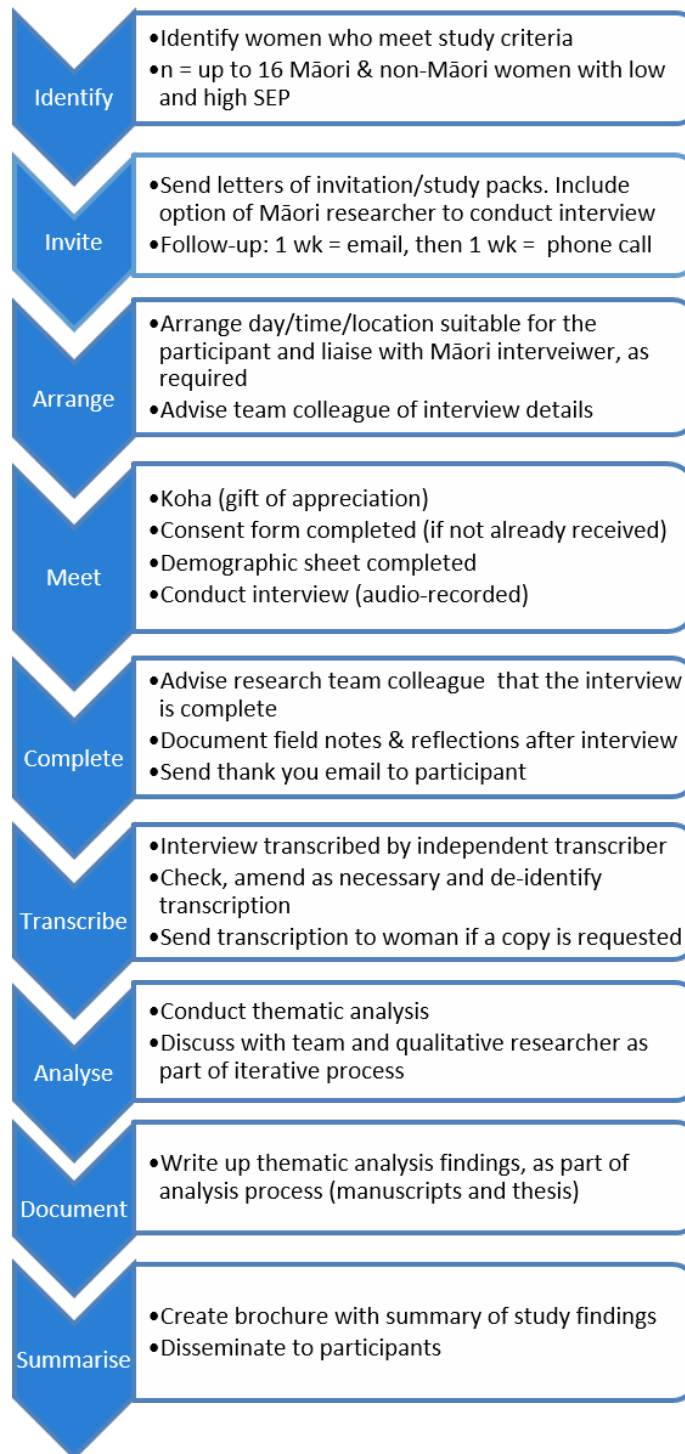


Figure 8. Qualitative study process

3.5.3 Ethics

An ethics application was submitted to the Central Health and Disability Ethics Committee (HDEC) on 11 August 2015. The application was for a substantial amendment to the original HDEC submission for *E Moe, Māmā* and the subsequent *Moe Kura* study, as per the recommendation of an HDEC advisor whom Associate Professor Leigh Signal contacted regarding the proposed qualitative study. Ethical approval was granted 20th August 2015, reference CEN/09/09/070/AM05.

Participation in the study was voluntary, women could withdraw at any time and transcribed data were de-identified to ensure participant confidentiality. Potential risks to participants included a minor inconvenience associated with the time needed to complete the forms and to be interviewed. To minimise this, individual interviews were scheduled on days, and at times and locations, to meet participants' needs to the best of the researcher's ability, including meeting on weekends, evenings and at a variety of settings including mothers' homes and workplaces. It was recognised that interviews could raise concerns for women if they were worried about their child's sleep. To address this, information on child sleep and who to contact for professional advice if mothers were concerned was offered to all participants (Appendix 5).

Respect for participants was a key ethical consideration. A potential power imbalance between the 'expert' researcher/interviewer and participants was recognised (Braun & Clarke, 2013). To minimise this, interviews were conducted with sensitivity, assisted by the researcher's previous experience as an occupational therapist working in mental health services. Women were advised that they were under no obligation to answer any questions that they were not comfortable with, that the researcher was interested in women's unique experiences and that there were no 'right' or 'wrong' answers. The interview process was designed to help redress the power imbalance by providing women

with control over the setting and time of interviews, enabling participants to 'drive' the topics discussed during interviews rather than a rigid interview schedule being used, and by offering women the opportunity to comment on transcripts prior to analysis. In acknowledgement of the time and information given by participants, elements of reciprocity were built into the study process. Women were given a koha¹⁰, offered information on child sleep and sent a summary brochure.

Identifying as a NZ European/Pākehā woman, the researcher recognised that differences in ethnic identity may have made it difficult for Māori women to feel connected and/or comfortable to share their experiences with her. Women were offered an alternative option of being interviewed by a Māori member of the research team, Tiffany Te Moananui (Ngāti Tamatera me Tainui), who was employed by the researcher specifically for this task.

As interviews were conducted in the community, there was also a potential risk to researcher safety. To address this, a safety protocol was developed (Appendix 6). Details of the interview date, time, location and expected duration were recorded in a secure electronic document accessible only by the research team and the researcher notified a team member when they started and finished each interview.

3.5.4 Funding

To assist with qualitative study costs, including koha and transport, the researcher applied for and was awarded a \$5,000 'Massey Foundation new NZ Bursary' in August 2015.

¹⁰ Gift of appreciation.

3.5.5 Recruitment

3.5.5.1 Recruitment Criteria and Rationale

In line with the pragmatic paradigm of the thesis (Greene & Hall, 2010; Morgan, 2014b) (Section 3.1), the decision on how many participants to recruit was informed by a combination of practical constraints, including time and monetary resources available to the researcher, and the need to collect sufficient data to ensure adequate information power to address the research questions within the theoretical framework of the study (Malterud, Siersma, & Guassora, 2016). For experiential qualitative research, using individual interviews to collect data and thematic analysis to analyse data, Braun and Clarke (2013) recommend using a small to moderate sample, with 'small' being defined as 6 to 10 participants and 'medium' 10 to 20 participants.

After consultation with qualitative researchers, and in light of Braun and Clarke's (2013) guidelines, a pragmatic decision was made to aim to recruit a purposive sample of *up to* 16 Māori women and 16 non-Māori women, with low and high measures of SEP. It was recognised that data saturation may be reached with fewer interviews, depending on the richness of information provided in each interview (Fusch & Ness, 2015; Patton, 2015), and that a continuous evaluation of the sample size would be part of the ongoing research process (Malterud et al., 2016). To assist with judging when to finish recruiting, the researcher kept a reflective journal, which she completed after each interview. This detailed key issues raised by women, personal responses to what was discussed and reflections on how communication between the interviewer and interviewee felt.

Participant criteria included having completed *Moe Kura* Age 3 questionnaires, having a *Moe Kura* child younger than 5 years of age, and living in the wider Wellington region of NZ. For recruitment purposes, maternal ethnicity was based on women's responses, and subsequent categorisation as Māori or non-Māori, to the 2006 NZ Census ethnicity

question in Age 3 Maternal Questionnaires (Statistics New Zealand, 2006). SEP was based on Age 3 Maternal Questionnaire NZiDep scores (Salmond et al., 2006), with scores of 1 (no deprivation characteristics) representing high SEP and scores of 3 to 5 (≥ 2 deprivation characteristics) representing low SEP. NZiDep was chosen over the other available SEP measures from *Moe Kura* Age 3 questionnaires (NZDep2013 (Atkinson et al., 2014), maternal education and income) because of its individual level of measurement and focus on personal experiences of deprivation (Salmond et al., 2006).

A purposive sampling strategy was chosen in order to select “information-rich cases” (Patton, 2015, p.264) to gain insights into maternal experiences of children’s sleep. The decision to proactively recruit both Māori and non-Māori women was informed by the Kaupapa Māori research principles of the wider *Moe Kura* study (Paine et al., 2013) and associated emphasis on equal explanatory power, which includes promoting the Māori ‘voice’ in qualitative studies (Reid et al., 2017). Importance was placed on collecting data in a way that enabled rich description of both Māori and non-Māori women’s experiences and views, rather than a more general recruitment approach which would run the risk of losing Māori women’s perspectives due to non-Māori outnumbering Māori in the *Moe Kura* sample.

As sleep, in this thesis, is viewed from a social determinants of health (Howden-Chapman & Tobias, 2000; Ministry of Health, 2002; Solar & Irwin, 2010) and associated socio-ecological perspective (Grandner, 2017; Grandner et al., 2010; C. Jackson et al., 2015), socially produced contexts of mothers and children were an important aspect of the study. Therefore, mothers with low and high measures of SEP were a focus in order to gain insights into experiences and meanings of preschoolers’ sleep across diverse socioeconomic environments. This also aligned with the emphasis placed on context when conducting qualitative research inquiry, as qualitative data are viewed as being produced

within, and unable to be separated from, the contexts in which people live (Braun & Clarke, 2013; Patton, 2015).

Limiting study criteria to children under the age of 5 was due to most children in NZ starting school on their fifth birthday, which was envisaged to change children's sleep patterns and therefore impact on mothers' experiences of sleep. Geographical restrictions were for pragmatic reasons, as the researcher lives in the Wellington area.

3.5.5.2 Recruitment Procedure

The researcher identified all women from *Moe Kura* who were eligible to participate in the qualitative study (Section 3.5.5.1). She then prioritised potential participants in order of children's ages, so that mothers of children who were nearing their fifth birthdays were contacted first. Study packs were posted to women on a rolling basis (Table 3) and included a letter of invitation to participate in the study and an information sheet (Māori or non-Māori version) and a consent form (Appendix 7).

Email follow up (Appendix 8) occurred one week after study packs were sent, if the researcher had not been contacted by the potential participant. If no response was received after email contact, a follow up phone call was made a week later by the researcher. As women consented to participate, interviews were arranged and conducted so that data were collected on an ongoing basis.

Table 3. Qualitative Study Pack Distribution

Māori		Non-Māori	
Low SEP	High SEP	Low SEP	High SEP
12/10/15: 8 packs ^a	12/10/15: 7 packs ^a	31/08/15: 8 packs ^a	31/08/15: 8 packs ^a
06/11/15: 3 packs	06/11/15: 1 pack	21/09/15: 2 packs	06/11/15: 1 pack
20/11/15: 4 packs	20/11/15: 2 packs	24/09/15: 1 pack	23/11/15: 1 pack
	27/11/15: 1 pack	05/10/15: 3 packs	04/12/15: 1 pack
	27/01/16: 1 pack		
	09/02/16: 1 pack		
Total packs sent: 15	Total packs sent: 13	Total packs sent: 14	Total packs sent: 11

^aPacks were first sent to non-Māori women while the researcher recruited a Māori interviewer, then to potential Māori participants once Ms Te Moananui was employed.

3.5.6 Participants

Concurrent recruitment and data collection commenced 31st August 2015 and finished 29th February 2016. The final sample consisted of 15 Māori women (low SEP=7; high SEP=8) and 16 non-Māori women (low SEP=7; high SEP=9).

Two women in the high SEP group (Māori: n=1; non-Māori: n=1) had NZiDep scores of 1 (high SEP; 0 deprivation characteristics) in Age 3 Maternal Questionnaires and increased scores of 2 (1 deprivation characteristic) when NZiDep was re-measured at interviews. These participants were retained in the high SEP group, in line with previous use of NZiDep scores in a longitudinal study of child deprivation in NZ, where children living in households with two or more deprivation characteristics (scores of 3 – 5) were categorised as living in deprivation (equivalent of low SEP in the qualitative study) versus those with no or one deprivation characteristic (equivalent of high SEP in the qualitative study) (Gunasekara & Carter, 2012).

3.5.7 Response Rates

Response rates, based on the type of response as a proportion of the number of packs sent, are provided in Table 4.

Table 4. Qualitative Study Response Rates

	Māori		Non-Māori	
	Low SEP n (%)	High SEP n (%)	Low SEP n (%)	High SEP n (%)
Number of packs sent	15	13	14	11
Participated	7 (46.7%)	8 (61.5%)	7 (50.0%)	9 (81.8%)
Declined (after follow-up)	-	3 (23.1%)	3 (21.4%)	1 (9.1%)
Other	1 (6.7%) ^a	-	-	1 (9.1%) ^b
No response/lost to follow-up	7 (46.7%)	2 (15.4%)	4 (28.6%)	-

^aNot eligible due to having moved out of the Wellington area; ^bAgreed to participate only if the interview could be conducted by telephone, which was not possible as interviews needed to be recorded.

3.5.8 Data Collection

3.5.8.1 Data Collection Method

Face-to-face, semi-structured individual interviews were used to collect qualitative data, as interviews are considered an “ideal” (Braun & Clarke, 2013, p.45) data source for addressing experiential research questions. A semi-structured interview format utilises an interview guide of pre-prepared questions to help structure an interview, but questions are not adhered to in a strict manner (i.e. they are not asked in any set order, nor are they used word-for-word by the interviewer). This allows scope for participants to discuss issues not anticipated by the researcher and are therefore ideal for capturing rich descriptions of people’s lived experiences (Braun & Clarke, 2013).

3.5.8.2 Data Collection Procedure

Once confirmation of participation was received from women, either via completed consent form, email or verbal acknowledgement, a day, time and location for the interview was arranged. As per the safety procedure (Appendix 6), details of the interview were entered into the secure electronic document and the researcher notified a team member prior to commencing the interview. All interviews were conducted by the researcher. One participant indicated a preference to be interviewed by Ms Te Moananui, however the days and times that she was available did not suit the participant who then decided to be interviewed by the (Pākehā) researcher instead.

Upon meeting, participants were asked to complete a consent form if they had not already done so. Women were given koha of a \$20 gift voucher of their choice from three options of a supermarket, department store or retail outlet; stickers for their child; a picture book entitled 'Time for Bed Little Kiwi' (Darroch, 2010); and a packet of biscuits. Women were then offered the option of printed information on children's sleep (Appendix 5) and asked to complete a demographic sheet (Appendix 9).

Before commencing, the researcher reiterated that the interview would be audio-recorded, as detailed in the information sheet and consent form; that women were under no obligation to answer any questions they were not comfortable with; that the researcher was interested in women's own unique experiences; and that there were no 'right' or 'wrong' answers. The researcher started the recorder and conducted the interview using an interview guide (Appendix 10), during which time she took notes. Once finished, the researcher confirmed with a team member, verbally or by text message, that the interview was safely completed and field notes and reflections were documented.

3.5.9 Data Preparation

Demographic sheet data were entered into a Microsoft Excel spreadsheet (Microsoft Office Excel, 2010) by a research assistant and cross-checked by the researcher. Interview data were transcribed verbatim by a professional transcription service and all transcribers signed confidentiality agreement forms prior to transcription (Appendix 11). The researcher checked transcripts against audio recordings and made amendments as required, then re-checked and de-identified transcripts.

Copies of de-identified transcripts were posted to women who requested a copy (Māori low SEP=71% [n=5]; Māori high SEP=29% [n=2]; non-Māori low SEP=43% [n=3]; non-Māori high SEP=38% [n=3]), along with a transcript feedback form (Appendix 12). Women were given the option of either keeping the copy for their records and taking no further action or, alternatively, returning feedback in a pre-paid envelope after which a copy of the transcript with feedback would be posted to them. None of the participants who requested a transcript copy returned comments or amendments.

3.5.10 Data Analysis

Descriptive statistics of demographic data were produced, using IBM SPSS statistical software (Version 23.0), in order to describe characteristics of the sample.

Interview data were analysed using Braun and Clarke's method of thematic analysis (Braun & Clarke, 2006, 2013; Clarke & Braun, 2013) to identify and analyse patterns across the qualitative data set. This method involves a recursive, iterative process of moving between six phases in a non-linear fashion (Braun & Clarke, 2006, p.87):

- "Familiarising yourself with your data: Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.

- Generating initial codes: Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
- Searching for themes: Collating codes into potential themes, gathering all data relevant to each potential theme.
- Reviewing themes: Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic ‘map’ of the analysis.
- Defining and naming themes: Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
- Producing the report: The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.”

De-identified interview transcripts were imported into nVivo 11 (QSR International Pty Ltd, 2015). Complete coding was conducted by the researcher across the entire dataset using a data-driven, inductive approach, therefore no preconceived coding frame was developed prior to analyses (Braun & Clarke, 2006, 2013; Patton, 2015). Coding entailed highlighting, collating and labelling excerpts of data that were relevant to the research questions (Braun & Clarke, 2006, 2013; Clarke & Braun, 2013). Braun and Clarke’s method of thematic analysis views coding as an active, evolving and reflexive process which is influenced by the researcher (Clarke & Braun, 2013). Thus, this method does not support the use of inter-rater reliability to ‘test’ if coding has been done ‘correctly’.

Mind maps of codes were created by the researcher to assist with the identification of patterns across the dataset and the development of draft, or ‘candidate’, themes. Each

theme was based on groups of codes that shared a central organising concept relevant to the qualitative study's research questions, as opposed to prevalence of issues raised (Braun & Clarke, 2006). Draft thematic maps were drawn to illustrate candidate themes and potential inter-theme relationships. Mind maps, candidate themes and draft thematic maps were discussed with supervisors and with qualitative researcher Dr Ella Kahu, Lecturer and Senior Tutor in Psychology, Massey University Wellington.

The researcher engaged in an iterative process of reflecting on discussions and feedback, reviewing coded data, revising themes, defining and naming themes and refining thematic maps. While themes were identified at a semantic (surface) level, as opposed to at a latent (theoretically interpretive) level, the process of theme development and subsequent theme reporting included interpretation of data beyond simply describing what participants said (Braun & Clarke, 2006). This interpretation was influenced by the researcher's worldviews and life experiences, as well as the theoretical lenses of the thesis.

The final stage of the analysis involved reporting findings in the form of two written manuscripts, details of which are provided in Chapters 6 and 7. The process of writing, and of discussing manuscript drafts with supervisors, enabled the researcher to further refine themes and to interpret their meanings in relation to the aims of the qualitative study and overall thesis. Writing was therefore an integral part of the analytical process (Braun & Clarke, 2006, 2013).

CHAPTER 4 QUANTITATIVE STUDY RESULTS: SLEEP DURATION

The quantitative analyses described in the previous chapter (Section 3.4.5) produced a comprehensive body of results. Quantitative findings are therefore presented in two chapters. This chapter focusses on results pertaining to the duration of preschoolers' sleep, followed by Chapter 5 which focusses on children's sleep timing and problems.

Prevalence estimates of categorical sleep duration variables were prepared and compiled in tables, which are included in Appendices 13 to 17. These are briefly described below, followed by a manuscript which incorporates descriptive and multivariate analysis findings on preschoolers' sleep durations. The chapter concludes with a list of key findings.

The prevalence of short (<10hrs vs 10–13hrs), long (>13hrs vs 10-13hrs) and week/weekend sleep duration (24hr) differences (>1hr versus ≤1hr) was estimated for Māori and non-Māori preschoolers and stratified by gender, area-level deprivation (NZDep2013 quintiles) and individual-level deprivation (NZiDep scores) (Appendices 13 - 17). A larger proportion of Māori preschoolers had short sleep and week/weekend sleep duration differences >1hr than non-Māori preschoolers. For both Māori and non-Māori children, greater socioeconomic deprivation corresponded with a higher proportion of short or inconsistent sleep durations. Short or inconsistent sleep duration was more prevalent for Māori than non-Māori preschoolers at equivalent area- and individual-levels of deprivation in a number of instances. In contrast, no associations were found between ethnicity, or SEP, and long sleep.

The univariate relationships observed in the prevalence tables (Appendices 13 - 17) were investigated further using multivariate regression analyses, results of which are presented

and discussed in the following manuscript. This was prepared by the researcher (Appendix 18), was undergoing peer review at the journal *Sleep Health* at the time the thesis was submitted for examination and was accepted for publication on 28th May 2019. Confirmation was provided by the Editor-in-Chief of *Sleep Health* that manuscripts accepted for publication could be included in a doctoral thesis (L. Hale, personal communication relating to manuscript in Chapter Seven, January 29, 2019).

4.1 How Long Do Preschoolers in Aotearoa/New Zealand Sleep?

Associations with Ethnicity and Socioeconomic Position

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). How long do preschoolers in Aotearoa/New Zealand sleep? Associations with ethnicity and socioeconomic position. *Sleep Health*. DOI: <https://doi.org/10.1016/j.sleh.2019.05.004>

4.1.1 Abstract

Objectives: To investigate potential sleep inequities in preschoolers in Aotearoa/New Zealand, by examining sleep durations and week/weekend sleep duration differences of Māori (indigenous) and non-Māori preschoolers; and independent associations between ethnicity (child and maternal), socioeconomic position (SEP) and preschoolers' sub-optimal and inconsistent week/weekend sleep durations.

Design: Cross-sectional analysis of questionnaire data from the *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand* longitudinal study when children were 3 to 4 years old.

Participants: 340 Māori and 570 non-Māori preschoolers and their mothers.

Measurements: Measures included preschoolers' usual nighttime sleep duration on week nights (week nighttime sleep) and weekends (weekend nighttime sleep); usual sleep

duration across 24 hours, including naps, on week nights (week sleep [24hr]) and weekends (weekend sleep [24hr]) (<10hrs/10-13hrs/>13hrs); and the difference between week and weekend sleep durations per 24 hours (sleep [24hr] difference) (>1hr/≤1hr). Log-binomial regression models investigated associations between child and maternal characteristics and sleep duration measures. Child models included child ethnicity, child gender and child SEP (area and individual socioeconomic deprivation). Maternal models included maternal ethnicity, maternal age and maternal SEP (area and individual socioeconomic deprivation).

Results: Ethnicity and low SEP were independently associated with week day sleep (24hr) <10hrs, weekend sleep (24hr) <10hrs, and with sleep (24hr) difference >1hr.

Conclusions: Ethnic and socioeconomic inequities in sleep durations are evident as early as 3 to 4 years of age in NZ, highlighting the importance of addressing the socio-political drivers of sleep inequities early in the life course.

Key words: sleep duration, preschooler, ethnicity, socioeconomic position, inequities, social patterning

4.1.2 Introduction

Short sleep in the preschool years is associated with poorer physical and emotional health outcomes (Chaput et al., 2017; Reynaud et al., 2018) and an increased risk of developing obesity (M. Miller et al., 2018). Consistency in sleep duration is also important. Greater differences between week and weekend sleep durations are associated with internalising behaviour in children (Pesonen et al., 2011) and increased intake of fat and protein in preschoolers with obesity (Petrov et al., 2017). Identifying the determinants of poor sleep

health early in the life course is therefore important for informing interventions to prevent sleep, and potentially associated health, problems.

International research indicates that children's sleep is socially patterned (L. Hale et al., 2015). In Australia, children classified as being persistent short sleepers across the first 7 years of life were more likely to live in a household experiencing financial hardship (C. Magee et al., 2014). In the US, minority race/ethnicity and low socioeconomic status has been associated with young children having shorter sleep durations at night (McLaughlin Crabtree et al., 2005) and across 24 hours (Pena et al., 2016). However the relationship between ethnicity and sleep health is not always consistent. A US study found that the distribution of children's sleep differed by race/ethnicity, with Black children more likely to frequently nap, continue to nap through to older age and sleep less at night, but that total weekly sleep durations were similar, compared to Non-Hispanic White children (Crosby et al., 2005).

In Aotearoa/New Zealand (NZ), the colonisation and marginalisation of Māori (the indigenous people of NZ) has led to significant ethnic inequities in social and health outcomes (Reid & Robson, 2007). For example, Māori children have higher rates of obesity and asthma than non-Māori children. Socioeconomic inequities in child health also exist, with children living in the most deprived neighbourhoods having higher rates of obesity, respiratory conditions and communicable diseases such as rheumatic fever, compared to children living in the least deprived areas (Ministry of Health, 2013; Simpson, Oben, et al., 2016). In regard to sleep, the odds of short sleep duration are greater for Māori adults compared to non-Māori adults, and for adults living in more socioeconomically deprived areas (Paine & Gander, 2016). However, whether ethnic and socioeconomic inequities in sleep duration and consistency exist in early childhood in NZ is unknown.

Aligning with US National Sleep Foundation (NSF) guidelines (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015), the Ministry of Health in NZ advise that preschool-aged children (3 - 4 years) sleep 10 to 13 hours per 24 hour period and have consistent sleep/wake patterns (Ministry of Health, 2016, 2017b). Current information indicates that 84% of 3 to 4 year olds are obtaining the recommended 10 to 13 hours per day of sleep (Ministry of Health, 2017b) and 90% of 4 year olds are sleeping 10 to 13 hours at night (Morton et al., 2017). However, as associations with ethnicity and socioeconomic position (SEP) have not been reported it is unclear if, or where, inequities exist.

One longitudinal examination of child (n = 939: 19.3% Māori, 11.8% Pacific, 8.0% Asian, 60.9% New Zealand European; age 4 - 12 years at baseline) sleep in NZ over a two year period found that Pacific children had shorter average sleep durations than New Zealand European children, after controlling for age, sex, socioeconomic deprivation, weight status and behavioural factors (Vaipuna et al., 2018). There was no significant difference between sleep duration of Māori and New Zealand European children, or by area-level socioeconomic deprivation. Findings were based on secondary analyses of data from two weight management interventions that were not designed to investigate sleep per se, the age range of children was broad, and the sample was geographically limited. The generalisability of results may therefore be limited, warranting further investigation in this area.

The current study considers preschoolers' sleep using a social determinants of health framework (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010) and an associated socioecological model of sleep (Grandner, 2017; C. Jackson et al., 2015). The societal context (e.g. economic and political systems and policies, institutional racism) is viewed as the fundamental driver of sleep health inequities. Power, privilege and social and

economic resources (social determinants) are unevenly distributed across society, resulting in social stratification (e.g. by ethnicity, SEP, age, gender) and differential living conditions and behaviours that support or inhibit sleep.

Therefore, we posit that two pathways may be involved in determining preschoolers' sleep durations. Preschoolers' own social position within society (indicated by child ethnicity and SEP) may influence how long they sleep. Thus, we predict that Māori children and those who experience greater socioeconomic deprivation will have shorter and more inconsistent sleep durations than non-Māori children and those who have greater socioeconomic resources. Alternatively, given children's young age and maternal dependence, it may be the position that mothers hold in society (indicated by maternal ethnicity and SEP) that influences how long preschoolers sleep. Therefore, we expect that children of Māori mothers and those whose mothers experience greater socioeconomic deprivation will have shorter and more inconsistent sleep durations than children of non-Māori mothers or children whose mothers have greater socioeconomic resources.

The main aims of this study were to: (1) investigate sleep durations and week/weekend sleep duration differences of Māori and non-Māori preschoolers and (2) examine independent associations between ethnicity (child and maternal), SEP and sub-optimal and inconsistent week/weekend sleep durations in a sample of 3 to 4 year olds from across NZ.

4.1.3 Methods

4.1.3.1 Participants

Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura) is a longitudinal programme of research investigating maternal and child sleep and health in NZ. *Moe Kura* builds upon an existing NZ (69% from the Wellington region of NZ; 31%

from the rest of NZ) pregnancy/birth cohort (Howe et al., 2015; Paine et al., 2013; Signal et al., 2016). The *Moe Kura* study is guided by Kaupapa Māori epidemiological principles, which is an indigenous approach to undertaking epidemiological studies in NZ, including Māori participation and control at all stages of the research, appropriate classification of ethnicity data to identify and monitor disparities, and equal explanatory power for Māori and non-Māori (Paine et al., 2013). Mothers completed sleep and health questionnaires about themselves and their child born in the study cohort when children were 3 to 4 years old. This analysis includes data from Māori (n = 293) and non-Māori (n = 617) mothers and their preschoolers (child ethnicity: Māori n = 340, non-Māori n = 570). Ethics approval was granted by the Central Health and Disability Ethics Committee of NZ (CEN/09/09/070/AM02).

4.1.3.2 Measures

Child Demographic Measures

The social construct of *child ethnicity* was measured using the New Zealand Census 2006 ethnicity question (Statistics New Zealand, 2006). Mothers identified the ethnic group(s) their child belonged to, rather than children's ethnicity defaulting to their mother's, an approach which is consistent with recommended ethnicity data collection protocols in NZ (Ministry of Health, 2004). Children identified as Māori (with or without other ethnic groups) were categorised as 'Māori' and all others as 'non-Māori' (Ministry of Health, 2004). *Child age* was calculated by subtracting child's birthdate from the questionnaire completion date. *Child gender* was dichotomised as girl/boy.

As all preschoolers usually lived with their mother for the majority (≥ 4 nights) of the week, mothers' home and neighbourhood environments were viewed as reflecting those of children. Two measures of maternal SEP were therefore used as proxies for child SEP: an area-level index of relative socioeconomic deprivation based on maternal residential

address, NZDep2013 (Atkinson et al., 2014), and an individual-level index of socioeconomic deprivation, NZiDep (Salmond et al., 2006), based on maternal responses.

The *NZDep2013* index is an ordinal scale from 1 to 10 assigned to small geographical areas in NZ based on eight dimensions of deprivation, including income, means tested benefit receipt, transport, household crowding, home ownership, employment status, qualifications, support and internet access (Atkinson et al., 2014). Decile 1 represents the least deprived and decile 10 the most deprived scores. NZDep2013 quintiles (i.e. 5 levels, each representing 20% of small areas) were utilised in these analyses.

The *NZiDep* is an individual-level index incorporating experiences of deprivation in the previous year (yes/no responses to the following situations: being out of paid work, receiving a means-tested benefit, having to buy cheaper food, feeling cold to save money on heating, wearing worn out shoes due to cost, foregoing fresh fruit and vegetables to pay for other necessities, getting help from a community organisation in the form of clothes or money, and seeking assistance to obtain food e.g. a food bank) (Salmond et al., 2006). As per the standardised scoring protocol, positive responses were summed to produce a score from 1 to 5 (1 = no deprivation characteristics, 2 = 1 deprivation characteristic, 3 = 2 deprivation characteristics, 4 = 3 or 4 deprivation characteristics and 5 = 5 or more deprivation characteristics) (Salmond, King, Crampton, & Waldegrave, 2005). NZiDep scores are not evenly distributed across the population (Salmond et al., 2005). For example, 31% of Māori and 54% of non-Māori, non-Pacific people have scores of 1 (no deprivation characteristics) and 29% of Māori and 5% of non-Māori, non-Pacific people have scores of 5 (≥ 5 deprivation characteristics) (Salmond et al., 2005).

Maternal Demographic Measures

The social construct of *maternal ethnicity* was self-identified by mothers using the New Zealand Census 2006 ethnicity question (Statistics New Zealand, 2006) and categorised as

'Māori' or 'non-Māori' as described above. *Mother's age* when their child was born was calculated by subtracting child age from maternal age at questionnaire completion and categorised (<20yrs/20-<30yrs/30-<40yrs/≥40yrs). Maternal SEP was measured using the area-level deprivation measure *NZDep2013* (Atkinson et al., 2014) based on women's residential address and the individual-level deprivation measure *NZiDep* (Salmond et al., 2006), described above. We also explored using *maternal education* as a measure of maternal SEP, with women's highest completed educational qualification categorised as no qualification/secondary school qualification/tertiary qualification.

Child Sleep Measures

Mothers answered questions about their child's sleep habits over the past seven days, including "what time did your child usually go to sleep?" and "what time did your child usually wake up?" Nighttime sleep was calculated by subtracting preschoolers' usual sleep start times from usual wake times, during the week (Sunday to Thursday) and on weekends (Friday and Saturday), to produce *week nighttime sleep* and *weekend nighttime sleep*.

Sleep durations per 24 hours, including naps, were measured using a modified version of the Children's Sleep Habits Questionnaire sleep duration question ("what is your child's usual amount of sleep each week day/night i.e. Sunday to Thursday night? [combining nighttime sleep and naps]"; "what is your child's usual amount of sleep each weekend day/night i.e. Friday and Saturday? [combining nighttime sleep and naps]") (Owens, Spirito, & McGuinn, 2000) to produce *week sleep (24hr)* and *weekend sleep (24hr)* variables. Sleep (24hr) variables were categorised as <10hrs/10-13hrs/>13hrs, based on NSF sleep duration guidelines (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015).

Sleep (24hr) difference was the absolute difference (in hours) between week and weekend sleep durations per 24 hours. This was categorised as $>1\text{hr}/\leq 1\text{hr}$, based on recommendations that children's sleep schedules should not vary by more than 30 to 60 minutes across the week (Allen et al., 2016). *Napping transition* was categorised as stopped napping completely/napping at least some days. This was based on responses to the question "Is your child transitioning away from napping (now not needing a nap every day)?" (yes [does not nap every day]/ no [naps every day]/ has stopped napping completely) (B. Galland, personal communication, October 24, 2012).

4.1.3.3 Statistical Analysis

An alpha level of .05 was used for analyses. Descriptive statistics and univariate analyses by ethnicity (independent *t*-tests) were produced for continuous demographic and sleep variables using IBM SPSS statistical software (Version 23.0). SAS (Version 9.4) was used to calculate unadjusted prevalence estimates, 95% confidence intervals (CI) and Pearson chi-squares for categorical demographic and sleep variables.

Log-binomial regression models were fit using PROC GENMOD (SAS, Version 9.4) to produce fully adjusted prevalence ratios and 95% confidence intervals for sleep duration outcome variables. Independent variables in *child models* were child ethnicity, child gender, child proxy NZDep2013 quintile and child proxy NZiDep score. *Maternal models* included maternal ethnicity, maternal age, maternal NZDep2013 quintile and maternal NZiDep score. Maternal education was not included in models, as most women had at least a secondary school educational qualification (Māori = 90.4%; non-Māori = 97.7%). Potential multicollinearity of independent variables was checked using PROC REG.

Child and maternal models were initially run with all relevant independent variables plus two interaction terms: ethnicity \times NZDep2013 and ethnicity \times NZiDep, to examine

whether associations between SEP and sleep durations differed by ethnicity at comparative area- and individual-levels of deprivation. No interactions were significant (Wald statistic: $p > .05$) and therefore were excluded from the final models.

4.1.4 Results

While most (93%) children belonged to the same ethnic group as their mothers, 16% of the 340 Māori children in the sample had a non-Māori mother and 1% of the 570 non-Māori children in the sample had a Māori mother. Children's ages ranged from 2.9 to 4.7 years for Māori children and 2.9 to 4.8 years for non-Māori children. Māori women were significantly younger than non-Māori women when their *Moe Kura* child was born, a greater proportion of Māori children and Māori mothers lived in socioeconomically deprived areas or experienced individual deprivation, and a smaller percentage of Māori women had a tertiary educational qualification (Table 5).

As outlined in Table 6, average nighttime sleep durations on weekends and average sleep durations (24hr) on weekdays and weekends were shorter for Māori preschoolers than non-Māori preschoolers. The average difference in sleep (24hr) between the week and weekend was larger for Māori children. A significantly greater proportion of Māori children had short sleep durations (24hr) on weekdays and weekends, and sleep (24hr) differences of more than 1 hour between the week and weekend. In contrast, no differences by ethnicity were observed for long sleep durations (24hr; >13hrs). In addition, a smaller proportion of Māori preschoolers had stopped napping completely.

Results from child and maternal multivariate models on short sleep (24hr) and week/weekend sleep (24hr) differences of greater than 1 hour are summarised in Table 7. Model results for long sleep (24hr) were unable to be reliably interpreted due to few preschoolers sleeping >13 hours, and are therefore not reported.

Table 5. Demographic Characteristics of Children and Mothers, by Ethnicity

Characteristic	% (95% CI)		Māori vs non-Māori		
	Māori Children (n = 340)	Non-Māori Children (n = 570)	χ^2	df	<i>p</i>
Child age (yrs), mean (SD) ^a	3.1 (0.31)	3.2 (0.27)	0.63	908	.53
Gender:			0.22	1	.64
Girls	49.3 (43.9–54.6)	50.9 (46.7–55.0)			
Boys	50.7 (45.4–56.1)	49.1 (45.0–53.3)			
Area-level deprivation (NZDep2013):			114.70	4	<.01
Quintile 1 (least deprived)	14.5 (10.7–18.3)	34.7 (30.7–38.8)			
Quintile 2	15.4 (11.5–19.3)	26.5 (22.8–30.2)			
Quintile 3	18.7 (14.5–23.0)	18.6 (15.3–21.8)			
Quintile 4	18.7 (14.5–23.0)	11.2 (8.6–13.9)			
Quintile 5 (most deprived)	32.6 (27.6–37.7)	9.0 (6.6–11.4)			
Individual-level deprivation (NZiDep score):			91.12	4	<.01
1 (least deprived)	28.3 (23.5–33.1)	55.2 (51.1–59.3)			
2	24.2 (19.6–28.7)	23.9 (20.4–27.4)			
3	16.5 (12.5–20.5)	10.1 (7.6–12.6)			
4	19.2 (15.0–23.4)	8.1 (5.9–10.4)			
5 (most deprived)	11.8 (8.3–15.3)	2.7 (1.3–4.0)			
	Māori Mothers (n = 293)	Non-Māori Mothers (n = 617)			
Maternal age (yrs) ^b , mean (SD) ^a	28.4 (6.20)	32.0 (5.07)	8.80	482	<.01
Highest educational qualification:			67.10	2	<.01
Tertiary	64.4 (58.8–69.9)	87.3 (84.7–90.0)			
Secondary	26.0 (20.9–31.0)	10.4 (8.0–12.8)			
No qualification	9.7 (6.3–13.1)	2.3 (1.1–3.5)			
Area-level deprivation (NZDep2013):			141.38	4	<.01
Quintile 1 (least deprived)	12.6 (8.8–16.5)	34.1 (30.2–37.9)			
Quintile 2	13.7 (9.7–17.7)	26.4 (22.9–30.0)			
Quintile 3	17.5 (13.1–22.0)	19.2 (16.0–22.3)			
Quintile 4	18.9 (14.4–23.5)	11.7 (9.1–14.3)			
Quintile 5 (most deprived)	37.2 (31.5–42.8)	8.6 (6.4–10.9)			
Individual-level deprivation (NZiDep score):			98.47	4	<.01
1 (least deprived)	26.4 (21.2–31.5)	54.1 (50.1–58.0)			
2	22.9 (18.1–27.8)	24.5 (21.1–27.9)			
3	17.5 (13.1–21.8)	10.1 (7.7–12.5)			
4	20.2 (15.6–24.8)	8.5 (6.3–10.7)			
5 (most deprived)	13.0 (9.1–16.9)	2.8 (1.5–4.1)			

^aIndependent t-test (*t*, *df* and *p*) for comparison of means; ^bMaternal age when *Moe Kura* child was born.

Table 6. Preschoolers' Sleep Durations and Week/Weekend Sleep Duration Differences in Hours, by Child Ethnicity

Sleep variable	Māori (n)	Non-Māori (n)	Māori children	Non-Māori children	Māori vs non-Māori ^a		
			Mean (SD)	Mean (SD)	<i>t</i>	df	<i>p</i>
Nighttime sleep:							
Week:							
Girls	155	276	11.03 (0.82)	11.02 (0.67)	-0.08	270	.94
Boys	163	275	10.75 (1.00)	10.96 (0.77)	2.25	277	.03
All	321	556	10.88 (0.92)	10.99 (0.72)	1.83	547	.07
Weekend:							
Girls	153	272	10.87 (0.90)	11.00 (0.75)	1.44	271	.15
Boys	157	274	10.62 (0.95)	10.90 (0.84)	3.27	429	<.01
All	313	551	10.74 (0.93)	10.95 (0.80)	3.38	570	<.01
Sleep (24hr):							
Week: ^b							
Girls	160	282	11.26 (1.58)	11.41 (1.02)	1.13	236	.26
Boys	165	272	11.15 (1.55)	11.46 (1.19)	2.23	281	.03
All	328	559	11.20 (1.56)	11.44 (1.12)	2.48	526	.01
Weekend:							
Girls	161	281	11.06 (1.49)	11.45 (1.11)	2.90	262	<.01
Boys	163	272	11.03 (1.56)	11.42 (1.18)	2.78	272	.01
All	327	558	11.04 (1.52)	11.42 (1.15)	3.96	544	<.01
Sleep (24hr) difference: ^c							
Girls	159	281	0.60 (0.98)	0.29 (0.53)	-3.68	210	<.01
Boys	162	270	0.69 (1.06)	0.34 (0.67)	-3.79	239	<.01
All	324	556	0.65 (1.02)	0.32 (0.67)	-5.13	487	<.01
			% (95% CI)	% (95% CI)	χ^2	df	<i>p</i>
Week sleep (24hr):							
<10hrs	328	559	14.3 (10.5-18.1)	4.5 (2.8-6.2)	28.62	2	<.01
10-13hrs			79.6 (75.2-84.0)	90.9 (88.5-93.3)			
>13hrs			6.1 (3.5-8.7)	4.7 (2.9-6.4)			
Weekend sleep (24hr):							
<10hrs	327	558	15.0 (11.1-18.9)	5.6 (3.6-7.5)	23.44	2	<.01
10-13hrs			79.8 (75.4-84.2)	90.3 (87.9-92.8)			
>13hrs			5.2 (2.8-7.6)	4.1 (2.5-5.8)			
Sleep (24hr) difference ^c >1hr:							
>1hr	324	556	18.8 (14.5-23.1)	7.0 (4.9-9.1)	28.36	1	<.01
≤1hr			81.2 (76.9-85.5)	93.0 (90.9-95.1)			
Napping:							
Stopped napping completely	333	561	18.6 (14.4-22.8)	35.7 (31.7-39.6)	29.26	1	<.01
Naps at least some days			81.4 (77.2-85.6)	64.3 (60.4-68.3)			

^aIndependent t-test (*t*, *df* and *p*) for comparison of means, and Pearson chi-square (χ^2 , *df* and *p*) for comparison of proportions, between Māori and non-Māori; ^bOutlier of 4 hrs sleep duration removed; ^cDifference between week/weekend usual sleep duration (24hr). SD = standard deviation; *df* = degrees of freedom.

Findings from child models (Table 7) indicate that Māori children were twice as likely as non-Māori children to have short and inconsistent week/weekend sleep durations, after adjusting for gender and SEP. Increasing neighbourhood deprivation was associated with a greater prevalence of short sleep on week days. Preschoolers living in the most deprived neighbourhoods (NZDep quintiles 4 and 5) were four times more likely to have short sleep during the week than children living in the least deprived areas, independent of ethnicity, gender and individual-level deprivation. In addition, children living in high deprivation neighbourhoods (NZDep quintile 4) were twice as likely to have inconsistent week/weekend sleep durations than children living in the least deprived areas. Preschoolers whose mothers experienced high individual deprivation (NZiDep 5) were twice as likely as children of mothers reporting no deprivation characteristics to have short sleep on the weekend. Although differences in average sleep durations were observed between Māori and non-Māori boys (Table 6), gender was not associated with short or inconsistent week/weekend sleep duration after adjusting for sociodemographic variables (Table 7).

Maternal model results (Table 7) show that Māori mothers were more than twice as likely to have a preschooler with short sleep (24hr) during the week and on weekends, and three times as likely to have a preschooler with week/weekend sleep durations that differed by more than an hour, compared to non-Māori mothers. Mirroring the dose-response relationship observed in child models, increasing neighbourhood deprivation was associated with an increasing likelihood of mothers reporting short preschooler sleep durations during the week. Mothers living in NZDep quintiles 2 to 5 went from being three to almost five times more likely to have preschoolers with short sleep durations during the week, compared to women living in the least deprived areas, after controlling for all other covariates. High maternal neighbourhood deprivation (NZDep quintile 4) was also independently associated with inconsistent week/weekend sleep durations for

Table 7. Adjusted Prevalence Ratios and 95% CI for Short Sleep Durations (24hr) and Week/Weekend Sleep Duration (24hr) Differences of Greater Than One Hour, Child Models and Maternal Models

Child model	Week sleep (24hr) <10hrs ^a	Weekend sleep (24hr) <10hrs ^b	Sleep (24hr) difference >1hr ^c	Maternal model	Week sleep (24hr) <10hrs ^a	Weekend sleep (24hr) <10hrs ^b	Sleep (24hr) difference >1hr ^c
Child ethnicity:				Maternal ethnicity:			
Non-Māori	Ref	Ref	Ref	Non-Māori	Ref	Ref	Ref
Māori	2.23 (1.31–3.82)	2.04 (1.24–3.36)	2.47 (1.59–3.84)	Māori	2.73 (1.58–4.72)	2.51 (1.51–4.16)	3.31 (2.12–5.15)
Child gender:				Maternal age:			
Male	Ref	Ref	Ref	≥40 yrs	Ref	Ref	Ref
Female	1.00 (0.64–1.56)	1.00 (0.66–1.52)	0.91 (0.62–1.33)	30 - <40 yrs	1.31 (0.33–5.22)	0.58 (0.24–1.39)	0.64 (0.27–1.51)
				20 - <30 yrs	1.41 (0.35–5.72)	0.63 (0.25–1.57)	1.02 (0.43–2.42)
				<20 yrs	1.91 (0.41–8.94)	0.58 (0.18–1.89)	0.82 (0.26–2.59)
NZDep2013:				NZDep2013:			
Quintile 1	Ref	Ref	Ref	Quintile 1	Ref	Ref	Ref
Quintile 2	2.58 (0.93–7.17)	1.38 (0.62–3.06)	1.38 (0.70–2.71)	Quintile 2	3.19 (1.05–9.73)	1.48 (0.65–3.39)	1.35 (0.70–2.61)
Quintile 3	2.60 (0.92–7.39)	1.65 (0.75–3.65)	1.56 (0.80–3.08)	Quintile 3	3.22(1.04–10.00)	1.83 (0.80–4.17)	1.34 (0.68–2.64)
Quintile 4	3.91(1.43–10.72)	1.55 (0.68–3.54)	2.34 (1.23–4.43)	Quintile 4	4.71(1.57–14.15)	1.64 (0.70–3.86)	1.96 (1.04–3.70)
Quintile 5	4.14(1.54–11.12)	2.08 (0.97–4.45)	1.27 (0.63–2.55)	Quintile 5	4.52(1.52–13.48)	2.14 (0.96–4.78)	0.99 (0.49–1.98)
NZiDep score:				NZiDep score:			
1	Ref	Ref	Ref	1	Ref	Ref	Ref
2	0.89 (0.44–1.79)	0.65 (0.31–1.33)	1.22 (0.75–2.00)	2	0.86 (0.43–1.72)	0.64 (0.31–1.33)	1.18 (0.72–1.92)
3	1.38 (0.68–2.79)	1.31 (0.66–2.60)	0.59 (0.27–1.31)	3	1.28 (0.64–2.55)	1.19 (0.60–2.36)	0.63 (0.30–1.33)
4	1.48 (0.75–2.93)	1.70 (0.90–3.19)	1.33 (0.74–2.38)	4	1.26 (0.63–2.53)	1.66 (0.88–3.13)	1.13 (0.63–2.01)
5	1.84 (0.87–3.86)	2.38 (1.21–4.67)	1.52 (0.79–2.89)	5	1.45 (0.68–3.11)	2.05 (1.03–4.08)	1.31 (0.69–2.47)

^aUsual week sleep duration (24 hr): <10hrs vs 10-13 hrs. ^bUsual weekend sleep duration (24hr): <10hrs vs 10-13hrs. ^cAbsolute difference between week/weekend usual sleep duration (24 hr): >1hr vs ≤1hr.

preschoolers. Mothers who experienced the greatest degree of individual deprivation (NZiDep 5) were twice as likely to have a preschooler who had short sleep (24hr) on weekends than mothers who reported no deprivation characteristics.

4.1.5 Discussion

This study reports the first normative data on sleep durations of Māori and non-Māori preschoolers and provides evidence that ethnic and socioeconomic inequities in sleep duration exist as early as 3 to 4 years of age in NZ. Results suggest that social patterns of short sleep previously reported for NZ adults (Paine & Gander, 2013, 2016) begin early in life. Whether these inequities are intergenerational and persistent across the life course remains to be determined.

Average sleep durations across 24 hours for Māori (week = 11.2hrs, weekend = 11.0hrs) and non-Māori (week = 11.4hrs, weekend = 11.4hrs) preschoolers fell within the recommended 10 to 13 hours for this age group (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015). These normative data indicate that the majority of preschoolers in NZ obtain sufficient sleep, although an examination of short and long sleep indicated that approximately one fifth of Māori and one tenth of non-Māori preschoolers had sleep durations outside of the recommended range. Our findings underscore the importance of going beyond simply describing average durations in order to ascertain which children experience the greatest burden of sub-optimal sleep, and of examining sleep health by ethnicity to ensure that indigenous sleep data are not lost within statistics that include the predominant ethnic group (Reid et al., 2017).

We explored the determinants of sub-optimal preschooler sleep durations using indicators of child and maternal social position. In child models, child ethnicity and SEP were independently associated with short and inconsistent sleep durations. Māori children and

children living in more socioeconomically deprived environments were more likely to sleep less than 10 hours per 24 hours, and to have sleep durations that differed by more than an hour between the week and weekend, after taking into account child gender. Similarly, maternal models indicated that maternal ethnicity and SEP were independent predictors of preschoolers having short or inconsistent sleep. Results from both models were similar which is likely to reflect, at least in part, the fact that maternal measures of SEP were used as proxy measures of child SEP. It may also indicate that at this young age, child and maternal experiences are intertwined due to children's developmental stage and associated parental/caregiver dependence. Longitudinal research that tracks relationships between child and maternal ethnicity, SEP and child sleep duration is recommended to ascertain how these patterns may change over time.

Unlike some previous research in the UK which found no relationship between deprivation and child sleep duration (Barazzetta & Ghislandi, 2017), our findings indicate that greater neighbourhood-level, and to a lesser extent individual-level, deprivation is associated with preschoolers obtaining insufficient sleep. A dose-response relationship was evident between SEP and short sleep, whereby increasing area-level deprivation was associated with increasing prevalence of short sleep. These results demonstrate unfair and preventable differences in sleep by SEP, indicating a critical role of power and politics that work to create sleep health inequities in NZ.

There are a number of potential pathways that might explain this association between SEP and sleep duration. For example, low socioeconomic status (based on parental education, occupation and income) and living in a disadvantaged neighbourhood have been associated with parent and child stress and negative psychological outcomes in the US (Santiago, Wadsworth, & Stump, 2011). Lower socioeconomic status has been associated with a greater likelihood of children having pre-sleep worries (Bagley et al., 2015) and

maternal life stress has been associated with shorter sleep duration in preschoolers from low income and minority ethnic groups in the US (Caldwell & Redeker, 2015). It may therefore be that children and mothers with low SEP in our study experienced higher levels of psychosocial stress. This may have had a negative impact on preschoolers' bedtime routines, time in bed, sleep regulation (Bagley et al., 2015; Caldwell & Redeker, 2015) and, thus, sleep duration.

Evidence also suggests that low-income families are more likely to experience sub-optimal sleep environments (e.g. too loud, too cold) and that this is associated with shorter sleep durations in preschoolers (Wilson et al., 2014). Although we did not look specifically at the impact of sleeping environments in this study, our measures of SEP incorporated household crowding (NZDep) (Atkinson et al., 2014) and cold housing temperatures (NZiDep) (Salmond et al., 2006). Therefore, it is possible that the association we found between lower SEP and sub-optimal sleep durations in children may reflect differences in housing and bedroom conditions. Future studies would benefit from further exploration of the pathways involved, including maternal work patterns, childcare arrangements and experiences of single- versus two-parent households. Nonetheless, the findings from our study suggest that addressing the socio-political drivers that result in differential access to socioeconomic resources, such as safe housing and reduced toxic stressors, for parents of young children may reduce inequities in preschooler sleep durations.

Ethnicity was consistently associated with sub-optimal child sleep durations even after controlling for individual- and area-based measures of SEP, suggesting that differences in SEP by ethnicity do not fully explain inequities in child sleep duration (Reid, Robson, & Jones, 2000). Racism is widely acknowledged to be a fundamental cause of ethnic inequities in health, including via the unfair structuring of the social determinants of health by race/ethnicity (D. Williams & Mohammed, 2013). A recent study from Australia

found that vicarious racism (via primary caregiver experiences) and direct experiences of racism are associated with school-aged children having greater difficulties settling or staying asleep (Shepherd et al., 2017). In NZ, self-reported racial discrimination is higher for Māori caregivers than those from the European/Other ethnic grouping and up to 30% of Māori children (0 – 14 years) have experienced vicarious racism compared with up to 14% of European/Other children (Paine et al., 2018). While not measured in this study, it may be that differences in experiences of racism between Māori and non-Māori children is an important driver of inequities in preschooler sleep durations. While this is an area requiring further research, our findings clearly show that Māori children are disproportionately impacted by poor sleep. Policies and interventions to improve the sleep health of preschool-aged children will therefore require significant attention to the structural factors that underpin the unfair treatment of indigenous people in society (Paradies et al., 2015; Reid & Robson, 2007).

While nap durations were not measured in the current study, we did ascertain that a smaller proportion of Māori preschoolers had stopped napping completely, compared to non-Māori preschoolers. This is consistent with napping differences between Black and Non-Hispanic White children in the US reported by Crosby et al (2005) and indicates that differences in nighttime sleep observed in our study are likely to have been influenced, at least in part, by daytime napping. This highlights the importance of measuring children's sleep across 24 hours and not assuming that napping cessation occurs at the same time for all children. This is important for informing early childhood education policy that is responsive to children's individual napping needs.

Overall, our study complements and extends the current body of research on the social determinants of preschooler sleep durations, which to date has largely been conducted in the US, by providing evidence of unfair and avoidable differences (Braveman, 2014b) in

preschooler sleep durations within the NZ context. The fact that ethnicity and SEP were independently associated with short sleep across 24 hours (including naps) strongly suggests that children from Māori and low SEP families are unfairly disadvantaged and burdened by insufficient sleep, as opposed to such inequities reflecting choice or cross-cultural differences (Mindell et al., 2013).

Strengths of our study include the large sample size with a relatively high proportion of Māori participants (37% of children, 32% of mothers) by design. Further strengths include the narrow age range of children and a nationally recruited study cohort with an NZDep profile representative of the NZ general population (Signal et al., 2016). The concurrent examination of ethnicity and SEP, of both children and mothers, in our models enabled us to identify the unique contribution of each of these factors in relation to children's sleep durations.

We also acknowledge a number of limitations. The cross-sectional nature of analyses impeded causal interpretations, therefore longitudinal follow up is recommended. We recognise that there may also be relationships between paternal ethnicity, SEP and preschoolers' sleep, however as these were not measured such associations were unable to be examined. Sleep duration was categorised based on NSF 'recommended' sleep durations, therefore some children with sleep durations in the 'may be appropriate' range (8 – 9 hrs; 14hrs) (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015) may in fact have obtained sufficient sleep for their individual needs, whereas we classified their sleep duration as sub-optimal. As sleep was maternally-reported, subjective durations may have differed from objectively measured sleep. The NZiDep scores of women in our study did not completely align with the distribution of scores reported in the NZ general population (Salmond et al., 2005), thus potentially limiting the generalisability of our findings in relation to individual deprivation. That said,

a similar overall pattern was evident in our sample and in a nationally representative data set (Salmond et al., 2005), whereby Māori were disproportionately represented in high individual-level deprivation and under-represented in low individual-level deprivation. As a small proportion of children usually slept more than 13 hours, we were unable to examine independent associations with long sleep. Future research with sufficient statistical power to examine the social determinants of sub-optimal (both short *and* long) child sleep durations is warranted. However, keeping these limitations in mind, we were able to describe the social patterning of preschoolers' sleep durations in NZ and identify areas requiring further research to better understand and address preschooler sleep inequities.

4.1.6 Conclusions

Ethnic and socioeconomic inequities in sleep durations begin as early as 3 to 4 years of age in NZ, which is a critical public health issue. Māori and families who experience socioeconomic deprivation are significantly disadvantaged in relation to the length and consistency of preschooler sleep. The findings should be understood in relation to the over-representation of Māori in the most deprived neighbourhoods. While further research is required to understand the exact pathways involved, we contend that addressing socio-political drivers of the unequal distribution of power, privilege and resources experienced by Māori and families with low SEP is essential for reducing sleep inequities early in the life course and for preventing future adult sleep inequities.

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4.2 Summary of Key Findings

- Child ethnicity and SEP were independently associated with short and inconsistent preschooler sleep durations
- Maternal ethnicity and SEP were also independently associated with short and inconsistent preschooler sleep durations
- Results indicate that socio-political determinants of the unequal distribution of power, privilege and resources experienced by Māori preschoolers and mothers, and by preschoolers and mothers who hold low SEP, must be addressed to eliminate inequities in young children's sleep durations

CHAPTER 5 QUANTITATIVE STUDY RESULTS: SLEEP TIMING AND PROBLEMS

Results from quantitative analyses investigating preschoolers' sleep timing and sleep problems and relationships with ethnicity and SEP are presented in this chapter. Prevalence estimates of categorical sleep timing and sleep problem variables are provided in Appendices 19 to 28 of the thesis. These are briefly summarised below, followed by a manuscript that has been prepared for journal submission which presents findings from descriptive and multivariate analyses on preschoolers' sleep timing and sleep problems. The chapter concludes with a summary of key findings relating to these aspects of preschoolers' sleep health.

Prevalence of later bedtimes, social jetlag and sleep problems were estimated for Māori and non-Māori preschoolers and stratified by gender, area-level deprivation and individual-level deprivation (Appendices 19 - 28). A greater proportion of Māori preschoolers had later bedtimes on weeknights and weekends, social jetlag ≥ 1 hr, CSHQ scores indicative of disturbed sleep (≥ 41) and a moderate or large problem falling asleep than non-Māori preschoolers. For both Māori and non-Māori children, a concurrent pattern of increasing deprivation and increasing prevalence of later bedtimes and high CSHQ scores was also observed.

The social patterning of sleep timing and sleep problems that was evident in the univariate prevalence data was investigated further using multivariate analyses, as per the planned analyses outlined in Section 3.4.5.3. Results are reported and discussed in the following manuscript, which was prepared by the researcher (Appendix 29) in readiness for submission to the journal *Sleep Medicine*. All rights reserved© Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L.

5.1 Sleep Timing and Sleep Problems of Preschoolers in Aotearoa/New Zealand: Relationships with Ethnicity and Socioeconomic Position

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5.1.1 Abstract

Objectives: To provide normative sleep data and explore sleep inequities, we investigated maternal reports of when and how well Māori (indigenous) and non-Māori preschoolers sleep, and examined relationships between ethnicity (child and maternal), socioeconomic position (SEP) and sleep timing and problems of 3 to 4 year old children in Aotearoa/New Zealand (NZ).

Methods: Cross-sectional analysis of data from the *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand* longitudinal study. Log-binomial regression models were fit to investigate associations between child and maternal demographic variables and preschooler bedtimes, social jetlag and maternally-reported sleep problems. Child models included child ethnicity, child gender, area- and individual-level deprivation. Maternal models included maternal ethnicity, maternal age, area- and individual-level deprivation.

Results: 340 Māori and 570 non-Māori preschoolers and their mothers participated. Māori preschoolers had later average bedtimes and wake times than non-Māori preschoolers. Ethnicity and area-level deprivation were independently associated with later bedtimes. Ethnicity was associated with social jetlag and sleep problems, independent of SEP. Individual-level deprivation was associated with problems falling asleep. Preschoolers of Māori mothers in least deprived areas were more likely to have problems falling asleep than preschoolers of non-Māori mothers in least deprived areas.

Conclusions: Research is needed to understand what sleep timing differences mean for preschoolers' wellbeing in NZ. Fundamental causes of social and economic disadvantage experienced by Māori children and mothers and by families who hold low SEP must be addressed, in order to eliminate sleep health inequities in early childhood.

Key words: bedtime, social jetlag, sleep problems, preschooler, ethnicity, socioeconomic position

5.1.2 Introduction

While sufficient sleep duration is necessary for young children's health and development (Chaput et al., 2017; Paruthi et al., 2016a), emerging research indicates that consistency in sleep timing may also be important for preschoolers' wellbeing. Social jetlag, the shift in midsleep time between weeknights and weekends (Wittmann et al., 2006), has been associated with behavioural problems in preschoolers (Doi, Ishihara, & Uchiyama, 2015) and higher caloric intake via fat consumption in young children with obesity (Petrov et al., 2017). In addition, relationships have been identified between irregular bedtimes and behavioural problems in preschool-aged children (Bates et al., 2002; Komada et al., 2011; Wada et al., 2013; Yokomaku et al., 2008).

Sleep problems are also associated with the wellbeing of young children. In preschoolers, parent-reported sleep problems have been associated with behavioural and attention difficulties, poorer health-related quality of life, and daytime tiredness (Hiscock et al., 2007; Reynaud et al., 2018; Simola et al., 2010).

To support children to obtain the sleep they need, bedtimes no later than 9pm are commonly recommended (Allen et al., 2016; Mindell, Meltzer, et al., 2009). In Aotearoa/New Zealand (NZ), the Ministry of Health recommends that preschool-aged

children (3 - 4 years old) go to bed by 8pm, have consistent bedtimes and wake times, and that preschooler sleep problems are addressed (Ministry of Health, 2016, 2017b).

Recent NZ data indicate that average bedtimes for 3 and 4 year olds (7:53pm and 7:45pm respectively) are within these guidelines (Morton et al., 2017; Taylor, Williams, Farmer, & Taylor, 2015), and that 91% of 4 year olds (n = 6,156) go to bed at a similar time each night. About a third (28%) of parents consider their 4 year old's sleep habits or patterns to be a problem to some extent (Morton et al., 2017). However, there is a dearth of normative data on indigenous children's sleep, including whether inequities in sleep timing and problems exist between indigenous and non-indigenous preschoolers. Furthermore, it is unclear what the relationship is between socioeconomic position (SEP) and preschoolers' sleep timing and sleep problems.

This gap in knowledge is important to address. In the NZ adult population the prevalence of self-reported sleep problems is greater for Māori (the indigenous people of NZ) than non-Māori and socioeconomic deprivation is an independent risk factor for poor sleep (Paine & Gander, 2013; Paine et al., 2004; Paine et al., 2016, 2017). A greater proportion of Māori adults live in areas with high socioeconomic deprivation (Atkinson et al., 2014), and experience deprivation at the individual level (Salmond et al., 2005), than non-Māori. This reflects the social and economic disadvantage, marginalisation and discrimination experienced by Māori, stemming from NZ's history of colonisation (Reid et al., 2000). Investigating the relationship between ethnicity, SEP and preschooler sleep health is therefore vital for understanding if sleep inequities exist in early childhood and, if so, for informing interventions to tackle these early in the life course as a matter of social justice (B. Hale & Hale, 2009).

This study examines preschoolers' sleep through a social determinants of health (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010) and complementary socioecological

(Grandner, 2017; Grandner et al., 2010; C. Jackson et al., 2015) theoretical lens. Viewing sleep in this way recognises that the overarching societal context (e.g. political and economic systems, institutional discrimination) drives the inequitable distribution of power, privilege and resources across society, which results in social stratification (e.g. by ethnicity, SEP and gender), differential life opportunities and conditions of daily living. As early childhood is a time of parental dependency (Cheng, Goodman, & The Committee on Pediatric Research, 2015), the opportunity for good sleep health may differ for children depending on their position, and their mother's position, in society. Therefore, we expected that Māori preschoolers and preschoolers who hold lower SEP, and/or preschoolers of mothers who are Māori and who hold lower SEP, would be at a greater risk of inconsistent and problematic sleep. We also set out to provide normative data on the timing of Māori and non-Māori preschoolers' sleep and to explore if bedtimes differed by ethnicity or SEP.

Thus, the main aims of the study were to (1) examine sleep timing and sleep problems of Māori and non-Māori preschoolers and (2) investigate relationships between ethnicity (child and maternal), SEP and sleep timing and problems of preschoolers in NZ.

5.1.3 Methods

Data were drawn from the *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura)* study, which is a longitudinal programme of research on the sleep and health of women and children from a nationwide pregnancy and birth cohort (Howe et al., 2015; Paine et al., 2013; Signal et al., 2016). *Moe Kura* is guided by indigenous epidemiological principles, including Māori participation and control throughout the research process, the appropriate classification of ethnicity data to identify and monitor disparities, and Māori/non-Māori equal explanatory power (Paine et al., 2013). Cross-sectional analyses were conducted using questionnaire data completed by

mothers (Māori n = 293, non-Māori n = 617) when their *Moe Kura* child was 3 to 4 years of age (Māori n = 340, non-Māori n=570). The Central Health and Disability Ethics Committee of NZ granted ethical approval (CEN/09/09/070/AM02).

5.1.3.1 Measures

Child and Maternal Demographic Measures

Child ethnicity and *maternal ethnicity* was measured using the NZ Census ethnicity question (Statistics New Zealand, 2006). Maternal ethnicity was self-identified by mothers. Child ethnicity was identified by mothers, as opposed to defaulting to maternal ethnicity, in line with recommended NZ ethnicity data collection protocols (Ministry of Health, 2004). Respondents are able to identify with multiple ethnic groups, however for this analysis anyone who identified as Māori (with or without other ethnic groups) were classified as Māori, with everyone else classified as non-Māori.

Two measures of SEP were used in this study. An area-level index of socioeconomic deprivation, *NZDep2013* (Atkinson et al., 2014), is an ordinal scale (1 – 10) of relative socioeconomic deprivation assigned to small areas, based on eight dimensions of deprivation such as household crowding, income and employment status, using 2013 NZ Census data. In the current study, *NZDep2013* quintiles based on maternal residential address are reported, with quintile 1 representing 20% of small areas with the least deprived scores and quintile 5 representing the 20% of small areas with the most deprived scores.

An individual-level index of deprivation, *NZiDep* (Salmond et al., 2006), quantifies endorsement of eight aspects of deprivation experienced in the past year (being out of paid work, receiving a means-tested benefit, having to buy cheaper food, feeling cold to save money on heating, wearing worn out shoes due to cost, foregoing fresh fruit and

vegetables to pay for other necessities, getting help from a community organisation such as for clothing, and seeking assistance to obtain food e.g. a food bank). Positive responses were summed to produce NZiDep scores ranging from 1 to 5 (1 = no deprivation characteristics, 2 = 1 deprivation characteristic, 3 = 2 deprivation characteristics, 4 = 3 or 4 deprivation characteristics and 5 = 5 or more deprivation characteristics). All preschoolers lived with their mothers at least 4 nights per week, therefore maternal SEP was conceptualised as reflecting children's socioeconomic circumstances and access to material resources.

Other demographic measures were *child gender* (girl/boy), *child age* (at the time of questionnaire completion) and *maternal age* (mother's age when their *Moe Kura* child was born).

Sleep Measures

Mothers were asked to provide information on their child's sleep habits over the past seven days including their usual *weeknight bedtime* and *weeknight sleep start time* (Sunday to Thursday), usual *weekend bedtime* and *weekend sleep start time* (Friday and Saturday), usual *weekday wake time* (Monday to Friday) and usual *weekend wake time* (Saturday and Sunday). Usual bedtimes were categorised as >8pm vs. ≤8pm (Ministry of Health, 2017b) and >9pm vs. ≤9pm (Allen et al., 2016; Mindell, Meltzer, et al., 2009).

Weeknight midsleep time was the midpoint between a child's usual sleep start time and wake time during the week, and *weekend midsleep time* was the midpoint between a child's usual sleep start time and wake time on the weekend (Roenneberg et al., 2012). *Midsleep difference* was the absolute difference, in hours, between weeknight and weekend midsleep times, which was categorised to produce a *social jetlag* (≥1hr vs. <1hr) variable.

The Children's Sleep Habits Questionnaire (CSHQ) was used to measure preschooler sleep disturbances, based on mothers' responses to 33 items evaluating bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night wakings, parasomnias, sleep disordered breathing and daytime sleepiness (Owens, Spirito, & McGuinn, 2000). The CSHQ was originally designed to screen for behavioural- and medical-based sleep problems in school-aged children (Owens, Spirito, & McGuinn, 2000), and has since been deemed an effective sleep screening tool for toddlers and preschoolers (Goodlin-Jones et al., 2008). A *CSHQ score* was calculated using standardised scoring procedures, with higher scores indicating greater sleep disturbance (Owens, Spirito, & McGuinn, 2000). *CSHQ total score* was dichotomised (≥ 41 vs. < 41) to indicate problematic sleep or not.

The magnitude and frequency of sleep problems was measured using mothers' reports of how often, and how much, their preschooler's sleep patterns ("my child's sleeping patterns or habits") and time to fall asleep ("the time it takes my child to fall asleep") were a problem. Responses were categorised to produce variables to indicate the extent of problematic *sleep patterns* and *falling asleep* (magnitude: moderate or large/small/no problem; frequency: at least once a week/occasionally/never a problem).

5.1.3.2 Statistical Analysis

IBM SPSS statistical software (Version 23.0) was used to produce descriptive statistics, and univariate comparisons by ethnicity (independent *t*-tests), of continuous demographic and sleep data. Unadjusted prevalence estimates, 95% confidence intervals and Pearson chi-squares were calculated for categorical demographic and sleep variables using SAS (Version 9.4).

Log-binomial regression models (SAS PROC GENMOD), were fit to produce fully adjusted prevalence ratios and 95% confidence intervals of dependent dichotomous sleep

variables: bedtime (>8pm vs ≤8pm; >9pm vs ≤9pm), social jetlag (≥1hr vs <1hr), CSHQ total score (≥41 vs <41), and sleep problems (small vs no; moderate/large vs no; occasionally vs never; at least once a week vs never). Independent variables in *child models* included child ethnicity, child gender, child proxy NZDep2013 quintile and child proxy NZiDep score. *Maternal models* included maternal ethnicity, maternal age, maternal NZDep2013 quintile and maternal NZiDep score. Potential multicollinearity of independent variables was checked using PROC REG. Two interaction terms were included in initial models (ethnicity × NZDep; ethnicity × NZiDep) to investigate whether associations between SEP and sleep differed between Māori and non-Māori. Non-significant interactions (Wald statistic: $p > .05$) were removed and models re-run in their final form. A Bonferroni adjustment for multiple tests was applied to models that retained interaction terms.

As few children had a bedtime later than 9pm on weeknights, child and maternal models were unable to be reliably interpreted and are therefore not reported. Maternal models for social jetlag ≥1hr are also not reported, due to relatively low case numbers and associated limitations of reliably interpreting results.

5.1.4 Results

Most mother-child pairs shared the same ethnic group (n=910: 31% Māori mother/Māori child; 62% non-Māori mother/non-Māori child), 16% of Māori preschoolers had a non-Māori mother and 1% of non-Māori preschoolers had a Māori mother. There was an even distribution of girls and boys in the sample and Māori children were over-represented in the highest deprivation categories for area- and individual-level socioeconomic deprivation (Table 8). The average age of Māori mothers ($M = 28.4$ years, $SD = 6.2$ years) was younger than non-Māori mothers ($M = 32.0$ years, $SD = 5.1$ years; $p < .01$). A larger proportion of Māori women lived in the most deprived areas (NZDep2013 quintile 5 =

37%) and experienced the greatest individual deprivation (NZiDep score of 5 = 13%) than non-Māori women (NZDep2013 quintile 5 = 9%, $p < .01$; NZiDep score of 5 = 3%, $p < .01$).

Table 8. Characteristics of Māori and non-Māori Children in the Sample

	Māori Children (n = 340)	Non-Māori Children (n = 570)	Māori versus Non-Māori ^a <i>p</i>
	% (95% CI)	% (95% CI)	
Child age (years), mean (SD)	3.1 (0.31)	3.2 (0.27)	.53
Child gender:			.64
Girls	49.3 (43.9 – 54.6)	50.9 (46.7 – 55.0)	
Boys	50.7 (45.4 – 56.1)	49.1 (45.0 – 53.3)	
NZDep2013 quintile:			<.01
Quintile 1 (least deprived areas)	14.5 (10.7 – 18.3)	34.7 (30.7 – 38.8)	
Quintile 2	15.4 (11.5 – 19.3)	26.5 (22.8 – 30.2)	
Quintile 3	18.7 (14.5 – 23.0)	18.6 (15.3 – 21.8)	
Quintile 4	18.7 (14.5 – 23.0)	11.2 (8.6 – 13.9)	
Quintile 5 (most deprived areas)	32.6 (27.6 – 37.7)	9.0 (6.6 – 11.4)	
NZiDep score:			<.01
1 (least deprived)	28.3 (23.5 – 33.1)	55.2 (51.1 – 59.3)	
2	24.2 (19.6 – 28.7)	23.9 (20.4 – 27.4)	
3	16.5 (12.5 – 20.5)	10.1 (7.6 – 12.6)	
4	19.2 (15.0 – 23.4)	8.1 (5.9 – 10.4)	
5 (most deprived)	11.8 (8.3 – 15.3)	2.7 (1.3 – 4.0)	

^aIndependent *t*-test for comparison of means and Pearson chi-square for comparison of proportions.

As shown in Table 9, children tended to go to bed later and wake up later on the weekends. Average bedtimes and wake times were later for Māori preschoolers than non-Māori preschoolers and a larger proportion of Māori children had bedtimes that were usually later than current recommendations. The average difference between week and weekend midsleep time was greater for Māori children, who had a higher prevalence of midsleep difference ≥ 1 hr. Average CSHQ scores were higher for Māori children and a significantly larger proportion of Māori preschoolers had CSHQ scores indicative of sleep problems, compared to non-Māori preschoolers. More than ten percent of Māori and non-Māori children had sleep patterns or habits, or took time falling asleep, that mothers considered a moderate or large problem, and problems occurred at least once a week for approximately one quarter of children.

CHAPTER FIVE

Table 9. Sleep Timing and Sleep Problems of Māori and Non-Māori Preschoolers

	Māori (n)	Non-Māori (n)	Māori children	Non-Māori children	Māori versus Non-Māori ^a		
Bedtime							
Bedtime, Mean (SD):							
Weeknight	321	558	19:47 (00:51)	19:23 (00:38)	-7.15	526	<.01
Weekend	315	553	20:13 (00:59)	19:37 (00:46)	-9.30	533	<.01
Weeknight bedtime, % (95%CI):							
≤8pm	326	564	74.5 (69.8 – 79.3)	92.4 (90.2 – 94.6)	54.11	2	<.01
>8pm and ≤9pm			18.7 (14.5 – 23.0)	5.5 (3.6 – 7.4)			
>9pm			6.7 (4.0 – 9.5)	2.1 (0.9 – 3.3)			
Weekend bedtime, % (95%CI):							
≤8pm	323	560	57.3 (51.6 – 62.7)	84.6 (81.6 – 87.6)	81.60	2	<.01
>8pm and ≤9pm			27.2 (22.4 – 32.1)	10.5 (8.0 – 13.1)			
>9pm			15.5 (11.5 – 19.4)	4.8 (3.0 – 6.6)			
Wake time							
Wake time, Mean (SD):							
Weeknight	335	563	07:01 (00:46)	06:46 (00:37)	-4.88	595	<.01
Weekend	332	562	07:17 (00:52)	06:58 (00:46)	-5.47	632	<.01
Midsleep time							
Midsleep time, Mean (SD):							
Weeknight	321	556	01:36 (00:41)	01:19 (01:06)	-3.95	875	<.01
Weekend	313	551	01:55 (00:49)	01:32 (01:10)	-5.16	862	<.01
Midsleep difference (hrs), Mean (SD)	309	548	0.35 (0.40)	0.22 (0.31)	-5.01	520	<.01
Social jetlag, % (95%CI):							
<1hr difference	309	548	88.3 (84.8 – 91.9)	96.2 (94.6 – 97.8)	19.45	1	<.01
≥1hr difference			11.7 (8.1 – 15.2)	3.8 (2.2 – 5.4)			

^aIndependent *t*-test (*t*, *df* and *p*) reported for comparison of means, and Pearson chi-square (χ^2 , *df* and *p*) for comparison of proportions, between Māori and non-Māori children.

Table 9 continued

	Māori (n)	Non-Māori (n)	Māori children	Non-Māori children	Māori versus non-Māori ^a		
CSHQ							
CSHQ score, Mean (SD)	311	532	45.0 (7.4)	42.7 (6.0)	-4.82	546	<.01
CSHQ total score, % (95%CI):							
<41	311	532	31.2 (26.0 – 36.4)	41.0 (36.8 – 45.2)	8.03	1	.01
≥41			68.8 (63.6 – 74.0)	59.0 (54.8 – 63.2)			
Sleep problems							
Sleep patterns, % (95%CI):							
Problem magnitude							
No problem	340	568	51.8 (46.4 – 57.1)	51.8 (47.6 – 55.9)	0.20	2	.90
Small problem			32.4 (27.4 – 37.4)	31.3 (27.5 – 35.2)			
Moderate/large problem			15.9 (12.0 – 19.8)	16.9 (13.8 – 20.0)			
Problem frequency							
Never a problem	335	569	41.8 (36.5 – 47.1)	38.5 (34.5 – 42.5)	5.31	2	.07
Occasionally a problem			28.7 (23.8 – 33.5)	36.0 (32.1 – 40.0)			
Problem at least once a week			29.6 (24.6 – 34.5)	25.5 (21.9 – 29.1)			
Falling asleep, % (95%CI):							
Problem magnitude							
No problem	340	568	52.9 (47.6 – 58.3)	56.9 (52.8 – 61.0)	4.94	2	.08
Small problem			29.4 (24.5 – 34.3)	30.8 (27.0 – 34.6)			
Moderate/large problem			17.6 (13.6 – 21.7)	12.3 (9.6 – 15.0)			
Problem frequency							
Never a problem	339	569	36.6 (31.4 – 41.7)	34.8 (30.9 – 38.7)	4.52	2	.10
Occasionally a problem			36.3 (31.1 – 41.4)	42.9 (38.8 – 47.0)			
Problem at least once a week			27.1 (22.4 – 31.9)	22.3 (18.9 – 25.8)			

^aIndependent *t*-test (*t*, *df* and *p*) reported for comparison of means, and Pearson chi-square (χ^2 , *df* and *p*) for comparison of proportions, between Māori and non-Māori children.

Results of multivariate regression child models that had statistically significant findings are summarised in Table 10. Māori children were twice as likely as non-Māori children to have a bedtime later than 8pm during the week, a bedtime later than 9pm on the weekend or social jetlag of an hour or more, and were one and a half times more likely to have a moderate or large problem falling asleep, independent of gender and deprivation. We observed a dose-response relationship between area-level deprivation and some measures of bedtime, such that the likelihood of having a bedtime later than 8pm on a weeknight and 9pm on the weekend increased with greater deprivation. Preschoolers whose mothers reported two deprivation characteristics in the past year (NZiDep score of 3) were over one and a half times more likely to have a moderate or large problem falling asleep. There were no significant results for child models on CSHQ scores ≥ 41 , or the frequency or extent of problematic sleep, with the exception of moderate to large problems falling asleep.

Table 10. Adjusted Prevalence Ratios and 95% CI for Later Bedtimes and Sleep Problems, Child Models with Significant Results

	Weeknight bedtime >8pm ^a	Weekend bedtime >8pm ^a	Weekend bedtime >9pm ^b	Social jetlag ≥1hr ^c	Falling asleep mod/large problem ^d
Child ethnicity:					
Non-Māori	Ref	Ref	Ref	Ref	Ref
Māori	2.58 (1.74-3.83)	2.23 (1.71-2.90)	2.02 (1.22-3.34)	2.38 (1.30-4.36)	1.43 (1.00-2.06)
Child gender:					
Male	Ref	Ref	Ref	Ref	Ref
Female	0.93 (0.67-1.28)	0.89 (0.71-1.10)	0.81 (0.52-1.24)	1.16 (0.69-1.96)	0.94 (0.69-1.28)
NZDep2013 quintile:					
1 (least deprived)	Ref	Ref	Ref	Ref	Ref
2	1.54 (0.80-2.98)	0.93 (0.61-1.43)	1.02 (0.35-2.98)	0.44 (0.14-1.34)	0.74 (0.46-1.21)
3	1.83 (0.96-3.49)	1.53 (1.05-2.22)	2.73 (1.12-6.64)	1.36 (0.60-3.07)	0.89 (0.56-1.42)
4	2.02 (1.04-3.89)	1.25 (0.82-1.90)	3.21 (1.31-7.88)	1.64 (0.73-3.68)	0.62 (0.35-1.13)
5 (most deprived)	2.84 (1.55-5.21)	1.74 (1.21-2.51)	5.19 (2.22-12.13)	1.30 (0.56-2.99)	0.89 (0.55-1.46)
NZiDep score:					
1 (least deprived)	Ref	Ref	Ref	Ref	Ref
2	1.23 (0.79-1.91)	1.20 (0.89-1.61)	0.81 (0.44-1.49)	0.60 (0.27-1.34)	0.92 (0.60-1.42)
3	0.99 (0.57-1.71)	1.04 (0.73-1.50)	0.85 (0.42-1.72)	1.09 (0.50-2.35)	1.72 (1.10-2.67)
4	1.11 (0.67-1.83)	1.13 (0.80-1.59)	0.93 (0.49-1.77)	0.86 (0.36-2.05)	0.98 (0.56-1.71)
5 (most deprived)	1.30 (0.74-2.29)	1.29 (0.89-1.87)	1.00 (0.48-2.08)	1.58 (0.70-3.59)	0.74 (0.33-1.67)

^aRef = ≤8pm; ^bRef = ≤9pm; ^cRef = midsleep time difference <1hr; ^dRef = no problem.

Significant results from maternal models are summarised in Table 11. Preschoolers of Māori mothers were almost three times as likely to have a bedtime later than 8pm on weeknights and 9pm on the weekend. Children of Māori mothers also had a small, but statistically significant, increased likelihood of having a high CSHQ score or problems at least once a week with sleep patterns or falling asleep, independent of maternal age and deprivation. Greater area deprivation was independently associated with a higher likelihood of children having bedtimes after 8pm on weeknights and after 9pm on weekends. Preschoolers of mothers with NZiDep scores of 3 were more likely to have a high CSHQ total score or difficulties falling asleep. A significant interaction was found between maternal ethnicity and NZDep2013 for problems falling asleep. For children of women living in the least deprived areas (NZDep2013 quintile 1), children of Māori mothers were twice as likely to have a small problem and three times as likely to have a moderate or large problem falling asleep compared to children of non-Māori mothers. There were no significant findings for maternal models investigating factors associated with preschoolers' sleep patterns or habits being a small, moderate or large problem, or with children having occasional sleep problems.

Table 11. Adjusted Prevalence Ratios and 95% CI for Later Bedtimes and Sleep Problems, Maternal Models with Significant Results

	Weeknight bedtime >8pm ^a	Weekend bedtime >8pm	Weekend bedtime >9pm ^b	CSHQ total score ≥41 ^c	Falling asleep small problem ^d	Falling asleep mod/large problem ^d	Falling asleep problem ≥ once/week ^e	Sleep patterns problem ≥ once/week ^e
Maternal ethnicity:					*	*		
Non-Māori	Ref	Ref	Ref	Ref			Ref	Ref
Māori	2.92 (1.97-4.35)	2.77 (2.11-3.62)	2.95 (1.73-5.01)	1.17 (1.04-1.33)			1.36 (1.07-1.73)	1.27 (1.00-1.61)
Maternal age:								
≥40yrs	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
30 - <40yrs	0.84 (0.36-1.94)	0.81 (0.45-1.48)	1.24 (0.31-4.95)	1.04 (0.81-1.33)	0.81 (0.54-1.21)	0.72 (0.38-1.35)	0.73 (0.47-1.13)	0.76 (0.53-1.08)
20 - <30yrs	0.97 (0.42-2.28)	0.96 (0.52-1.77)	1.67 (0.41-6.72)	1.06 (0.82-1.37)	0.99 (0.65-1.50)	0.77 (0.40-1.50)	0.75 (0.47-1.18)	0.79 (0.54-1.15)
<20 yrs	1.30 (0.50-3.40)	1.41 (0.72-2.76)	1.05 (0.20-5.44)	1.13 (0.83-1.56)	1.03 (0.56-1.92)	0.55 (0.19-1.60)	0.46 (0.20-1.09)	0.73 (0.40-1.34)
NZDep2013 quintile:								
1 (least deprived)	Ref	Ref	Ref	Ref	M vs nM: 1.96 (1.02-3.77)	M vs nM: 3.27 (1.36-7.90)	Ref	Ref
2	1.69 (0.87-3.29)	0.96 (0.63-1.46)	0.97 (0.33-2.83)	1.01 (0.86-1.19)	M vs n-M: 0.56 (0.21-1.51)	M vs n-M: 0.93 (0.20-4.32)	0.80 (0.59-1.09)	0.94 (0.71-1.24)
3	1.87 (0.96-3.62)	1.46 (1.00-2.11)	2.48 (1.02-6.02)	1.09 (0.93-1.28)	M vs n-M: 0.76 (0.29-2.04)	M vs n-M: 2.44 (0.79-7.61)	0.91 (0.66-1.24)	0.89 (0.66-1.20)
4	2.00 (1.02-3.93)	1.16 (0.77-1.74)	2.77 (1.13-6.84)	0.97 (0.80-1.17)	M vs n-M: 1.10 (0.44-2.72)	M vs n-M: 2.24 (0.40-12.67)	0.71 (0.49-1.03)	0.74 (0.52-1.07)
5 (most deprived)	2.57 (1.36-4.86)	1.42 (0.98-2.07)	3.99 (1.69-9.47)	1.02 (0.85-1.21)	M vs n-M: 1.02 (0.42-2.46)	M vs n-M: 0.91 (0.30-2.83)	0.78 (0.56-1.08)	0.75 (0.53-1.06)
NZiDep score:								
1 (least deprived)	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2	1.24 (0.79-1.92)	1.19 (0.89-1.61)	0.72 (0.39-1.34)	1.03 (0.90-1.19)	0.95 (0.74-1.23)	0.95 (0.63-1.46)	0.93 (0.71-1.23)	0.88 (0.68-1.15)
3	1.00 (0.59-1.70)	1.04 (0.73-1.48)	0.79 (0.40-1.56)	1.20 (1.03-1.40)	1.24 (0.93-1.66)	1.61 (1.08-2.38)	1.38 (1.03-1.84)	1.13 (0.86-1.50)
4	1.02 (0.62-1.69)	0.95 (0.68-1.33)	0.75 (0.39-1.46)	1.13 (0.95-1.34)	1.06 (0.76-1.48)	0.93 (0.53-1.63)	0.89 (0.60-1.32)	0.83 (0.58-1.19)
5 (most deprived)	1.06 (0.59-1.91)	1.02 (0.70-1.49)	0.85 (0.41-1.77)	1.13 (0.91-1.40)	0.96 (0.61-1.52)	0.74 (0.33-1.65)	0.95 (0.61-1.50)	1.08 (0.73-1.61)

^aRef = ≤8pm; ^bRef = ≤9pm; ^cRef = CSHQ total score <41; ^dRef = no problem; ^eRef = never a problem. *There was a significant interaction between maternal ethnicity and NZDep2013 quintile (no vs small problem: $p=.01$; no vs moderate/large problem: $p=.02$). Bonferroni adjusted values for Māori vs non-Māori comparisons at equivalent NZDep quintile levels are reported in the NZDep2013 section.

5.1.1 Discussion

Our study provides the first normative data on when and how well Māori and non-Māori preschool-aged children sleep. Māori preschoolers had later average bedtimes and wake times than non-Māori preschoolers and we observed independent relationships between ethnicity, SEP and preschooler sleep timing and sleep problems. Results indicate that greater socioeconomic deprivation is associated with later bedtimes and that ethnic inequities exist in social jetlag and sleep problems of 3 to 4 year olds in NZ, independent of SEP. These findings address an identified gap in the knowledge of preschooler sleep and complement previous research which has shown that inequities exist in adult sleep problems in NZ (Paine & Gander, 2013).

Napping is associated with later sleep onset at night in preschoolers (Thorpe et al., 2015). In the current study cohort, we found napping to be more prevalent for Māori preschoolers than non-Māori preschoolers (Muller, Paine, Wu, & Signal, in press). This may be one reason why Māori children were more likely to have later average bedtimes, and therefore later average wake times, and were more likely to have bedtimes later than the current NZ guidelines (Ministry of Health, 2017b). As we did not account for napping in our models, this relationship requires further investigation. Nevertheless, our findings are consistent with those reported in the US, whereby preschoolers from minoritised racial/ethnic groups are more likely to nap during the day and have later bedtimes than White preschoolers (Parsons et al., 2018; J. Smith et al., 2018).

We also found a relationship between greater deprivation and later bedtimes, consistent with associations between lower household income and social class and later preschooler bedtimes, independent of race/ethnicity, in the US (Lavigne et al., 1999). In contrast, while 4 year old children in Brazil had average bedtimes and wake times that were approximately two hours later than those typically reported in high income countries,

higher maternal education and family income were associated with later bedtimes (Netsi et al., 2017).

This study was not designed to explore the consequences of children's bedtimes, therefore it is unclear if later bedtimes were a 'problem' per se, or simply a 'difference' in the timing of sleep across 24 hours for Māori children and children with low SEP in our study. In the US, bedtimes later than 9pm have been associated with increased odds of preschoolers obtaining insufficient sleep across 24 hours, however whether wake times and naps confounded this relationship is unclear as they were not controlled for in analyses (Owens, Jones, & Nash, 2011). Bedtimes at 9pm or earlier have been associated with fewer behavioural problems in preschoolers, after controlling for a host of demographic and behavioural factors such as screen time (Wada et al., 2013). The authors did not find a significant relationship between preschoolers' total time in bed across 24 hours and behaviour in comparative analyses indicating that later sleep timing may potentially be a risk factor for behavioural difficulties, irrespective of sleep duration. Later bedtimes may also increase the risk of preschoolers developing obesity. In the US, shorter nighttime sleep duration has been associated with increased body mass in preschoolers from low income families, but only for children with bedtimes later than 9pm (A. Miller et al., 2014). Longitudinally, earlier preschooler bedtimes were associated with reduced risk of obesity in adolescence, although as sleep duration was not controlled for it is unclear if this influenced the relationship (Anderson et al., 2016).

The difference in bedtimes that we observed by ethnicity and SEP and the limited research on outcomes of bedtimes later than those recommended for preschoolers, including a paucity of research on bedtimes and wellbeing of indigenous preschoolers, highlights the need for further investigation to understand how later bedtimes influence preschoolers' health and development. Our findings also raise the question of whether a range of

recommended bedtimes, similar to those for children's sleep durations (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015; Paruthi et al., 2016a), along with guidance to consider bedtime in conjunction with a preschooler's wake time and potential daytime napping, is needed.

We recognise that later preschooler bedtimes may not be a choice for some families, but may instead reflect barriers to being able to implement recommended child bedtimes. In our study cohort, Māori mothers who were in paid employment were more likely to be engaged in night work than non-Māori working mothers (not shown here). This may have impacted the timing of household evening activities, including children's bedtimes. We also observed a relationship between increasing area-level deprivation and later bedtimes, independent of ethnicity, indicating that limited access to socioeconomic resources may influence the time that children are able to go to bed.

Our findings complement those of a study that investigated preschoolers' bedtimes in the US (L. Hale et al., 2009). Preschool-aged children of Black and Hispanic mothers were just as likely to have a set time for bed, but reduced odds of that bedtime being implemented during the week, than preschoolers of White mothers. In addition, preschoolers of Black and Hispanic mothers, and children from households with lower income (income between 1 and 2 times the poverty line), went to bed later than children of White mothers and children from households with higher income (income greater than two times the poverty line). One interpretation of the combination of our results and those of Hale et al. (2009) is that mothers from predominant racial/ethnic groups and who hold higher SEP experience greater autonomy and face fewer challenges to implementing bedtimes for their preschoolers in the early evening, due to their position in society and associated daily living experiences, resources and opportunities (L. Hale & Hale, 2010).

Social jetlag and problems falling asleep were more prevalent for Māori preschoolers than non-Māori preschoolers, independent of SEP and gender, and children of Māori mothers were more likely to have sleep problems (CSHQ total score ≥ 41 , problems falling asleep \geq once a week, problematic sleep patterns \geq once a week), independent of SEP and maternal age. We also found that Māori mothers who lived in the least deprived areas were more likely to identify their child as having difficulties falling asleep compared to non-Māori mothers living in the least deprived areas. Children of mothers who reported experiencing two individual deprivation characteristics were also more likely to have difficulties falling asleep.

Our findings align with the social patterning of preschooler sleep health reported in the US, whereby children from minoritised racial/ethnic groups and low-income households are more likely to have poor quality or problematic sleep than those from dominant racial/ethnic groups and from households with greater socioeconomic resources (Caldwell & Redeker, 2015; McLaughlin Crabtree et al., 2005; Vaughn et al., 2015). They are also consistent with relationships found in the UK between household material deprivation and increased odds of children having a sleep problem (Barazzetta & Ghislandi, 2017).

We add to the literature by providing evidence of an increased risk of social jetlag for indigenous preschoolers independent of SEP which, to the best of our knowledge, has not been previously reported. As associations have been found between social jetlag and greater caloric intake in preschoolers with obesity (Petrov et al., 2017), and increased adiposity in school-aged children (Stoner et al., 2018), social jetlag may be a contributing factor to ethnic inequities in childhood obesity in NZ (Ministry of Health, 2016). Further research is required to test this proposition and to explore the meaning of social jetlag at a young age.

While not explicitly examined, a number of factors may have contributed to the relationship between low SEP and preschooler sleep problems. Previous research with school-aged children from families with low socioeconomic status found that pre-sleep worries kept children from sleeping well, as did environmental conditions such as noise, having an uncomfortable bed, room temperature and light (Bagley et al., 2015). In preschoolers from low-income families, sub-optimal sleeping environments such as rooms that were too bright, loud, hot or cold were associated with children falling asleep later at night compared to children without such environments (Wilson et al., 2014). Therefore, children in our study with lower SEP may have experienced worries and physical environments that negatively influenced how well they initiated and/or maintained sleep. It may also be that the built and social aspects of children's neighbourhoods influenced their sleep quality, as neighbourhood characteristics including poor housing, safety issues and limited access to parks and playgrounds are associated with an increased prevalence of sleep problems in children and adolescents (Singh & Kenney, 2013). Our findings provide evidence of the importance of equitable access to socioeconomic resources for families with young children, which needs to be addressed at the broad socio-political level to enable population change.

The associations that we found between ethnicity and social jetlag and sleep problems, independent of SEP, may be in part due to residual confounding by aspects of SEP not captured by the two measures we used (Galobardes et al., 2006). However, our findings also indicate that the experience of being a Māori preschooler or child of a Māori mother in NZ influences how well children sleep, beyond socioeconomic circumstances. A study of indigenous 5 to 10 year old children in Australia found that child experience of direct and vicarious racism (via the primary caregiver) was associated with children having difficulties initiating or maintaining sleep (Shepherd et al., 2017). We did not examine experiences of racism in this study, but data from NZ research indicate that up to 30% of

Māori children experience vicarious racism versus up to 14% of European/Other children (Paine et al., 2018). Māori children and children of Māori mothers in our study may have been at a higher risk of sleep problems associated with experiences of direct or vicarious racism. Addressing racism in NZ is therefore imperative for improving the sleep quality of Māori preschoolers.

Strengths of our study include the study design which resulted in a sample comprising of a relatively large proportion of Māori children and mothers, thus providing adequate statistical power to examine relationships between ethnicity and preschooler sleep. The use of multiple sleep measures enabled different facets of preschooler sleep timing and sleep problems to be investigated, and the concurrent inclusion of ethnicity, SEP and sociodemographic variables in models allowed independent relationships to be identified.

A number of limitations are also worth noting. As analyses were cross-sectional, we were unable to establish causal relationships between ethnicity, SEP and child sleep. Measures of sleep timing were based on maternal report of children's 'usual' bedtimes, sleep start times and wake times in the past week, which may have been influenced by recall bias. Maternal report may not accurately reflect the child's experience and may be influenced by a mother's own beliefs and experiences with sleep. As sleep was not measured on a daily basis, intraindividual variability in sleep timing was unable to be examined beyond usual week day/weekend differences. Measures of sleep problems were limited by the lack of validation of the CSHQ for the NZ context and the non-standardised wording of our other sleep problem questions. While our sample was a reasonable size, the small number of children with usual weeknight bedtimes later than 9pm and preschoolers with social jetlag of 1 hour or more limited our ability to fully examine these measures. Compared to the national distribution of NZiDep scores in NZ, a smaller proportion of Māori and non-Māori women in our sample reported experiencing 5 or more deprivation characteristics

(Salmond et al., 2005), thus limiting statistical power to identify associations between high individual deprivation and preschoolers' sleep.

5.1.2 Conclusions

Further research is warranted, to ascertain if later sleep times, after accounting for the total amount of sleep a child obtains including daytime naps, is problematic or instead represents differences in the way families structure their lives. We also found evidence of ethnic inequities in social jetlag and sleep problems, independent of SEP, and that socioeconomic deprivation is an independent risk factor for preschooler sleep problems. Our findings support the need to address the societal drivers of social and economic disadvantage experienced by Māori children and mothers and families who hold low SEP, in order for sleep health inequities in early childhood to be eliminated.

5.2 Summary of Key Findings

- Bedtimes and wake times were later for Māori than non-Māori preschoolers
- Socioeconomic deprivation was associated with later preschooler bedtimes
- Ethnic inequities were evident in preschooler social jetlag and sleep problems
- Findings support the need for the fundamental causes of early sleep health inequities to be addressed.

CHAPTER 6 QUALITATIVE STUDY RESULTS: MATERNAL PERSPECTIVES AND EXPERIENCES OF PRESCHOOLERS' SLEEP

As outlined in the Methodology chapter, the rationale for using a mixed methods study design was to gain both a broad and deep understanding of social determinants of preschoolers' sleep health in NZ via quantitative and qualitative inquiry. It was evident from the quantitative results presented in the previous two chapters that the sleep of preschoolers in the *Moe Kura* sample was socially patterned, with children from Māori and low SEP families experiencing the greatest burden of poor sleep health. This chapter presents results from the qualitative study, in the form of a journal manuscript, which shed light on how good and poor preschooler sleep health was perceived and experienced by mothers in the sub-sample of Māori and non-Māori women with low and high SEP. These findings help situate preschoolers' sleep within families' day-to-day lives and provide insight into how young children's sleep is viewed by mothers within diverse social contexts.

The following manuscript was prepared by the researcher (Appendix 30) and accepted for publication in the journal *Qualitative Health Research*. Approval has been granted by the journal's managing editor (V. Shannon, personal communication, February 13, 2019) to include the manuscript in this thesis.

6.1 “Their sleep means more harmony”: Maternal perspectives and experiences of preschoolers’ sleep in ethnically and socioeconomically diverse families in Aotearoa/New Zealand

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). “Their sleep means more harmony”: Maternal perspectives and experiences of preschoolers’ sleep in ethnically and socioeconomically diverse families in Aotearoa/New Zealand. *Qualitative Health Research*. DOI: <https://doi.org/10.1177/1049732319842156>

6.1.1 Abstract:

Viewing sleep through a socioecological lens, maternal perceptions and experiences of preschoolers’ sleep were explored using semi-structured interviews with 15 Māori (indigenous) and 16 non-Māori mothers, with low and high socioeconomic position. Thematic analysis identified four themes: child happiness and health; maternal wellbeing; comfort and connection; and family functioning and harmony. Mothers perceived healthy preschooler sleep as supporting children’s mental and physical health, parents’ sleep/wake functioning, family social cohesion and emotional connectedness, and poor preschooler sleep as negatively influencing child, maternal and family wellbeing. While many experiences were shared, some perceptions of sleep and sleep practices differed between mothers. Influences included health paradigms, socioeconomic circumstances, maternal autonomy, employment, parenting approaches and societal expectations. Healthy preschooler sleep is valued by mothers and may play a protective role in family health and resilience. Preschooler sleep initiatives need to be responsive to maternal perspectives and address societal drivers of sleep experiences.

Key words: preschooler, sleep, ethnicity, socioeconomic position, family, health, qualitative, resilience, context, society

6.1.2 Introduction

It is estimated that at least 20% to 30% of preschoolers experience sleep problems, including insufficient sleep duration, bedtime delays, night waking and parentally-reported problematic sleep (Hiscock et al., 2007; Owens, 2007; Owens et al., 2011; Owens & Mindell, 2011). This is a significant concern, given the growing body of quantitative evidence demonstrating associations between sleep issues in the preschool years and adverse child health and wellbeing outcomes, including increased risk of cognitive, behavioural, and emotional regulation difficulties (Bates et al., 2002; Hatzinger et al., 2010; Hiscock et al., 2007; Reynaud et al., 2018; Vaughn et al., 2015; Yokomaku et al., 2008), overweight and obesity (Cappuccio et al., 2008; Jiang et al., 2009; Li et al., 2017; L. Magee & Hale, 2012) and injury (Hiscock et al., 2007; Owens et al., 2005). Furthermore, problematic or disturbed preschooler sleep has been negatively associated with parental wellbeing, including maternal sleep quality, mental and physical health, daytime functioning (Martin, Hiscock, Hardy, Davey, & Wake, 2007; Meltzer & Montgomery-Downs, 2011; Mindell, Sadeh, Kwon, & Goh, 2015), parental relationship satisfaction (Peltz, Rogge, Sturge-Apple, O'Connor, & Pigeon, 2016) and parental daytime sleepiness (Boergers, Hart, Owens, Streisand, & Spirito, 2007).

It is evident that the sleep of preschool-aged children (defined as 3 – 5 years in the US, 3 – 4 years in Aotearoa/New Zealand [NZ]) is an important area of health, however there is a dearth of qualitative research on families' views of preschooler sleep. An in-depth understanding of how preschooler sleep is perceived and experienced by families is important for informing clinical practice and public health programmes to enable sleep to be recognised as a critical aspect of child health and wellbeing.

In NZ, a qualitative study by Smith and colleagues (L. Smith, Galland, & Lawrence, 2017) has forged the way in this area. Maternal experiences of the impact of 3 to 4 year olds'

behavioural sleep problems, such as bedtime resistance and night waking, were explored using face-to-face, semi-structured interviews with 16 women living in the Dunedin area. Women experienced a multitude of negative emotional responses to their children's sleep problems, including feelings of guilt, frustration and defeat, as well as negative impacts on daytime functioning such as exhaustion, negative mood, poor concentration and inability to socialise. Mothers also described fathers' and siblings' sleep and daytime functioning as being negatively affected by problematic preschooler sleep. Results shed light on the negative and far-reaching impacts of preschooler sleep problems experienced by women and their families in NZ, and also indicate the need for further research. As their sample consisted of predominantly New Zealand European (non-indigenous) participants with relatively high socioeconomic position (SEP), it is unclear whether or not the impact of poor preschooler sleep health is experienced the same way by mothers who identify as Māori (the indigenous people of NZ) or who hold lower SEP in NZ society.

While sleep is a fundamental biological need that is regulated by physiological processes (Carskadon & Dement, 2017; Gander, 2003), socioecological models of sleep are based on the premise that sleep is influenced by dynamic interactions with the physical (e.g. the built home environment), social (e.g. community networks) and, ultimately, broader societal (e.g. economic and political systems, discrimination) contexts in which we live (Grandner, 2017; Grandner et al., 2010; C. Jackson et al., 2015). In NZ society, which has a history of colonisation and marginalisation of Māori (Reid & Robson, 2007), Māori are disproportionately represented in the most socioeconomically deprived areas (Atkinson et al., 2014). Māori adults have poorer sleep than non-Māori adults, and socioeconomic deprivation is an independent risk factor for myriad poor sleep outcomes including insufficient sleep duration, excessive daytime sleepiness, insomnia and self-reported sleep disturbance (Paine & Gander, 2013, 2016; Paine et al., 2004, 2005; Paine et al., 2016, 2017). Ethnic and socioeconomic inequities are also evident in child and adult health

(Ministry of Health, 2013, 2015; Simpson et al., 2017). Therefore, understanding how preschooler sleep health is perceived and experienced by Māori mothers and mothers with low SEP should be the first step in informing sleep health interventions that meet the needs of families who experience the greatest burden in society and to help prevent sleep, and associated health, inequities in future generations.

Parental/caregiver perceptions and experiences of non-problematic preschooler sleep are yet to be explored in NZ. An understanding of what constitutes healthy sleep for families is necessary to inform clinical and public health programmes that support and promote good sleep health and wellbeing, in contrast to those centred around treating sleep disorders (Buysse, 2014).

Addressing these identified research gaps, the purpose of this experiential qualitative study was to explore how good and poor preschooler sleep health is perceived and experienced by Māori and non-Māori mothers, with low and high SEP, in NZ.

6.1.3 Methods

All procedures were approved by the Central Health and Disability Ethics Committee (CEN/09/09/070/AM05). The current study was embedded in the wider *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura)* project. *Moe Kura* is a programme of research on the sleep and health of Māori and non-Māori women and their children who were born during the *E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand* study (Howe et al., 2015; Paine et al., 2013; Signal et al., 2016). Data have been collected from 294 Māori and 618 non-Māori mothers in *Moe Kura* on their sleep and health, and that of their 3 to 4 year old children, using maternally-completed questionnaires (Age 3 questionnaires).

6.1.3.1 Recruitment

The aim was to recruit a purposive sample of up to 16 Māori and 16 non-Māori women with low and high SEP, from the Wellington region of NZ, whose *Moe Kura* children were 4 years old. Limitations were placed on recruitment numbers due to resource availability, whilst recognising that data saturation may occur with fewer participants depending on the quality, relevance and richness of data collected (Fusch & Ness, 2015; Malterud et al., 2016). In keeping with the Kaupapa Māori research principles of the wider research programme (Paine et al., 2013), both Māori and non-Māori women were actively recruited to ensure equal focus was given to Māori and non-Māori perspectives. Potential participants were identified based on women's responses to the Age 3 questionnaire. Maternal ethnicity was based on the NZ Census ethnicity question (Statistics New Zealand, 2006), which enables self-identification with multiple ethnicities. Women who selected Māori (with or without other ethnicities) were categorised as Māori, and all others were categorised as non-Māori (Ministry of Health, 2004).

Maternal SEP was based on New Zealand Individual Deprivation Index scores (NZiDep; Salmond, Crampton, King, & Waldegrave, 2006). The NZiDep index is a non-occupational measure of individual deprivation developed in NZ, which quantifies eight deprivation characteristics (e.g. receiving benefits or foregoing fresh foods to afford other necessities) into scores ranging from 1 to 5. For recruitment purposes, an NZiDep score of 1 (0 deprivation characteristics) was categorised as high SEP and scores of 3 to 5 (2 - 8 deprivation characteristics) as low SEP.

Potential participants were sent study packs containing a letter of invitation, an information sheet and consent form. Women were provided with the option of being interviewed by a Māori or non-Māori member of the research team. Concurrent recruitment and data collection commenced 31st August 2015 and finished 29th February

2016. No new qualitative concepts were raised in the final interviews, which supported the initial sample size goal and decision to close recruitment.

6.1.3.2 Procedures

Face-to-face, semi-structured, individual interviews were conducted with 15 Māori and 16 non-Māori women who consented to participate. All interviews were carried out by Diane Muller, who identifies as NZ European/Pākehā (non-Māori). One mother indicated a preference for a Māori interviewer however, due to time availability of the Māori researcher, opted to be interviewed by a non-Māori researcher.

Prior to interviews, mothers completed a brief questionnaire on aspects of their social and built environment. Maternal, child and household demographic information was collected along with information on children's sleeping environments and potential sleep problems, based on the questions: 'how much of a problem for you is the time it takes your child to fall asleep?' and 'how much of a problem for you is your child's sleeping patterns or habits?' (response options: no/small/moderate/large problem).

All interviews were audio recorded and conducted using an interview guide which included the questions: 'can you please tell me a little about your household and who lives in your home?'; 'how would you describe (child)?'; 'how would you describe (child's) sleep?'; 'what do you think makes a difference to (child's) sleep?'; 'how do you feel about (child's) sleep?'. Questions were broad in nature to enable women to raise what was important to them about their child's sleep, in line with a qualitative inquiry approach (Patton, 2015).

Women were provided with the option of being sent a copy of their interview transcript, either to give feedback or for their own records. Seven Māori (47%) and six non-Māori (38%) women requested copies, none of whom returned comments.

6.1.3.3 Data analysis

Descriptive statistics of questionnaire data were produced using IBM SPSS statistical software (Version 23.0). Interview data were transcribed by a professional transcription service, and transcriptions were checked, de-identified and analysed using Braun and Clarke's method of thematic analysis (2006). This entailed six iterative phases: familiarisation with the data, generating codes, searching for themes, reviewing themes, defining and naming themes, and reporting results (Braun & Clarke, 2006, 2013). Diane Muller generated codes inductively by highlighting, labelling and collating sections of text that were relevant to the research aim, without a pre-determined coding framework, in nVivo (version 11). Patterns of meaning were examined by producing and discussing mind maps of codes with all authors and an independent qualitative researcher. Diane Muller identified candidate themes (groups of codes with a central organising concept) and reviewed these with all authors. Themes were based on semantic or 'surface level' content of the data (Braun & Clarke, 2006, 2013; Patton, 2015). Analysis was also influenced by a socioecological view of sleep (Grandner, 2017; C. Jackson et al., 2015), whereby sleep was considered within multiple contextual layers of families' lives as opposed to being viewed simply as a biological process. The final phase of analysis was reporting the results, which included the iterative process of selecting text excerpts to illustrate themes and refining theme descriptions. Data quality was supported by using a methodical process to check transcripts, research rigour was supported by using a systematic and iterative process to analyse data, reflexivity was enhanced by personal reflections being documented after each interview, and documentation of the study processes provided transparency (Braun & Clarke, 2013; Tracy, 2010).

6.1.3.4 Participants

Response rates, based on women who participated versus study packs sent, were: 47% for Māori women with low SEP, 62% for Māori women with high SEP, 50% for non-Māori women with low SEP and 82% for non-Māori women with high SEP.

Māori mothers tended to be younger than non-Māori mothers and Māori and non-Māori households were similar in size (Table 12). Most women lived with a partner (73% Māori, 88% non-Māori; no women were living with a same-sex partner) and three Māori households included grandparents. All children were categorised as belonging to the same ethnic group as their mothers, except for one child whose mother identified as non-Māori and identified her child as Māori. Children were aged 4, except four who turned 5 the week of interviews (Māori: n = 2, non-Māori: n = 2). Most children had their own bedroom, all had their own bed and no children had a large sleep problem, based on pre-interview questionnaire responses.

Table 12. Household Characteristics Based on Pre-interview Questionnaires, Reported by Maternal Ethnicity

	Māori mothers n = 15	Non- Māori mothers n = 16	n	Māori versus non- Māori mothers p
Maternal age in years (mean [SD])	32.7 (5.8)	38.1 (5.5)	31	.01
Maternal age range (years)	20 - 42	27 - 46	31	
Maternal SEP based on NZiDep scores (n [%])				.87
High SEP (NZiDep 1 - 2)	8 (53%)	9 (56%)	17	
Low SEP (NZiDep 3 - 5)	7 (47%)	7 (44%)	14	
Child gender (n [%])				.87
Female	8 (53%)	9 (56%)	17	
Male	7 (47%)	7 (44%)	14	
People living in home (mdn [range])	4 (2 - 6)	4 (3 - 5)	31	.83
Number of older siblings (n [%])				.04
0	9 (60%)	6 (38%)	15	
1	3 (20%)	9 (56%)	12	
2	3 (20%)	0 (0%)	3	
Missing data	0 (0%)	1 (6%)	1	
Number of younger siblings (n [%])				.26
0	5 (33%)	8 (50%)	13	
1	8 (53%)	8 (50%)	16	
2	2 (13%)	0 (0%)	2	
Number of bedrooms (mdn [range])	3 (2 - 5)	3 (2 - 7)	31	.57
Number of children shares a bedroom with (n [%])				.37
0	9 (60%)	12 (75%)	21	
1	6 (40%)	4 (25%)	10	

Note. SEP = socioeconomic position. High SEP group includes 2 women (1 Māori, 1 non-Māori) who had NZiDep scores of 1 (no deprivation characteristics) in Age 3 questionnaires and increased NZiDep scores of 2 (1 deprivation characteristic) in pre-interview questionnaires. Univariate comparisons: Independent *t*-test for comparison of means, Mann-Whitney *U* test for comparison of medians and Pearson chi-square for comparison of proportions.

6.1.4 Results

Four themes were identified: child happiness and health; maternal wellbeing; comfort and connection; and family functioning and harmony.

Theme: Child happiness and health

This theme centred around mothers' experiences of how sleep made a difference to their preschool-aged children's mental and physical health and wellbeing. Most mothers, across the sample, observed direct connections between sleep and children's subsequent waking functioning. When children obtained sufficient, good quality sleep, mothers described positive flow on effects on preschoolers' mood, behaviour and attention, with children being "happy", "easier to deal with", "focussed" and having energy and enthusiasm to engage in daily activities.

I know he has a good sleep and that he wakes up ready, energised for the next day.

Māori māmā, low SEP

This morning he has been in a great mood because he's had lots of sleep. And lots of good quality sleep.

Non-Māori mother, high SEP

Conversely, almost all women talked about how poor sleep negatively influenced their preschooler's mood and behaviour. When children had not had enough sleep, or had not "slept well", mothers described children being "grumpy", "cranky", "tearful", "fragile", "clingy", impatient, pushing boundaries or having difficulties sitting still. This meant that children were less able to successfully navigate their way through the day, compared to how they would normally.

For (*Moe Kura* child) it is really important because I notice her mood and the anxious tendencies really do come through if she hasn't had a good night's sleep. Like last night she didn't get to sleep until around 9ish and this morning everything's hard. She's got no patience. . . . She finds it really hard when she hasn't had a good night's sleep.

Māori māmā, low SEP

Fewer mothers spoke about the influence that sleep had on their child's physical wellbeing. Those that did described their child looking better when they slept well and of sleep being important for children's growth. Conversely, when children were very tired mothers observed that they lost their appetite at night and were more likely to get sick.

I know once they are run down with tiredness they can get sick. . . . Their body gives you signs that they are not sleeping well or they need more rest.

Māori māmā, high SEP

Theme: Maternal wellbeing

The core concept of this theme was that preschoolers' sleep impacted mothers' own mental and physical health, sleep and daytime functioning. Positively, across the sample, many mothers felt good about their child's sleep. Women felt "proud" and experienced a sense of achievement, relief and satisfaction with how their preschooler was currently sleeping, often in contrast to how they slept when younger.

Now he's older and sleeps through the night I love it. And it makes me feel better too that he's actually sleeping properly. And I'm sleeping properly.

Māori māmā, low SEP

For a number of women, this meant now getting enough undisturbed sleep themselves, which enhanced their ability to cope with day-to-day challenges, manage stress levels and maintain perspective.

I don't really have too many complaints about the way he's sleeping at the moment. I feel like I can actually handle things. So a lot of the time I'd just wake up and I'd be stressed out because I'd been up so early and the kids could do one little thing and I'm stressing about it. But now I just let the smaller things go easier.

Non-Māori mother, low SEP

For many women, motherhood meant a permanent change to the quantity and/or quality of their own sleep. Mothers described their sleep as having "never been the same" since having children, being more vigilant during the night and therefore "sleeping more lightly", and adapting to a new version of normal sleep.

Before I had (*Moe Kura* child) I liked to sleep all the time, I could sleep my life away. I'd need at least nine hours of sleep a day, but now everything has changed. Because of her my body has kind of adapted to about seven hours. I find that if I sleep any more I just feel more tired during the day.

Māori māmā, high SEP

Negatively, issues with children's sleep, such as bedtime delays and night waking, could place mothers under a great deal of emotional strain and result in fatigue and negative mood. Women across the sample described feeling "tired", "knackered", "angry", "irritable" or "grumpy" and some felt worried about the impact that poor sleep was having on their child.

She'll be in and out of bed because I think she knows (husband) is going to work, so she's in and out all the time which drives me nuts. I'm just like . . . go to bed . . . go to sleep. Yeah I really can't be bothered.

Māori māmā, low SEP

I'm angry. I'm tired. Yeah there's issues there. It definitely does [impact me]. And I do get to the point where I worry. He needs sleep. And he needs good sleep.

Non-Māori mother, low SEP

A number of mothers also described negative experiences of people telling them to do things differently in relation to their child's sleep. Some felt judged or misunderstood by family or friends, due to differing views on where children should sleep or how sleep should be supported.

I remember putting a Facebook status up (about *Moe Kura* child's sleep) then my mum friends gave me some pointers and most of them were really preaching about routines and stuff like that.

Māori māmā, low SEP

We're in a bedroom next to her, much smaller [than child's bedroom] but still quite big enough. So yes, that was met with lots of looks of disapproval from [our] parents, that we should have that room. Why? I mean, we just sleep in it.

Non-Māori mother, low SEP

Some Māori mothers raised the importance of preschoolers sleeping well for managing their own health conditions.

I have chronic fatigue, so the overflow for me is that it really impacts on my own health and wellbeing. Usually (partner)'s the one that gets up but I do find that the

longer (*Moe Kura* child) stays up, because I really need that time at the end of the day to unwind in order for me to go to sleep, if there's that kind of to-ing and fro-ing, it really does flow onto me and my own wellbeing as well.

Māori māmā, low SEP

A number of women with high SEP placed importance on children sleeping well so that they could function at work and cope with workplace stressors.

I have a high stress job and I need to be on my game because I'm only there 30 hours a week, so yes, sleep is just everything.

Non-Māori mother, high SEP

Bed sharing, in relation to maternal wellbeing, was viewed both positively and negatively. Many women saw bed sharing as beneficial, in that it was a practical way of getting the sleep that they, and their children, needed to be able to function well.

He goes to sleep in his own bed but doesn't stay in [it]. He wakes up anywhere normally between 12 and 2am. And we're at the stage now where he just comes into our bed and goes back to sleep straight away. So that's easy. . . . I don't see it as a problem. . . . We ended up bringing him into our bed somewhere between 9 to 12 months, because I was at the stage where I was tired and was going back to work and I needed to get sleep. So it just got easier when he was able to do it himself.

Non-Māori mother, high SEP

In contrast, some mothers did not view bed sharing favourably and actively chose not to bed share as a way of managing their own wellbeing including having enough sleep and personal space.

We've never let them sleep in our bed. It's never happened. Occasionally in the weekends they'll come in for a cuddle in the mornings but even from the word go they were in their own cots in their own bedrooms so that they know that's their bedrooms. And that's just what we did. Whereas I know people that still can't peel their child off them, but they're managing fine. But this is just the way we work in our household. I need my sleep and my space.

Non-Māori mother, low SEP

Bedtime delays could also impinge on mothers' time for themselves in the evenings, which they felt they needed for their own wellbeing, and when it wasn't obtained could be frustrating.

(*Moe Kura* child's) sleep, it's really important. And as selfish as it is, it's really nice when they go to bed, even though you love spending time with your kids. That evening time, you're really jealous of. If they have one of those nights where it's 9:30 and they can't settle, you start to get pretty frustrated with that. But fortunately we don't get too many.

Non-Māori mother, high SEP

Theme: Comfort and connection

Pivotal to this theme was maternal perceptions of mothers and children connecting emotionally and gaining comfort from sleep-related activities. Routines and rituals at bedtime, such as stories, songs and relaxation techniques, provided an opportunity for mothers and children to emotionally connect with each other.

Many mothers reported preschoolers experiencing periodic bad dreams and of supporting children via physical and emotional comfort during the night.

About a fortnight ago he was having bad dreams and waking at about 3 or 4 in the morning worried about something, but then he's very settled following. He'll cry out and either I go in there or he comes in, however aware of it and deep in sleep I am I suppose. And we just have a chat about it and a cuddle and I just sit with him until he calms down again and goes to sleep.

Non-Māori mother, high SEP

Children needing comfort, and wanting to reconnect emotionally and physically with parents after having been independent during the day, was perceived by mothers as being intertwined with preschoolers changing sleeping locations throughout the night, calling out for assistance, or preferring to bed share.

She's really independent otherwise. But bedtime, when she does sleep with me, she has to be touching my face or she has to be touching me, which can be a little bit frustrating. But sometimes it's nice to see that she likes that comfort. . . . So it's that whole comfort thing.

Māori māmā, high SEP

She is well able to take care of herself, but she is also very touchy feely and loves being cuddled. With regards to sleeping, she's been the one that has been hardest to let go of co-sleeping.

Non-Māori mother, low SEP

Many women talked of sleeping with their children specifically when they were sick, not only to monitor their physical health but to provide emotional comfort.

Just when he is sick, he sleeps with me. It's not so much he doesn't sleep, it's the fact that he wants comfort.

Māori māmā, low SEP

A number of women also described gaining comfort themselves from sleeping with their preschoolers.

Yeah well I guess it (bed sharing) will end when I sever it completely, but I get comfort out of it as well.

Māori māmā, high SEP

A sense of family connection and comfort was incorporated in the accounts of a number of Māori women, who described their preschooler enjoying sleeping with grandparents on a regular basis, and who reflected positively on themselves or their partners having slept with their own parents as children.

On the weekends she's allowed to sleep with me. . . . I slept with my Dad until I was about 11 and so my husband always says "you know she might end up" and I said well I don't care because I did it and there's something about sleeping with parents that is soothing. So I think she gets that as well.

Māori māmā, high SEP

Theme: Family functioning and harmony

Central to this theme was how preschoolers' sleep could influence family members' functioning and the general equilibrium of families, as well as inter-connections between family members in relation to sleep and wellbeing.

A number of mothers perceived children's sleep as affecting fathers' functioning differently from their own.

I think (father) struggles because he's always saying "I haven't had enough sleep". I can go on little sleep so it doesn't actually worry me, but he's always the one complaining about it. "Why can't you boys sleep in?"

Māori māmā, high SEP

Some women described their child coming into their bed to sleep at night resulting in their partner moving to a different room to sleep, or having a negative impact on their relationship with their partner.

For your own relationship [with partner], at some point your child's got to move out of your bed into their own.

Māori māmā, high SEP

Mothers also acknowledged that it was not just their preschooler's sleep that impacted family functioning. Other factors, such as sleep behaviours of other children or fathers' work patterns, could also influence the wellbeing of family members.

(Husband) works nights at the moment. . . In the weekends he sometimes works extra days, so he's gone to work at six this morning. It disrupts the whole house. No one sleeps, it's just awful.

Māori māmā, low SEP

While sleep and family life was complex, preschool-aged children sleeping well, in whichever form that that took for families, was viewed by mothers as equating to less stress, more positive social interactions and harmony within homes. In contrast, poor sleep could lead to friction and disharmony between family members.

And so it's kind of harmony, I guess is the word. Their sleep means more harmony and probably for us too. I'm quite a night person so it's very easy for me to get to 11 or 12 at night and go "ah, (*Moe Kura* child) and (older sibling) are going to wake me up at 6, 6:30 in the morning". And so if you get a few days like that, we find that's when everyone gets tired and fractious. But if we manage to keep our sleep

patterns pretty OK, and the kids do, then it does make a big difference to the household I think.

Non-Māori mother, high SEP

6.1.5 Discussion

This is the first qualitative study to explore how preschooler sleep is perceived and experienced by Māori and non-Māori mothers, with low and high SEP, in NZ. A strength of our research was the examination of non-problematic preschooler sleep, which uncovered a number of positive impacts ranging from the individual child to the wider family, that were incorporated in the four identified themes. Aspects of what was considered by mothers to be healthy sleep included preschoolers obtaining sufficient, good quality sleep at times, and in locations, that met children's and mothers' needs, aligned with parents' sleep-related views, and which enabled children and their families to function well during the day.

Across this diverse sample, sleep was valued by mothers for the wellbeing of their children, families and themselves. This is consistent with the concept of sleep health, which has been described as "a multidimensional pattern of sleep-wakefulness, adapted to individual, social, and environmental demands, that promotes physical and mental wellbeing" (Buysse, 2014, p.12). Sleep health is more than simply the absence of problematic or insufficient sleep, and focuses on the positive role of sleep in wellbeing. Our findings demonstrate how good preschooler sleep health is perceived by mothers as promoting not only individual child wellbeing, but that of the family as a whole. These results indicate that preschooler sleep health initiatives that meet the needs of Māori and families with low SEP, who are disproportionately impacted by poor health in NZ society (Ministry of Health, 2013, 2015), should therefore be prioritised.

Mothers shared similar experiences of positive, downstream impacts of good sleep health on their preschool-aged child's wellbeing. Mothers' views of sleep aiding children's physical growth and development, and preventing illness, are supported by research. Sleep plays a critical role in growth, with the secretion of growth hormone during slow wave sleep early in the night (Wyatt, 2014), and supports immune functioning in adults (Bryant, Trinder, & Curtis, 2004). In regards to children's mental health and wellbeing, mothers observed a raft of positive social, emotional and behavioural outcomes when preschoolers slept well. This is consistent with findings from a recent systematic literature review in which greater sleep quantity and quality of preschoolers was associated with better cognitive and behavioural outcomes, including internalising and externalising behaviours, attention and hyperactivity behaviours and peer social relationships (Reynaud et al., 2018).

Such positive physical and mental health impacts may be particularly important for preschoolers approaching school age, which in NZ commences when the child turns 5. Transitioning to school requires children to engage in social interactions, focus on tasks and sustain energy to endure the school day, all of which were incorporated in mothers' experiences of healthy preschooler sleep in our study. Good sleep health is therefore likely to be advantageous when settling into school, in contrast to sleep problems across the school transition period which are associated with poorer behaviour and learning outcomes for children (Quach et al., 2009).

Some women perceived their child as being independent during the day and needing to reconnect emotionally and physically with parents at night. These observations align with psychosocial development in the preschool years, typified by an increasing sense of independence and self-sufficiency, combined with a need for ongoing dependency on adults for emotional support and guidance (Puckett & Black, 2007), and illustrate a

potential inter-relationship between children's sleep behaviour and development. Our findings provide insight into the maternally perceived motivation behind some children wanting to bed share with, or seek assistance during the night from, parents, consistent with a study of night waking behaviours in preschoolers that found comfort to be the most common request when children woke during the night (Coulombe & Reid, 2014).

For many women, comforting preschoolers during the night when they awoke, and bedtime routines and rituals, involved positive social interactions and fostered a sense of connection with their children. These maternal experiences not only support previous research demonstrating that children's attachment and emotional security in parent-child relationships play an important role in supporting children's sleep (P. Keller & El-Sheikh, 2011; Vaughn et al., 2011), but also indicate that sleep-related activities can provide opportunities for mothers and children to connect emotionally and may play a role in mother-child relationship strengthening.

Across the sample, mothers perceived healthy preschooler sleep as having a positive impact on child wellbeing, mother-child connections, their own mental health, energy and ability to cope with parenting and work roles, and family-wide social interactions. These results suggest that child sleep health may have a role to play in family resilience, which is the ability of families to adapt positively to, and thrive in the face of, adversity (Walsh, 2003). Factors shown to contribute to family resilience include family connectedness, cohesion, strong emotional bonds, positive outlooks, and coping behaviours (Mackay, 2003; Walsh, 2003), elements of which were incorporated in mothers' reported experiences of good preschooler sleep health. Future research is warranted to examine this potential relationship.

Conversely, poor preschooler sleep health was perceived by mothers as negatively influencing multiple aspects of child and family wellbeing, again with many experiences

being shared by mothers across the diverse sample. Consistent with previous reports, insufficient or disturbed sleep manifested itself in a raft of ways for preschoolers, including irritability, tearfulness, short temper, poor concentration, hyperactivity and clinginess (Mindell & Owens, 2015). A number of women commented on a change in children's waking behaviour when they had not slept well, indicating a direct influence of poor sleep on children's behaviour, as opposed to behavioural difficulties being related to temperament.

Preschoolers' resulting negative mood and behaviour at times translated into maternally perceived family stress and conflict. In addition, night wakings and bedtime delays sometimes disrupted mothers' sleep, negatively impacted mothers' mood and impaired women's ability to cope during the day. The influence that preschooler sleep had on multiple aspects of family wellbeing is consistent with findings of Smith et al. (2017), and previous research linking child sleep disturbance with poor maternal sleep quality, and associated low mood and stress (Meltzer & Mindell, 2007).

Some mothers in our study felt judged by family and friends in relation to how and where their children slept. Our findings add to those of a recent qualitative study in the UK, in which parents of young children also described feeling judged by others about sleep (Hatton & Gardani, 2018). Given the negative impacts of problematic preschooler sleep on maternal wellbeing that we and others have found, this highlights the importance of clinicians, health promoters and public health professionals addressing sleep problems, and providing support for children's sleep health, in a non-judgemental way so as not to further burden or blame mothers (D. Jackson & Mannix, 2004). Our findings also point to a maternal perception of a society where mothers are responsible for 'making' their child sleep in a certain way and are to blame when children's sleep does not meet those expectations, which warrants further investigation.

A number of women described their sleep as having significantly changed since motherhood, which aligns with experiences of Italian women in caregiving roles who reported altered sleep patterns and quality that persisted beyond providing family members with care (Bianchera & Arber, 2007). In some instances, women had other children that were younger than their *Moe Kura* child, which may explain their current state of sleep, but this was not always the case. While this wasn't necessarily viewed negatively, it does raise the question of when, or if, mothers' sleep returns to that experienced pre-children, and what this may mean for women over time. Our findings also raise questions about the potential gendered nature of the impact of preschoolers' sleep on parents' sleep within families (Zarhin, 2016). Specifically, whether or not fathers' sleep changes mirror those of mothers warrants investigation, as do maternal perceptions of fathers coping differently with disrupted sleep.

Many experiences were shared by mothers, however some perspectives differed. Bed sharing, in particular, was viewed in diverse ways. Most children had their own bedroom and all children had their own bed, consistent with previously reported sleeping arrangements of preschoolers in Australia and NZ (n=286; 81.1% own room, 92.0% own bed) (Mindell et al., 2013). However, a number of preschoolers shared a bed with parents sometimes. Many women viewed this as a practical way of everyone in the house getting the sleep that they needed, while meeting children's emotional needs in a method aligned with their parenting style. Similarly, in Sweden bed sharing is common and positively perceived by parents as a way of providing children with security, safety and comfort (Welles-Nystrom, 2005). In contrast, women's negative experiences of bed sharing included strain on personal relationships, disrupted sleep, tiredness and difficulties coping during the day, consistent with negative impacts of problematic preschooler sleep reported by Smith et al. (2017).

Parenting practices are influenced by parents' own experiences and beliefs. Women's views on sleep, and sleep practices, were in line with broader paradigms of wellbeing. For example, a number of Māori mothers reflected positively on having bed shared with parents as children and of their preschoolers sleeping with grandparents, and made connections between children's sleep and their own health. This is consistent with some Māori models of health which are holistic in nature and emphasise, amongst other things, connectedness and interdependence (Durie, 1998; Rochford, 2004). Conversely, the view of bed sharing impinging on personal space and deterring children's autonomy, is consistent with some Western models of sleep and health that place importance on separate sleeping spaces and child independence (M. Keller & Goldberg, 2004).

One interpretation of our diverse findings is that there is no one 'right' or 'wrong' view or approach to preschooler sleep, however it is a mother's degree of autonomy that influences her experience. For example, mothers in our study who were in a position to actively choose to bed share (or not), and who were supported with that choice, had positive experiences. In contrast, when bed sharing was reactive, due to children's difficulties initiating or maintaining sleep, or was misaligned with parental or wider family beliefs, it was experienced negatively by mothers (M. Keller & Goldberg, 2004).

Preschooler sleep issues negatively affected many women in our study with both high and low SEP, and some reports of women with low SEP highlighted the significant burden this could place on mothers. While we do not suggest that the experience of women with high SEP is any less distressing, one interpretation of our findings is that wider socioeconomic factors may play a role in mothers' experiences of sleep. Poor preschooler sleep may potentially compound the stress of economic and material hardship that is already experienced by mothers with low SEP (Masarik & Conger, 2017). Whether healthy preschooler sleep can act as a protective factor by mitigating the impact of financial and

social pressure on mothers and children in low SEP families or, alternatively, whether addressing the societal drivers of low maternal SEP lessens the burden of children's sleep disturbance on mothers requires investigation.

Our study has several limitations which need noting. The study sample was restricted to one urban geographical area, so may not reflect experiences of mothers in other locations or rural settings. The majority of mothers interviewed had more than one child, and therefore we were unable to disentangle the impacts of preschoolers' sleep versus siblings' sleep on parents, although this in itself highlights the inter-connected nature of sleep in families. According to pre-interview questionnaire data, no preschooler had a large sleep problem, and the impacts of sleep problems reported by these mothers may not be generalisable to families with children who have more severe sleep difficulties. Women with high SEP were more likely to participate and made up a greater proportion of the study sample, which may have influenced results. As in any experiential study, our findings are based on mothers' words as experiences which places limitations on our understanding of women's actual lived experiences. Maternal reports of experiences of children and other family members must also be recognised as mothers' perceptions and not family members' lived experiences. We also recognise a potential power imbalance between the researcher "expert" who conducted the interviews and mothers who were interviewees, and acknowledge that her identity as non-Māori, her research knowledge, parenting views and personal experiences may have influenced data collection and analytical interpretations. Similarly, we recognise that the identity, experience and views of all authors may have influenced the interpretation of data.

Keeping these limitations in mind, our study provides insights into maternal perceptions of preschooler sleep health, highlighting a multitude of downstream impacts of sleep and factors at many levels that influence how sleep is perceived and experienced by families.

Our findings indicate that good preschooler sleep health is valued by Māori and non-Māori mothers living in diverse socioeconomic circumstances, and may have a protective role to play for the health, and potentially resilience, of children and their families. Conversely, poor preschooler sleep can negatively influence family wellbeing. Given the current sleep and health inequities that exist in NZ, these findings provide support for prioritising preschooler sleep health programmes that meet the needs of Māori and families with low SEP. Overall, our results indicate that preschooler sleep health initiatives need to consider children's sleep within social contexts, be responsive to families' views and experiences of sleep and tackle societal drivers of more negative experiences of preschoolers' sleep.

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Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest.

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CHAPTER 7 QUALITATIVE STUDY RESULTS: FACILITATORS AND BARRIERS TO PRESCHOOLERS' SLEEP

Women's accounts in the qualitative study not only illuminated the meaning and value of preschoolers' sleep within families, as outlined in the previous chapter, but also provided rich data on an array of factors that made it easier or more difficult for preschoolers to sleep well. This chapter presents and discusses findings on facilitators and barriers to preschoolers' sleep, in the form of a journal manuscript provided below. Qualitative study results from the preceding and current chapter were also disseminated to participants as a summary brochure that the researcher prepared (Appendix 31). This chapter concludes with a personal reflexive statement about the qualitative study.

The following manuscript was prepared by the researcher (Appendix 32) and has been accepted for publication in the journal *Sleep Health*. Approval has been given by the journal's editor-in-chief to include the manuscript in this thesis (Appendix 33).

7.1 “We’re doing the best job we can”: Maternal experiences of facilitators and barriers to preschoolers sleeping well in Aotearoa/New Zealand

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7.1.1 Abstract

Objectives: This study considered sleep from a social determinants of health and socioecological perspective. It aimed to explore facilitators and barriers to 4-year-old children sleeping well, as experienced by Māori and non-Māori mothers, with low and high socioeconomic position (SEP), in Aotearoa/New Zealand.

Design: Experiential qualitative research involving face-to-face, semi-structured individual interviews.

Participants: Fifteen Māori (low SEP = 7; high SEP = 8) and 16 non-Māori (low SEP = 7; high SEP = 9) mothers of preschoolers.

Measurements: Interviews were guided by questions about how preschoolers slept and what mothers thought made a difference to their child's sleep. Data were analysed inductively using thematic analysis.

Results: Four themes were identified – “health, activity and diet”, “sleep promoting physical environments”, “consistency” and “doing it our way”. Children being healthy and active, sleep conducive bedroom spaces, consistent routines and supportive social environments assisted preschoolers to sleep well. However, broader contextual factors beyond mothers' control influenced the degree of autonomy they had over implementing sleep supporting strategies that worked for their families. External influences included access to financial resources, parental work patterns, early childhood education service practices, access to quality housing, and affordable, culturally responsive and respectful professional sleep advice.

Conclusion: Efforts aimed at facilitating healthy sleep among preschoolers and effective preschooler sleep interventions must go beyond simply recommending individual-

focussed sleep promoting tips, to include actions on the social determinants of sleep and the socio-political drivers that influence these.

Key words: preschooler sleep, qualitative, Māori, socioeconomic position, autonomy, social determinants

7.1.2 Introduction

Sleep plays a fundamental role in young children's health, development and behaviour (El-Sheikh & Sadeh, 2015; Mindell & Owens, 2015; Reynaud et al., 2018). Longitudinally, short sleep duration in childhood has been associated with increased odds of overweight and obesity in later childhood and adulthood (L. Magee & Hale, 2012). Sleep problems are common in the preschool years (Hiscock et al., 2007; Petit et al., 2007; Steinsbekk et al., 2013) and may persist if left unaddressed (Mindell & Owens, 2015; K. Williams et al., 2017). Therefore, supporting preschoolers to sleep well is important for preventing potential sleep and health problems across the life course.

Children from minoritised racial/ethnic groups and those who occupy low socioeconomic position (SEP) are more likely to experience poorer sleep health than children from dominant racial/ethnic groups or those with high socioeconomic status (L. Hale, Parente, et al., 2013; Pena et al., 2016). A qualitative study of predominantly low income Latino parents of preschool-aged children (n=18) found that although most parents implemented sleep supporting bedtime routines, a number of environmental barriers to children sleeping well were experienced, including crowded housing, disruptive parental work patterns, and noisy and unsafe neighbourhoods (Martinez & Thompson-Lastad, 2015). One fifth (20%) of preschoolers from low income families in the United States (n=33; 52% Black, 39% White, 9% Other) slept in suboptimal environments that were too loud, bright, hot or cold, at least 1 to 2 nights per week, which were associated with shorter sleep

durations and later sleep onset times (Wilson et al., 2014). To understand how best to support preschoolers' sleep, and to address sleep inequities, children's environments and socioeconomic factors contributing to these environments must therefore be taken into account.

This study considers sleep from a social determinants of health (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010) and associated socioecological (Grandner, 2017; C. Jackson et al., 2015) perspective. Thus, preschooler sleep is viewed as being situated within interconnected contextual levels ranging from the family home (e.g. physical housing, family social relationships) and community (e.g. social networks, neighbourhoods) through to the broader societal context (e.g. economic and political systems and policies, institutional racism). Aotearoa/New Zealand (NZ) has a history of colonisation, resulting in Māori (indigenous people of NZ) being disproportionately represented in the most socioeconomically deprived neighbourhoods (Atkinson et al., 2014) and having poorer child and adult health than non-Māori (Ministry of Health, 2015; Simpson et al., 2017).

There is a dearth of research on families' experiences of factors that support or inhibit preschoolers sleeping well in NZ. Whether patterns of experience differ by ethnicity and socioeconomic position is unclear. Addressing this knowledge gap is important for informing public health and clinical sleep initiatives to support all preschoolers to sleep well and to help prevent ethnic and socioeconomic sleep inequities. Taking a novel approach to preschoolers' sleep, this study aimed to explore facilitators and barriers to preschool-aged children sleeping well, as experienced by Māori and non-Māori mothers, with low and high SEP.

7.1.3 Methods

Ethical approval was granted by the New Zealand Central Health and Disability Ethics committee (CEN/09/09/070/AM05). This study is embedded in a wider research programme including the *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura)* study, which is guided by Kaupapa Māori research principles (Paine et al., 2013). Among other things, this indigenous approach to research centralises and prioritises Māori needs and aspirations for health research, and aims for equal explanatory power via equal numbers of Māori and non-Māori participants and analysis of data from Māori to the same breadth and depth as for non-Māori (Te Ropu Rangahau Hauora a Eru Pomare, 2002). The Kaupapa Māori approach used in this study purposely rejected ‘victim-blaming’ and instead prioritised a structural analysis of the data.

7.1.3.1 Recruitment

Data were collected from a sub-sample of women who had previously completed *Moe Kura* questionnaires when their child was 3 to 4 years old. The current study aimed to recruit a purposive sample of up to 16 Māori and 16 non-Māori women, with low and high SEP, whose *Moe Kura* children were aged 4 and who lived in the Wellington region of NZ. Sample size estimates were based on guidelines for experiential qualitative interview research (Braun & Clarke, 2013) and resource constraints, while recognising that data saturation may be reached with fewer participants depending on the richness of the interview data (Fusch & Ness, 2015; Patton, 2015). The decision to recruit equal numbers of Māori and non-Māori mothers was driven by the Kaupapa Māori framework of the broader research programme (Paine et al., 2013). The aim to recruit mothers with both low and high SEP was to enable the exploration of sleep experiences within a range of socioeconomic environments.

Maternal ethnicity was based on women's *Moe Kura* questionnaire responses to the 2006 New Zealand Census ethnicity question (Statistics New Zealand, 2006). Women who selected Māori with or without other ethnic groups were categorised as 'Māori' and all others as 'non-Māori' (Ministry of Health, 2004). SEP was based on New Zealand Individual Deprivation Index scores (NZiDep; Salmond, Crampton, King, & Waldegrave, 2006) recorded in *Moe Kura* questionnaires. NZiDep is an individual-level SEP measure based on 8 deprivation characteristics experienced in the past year. To identify potential participants, scores of 1 (0 deprivation characteristics reported) were categorised as 'high SEP' and scores of 3 – 5 (2 – 8 deprivation characteristics) as 'low SEP'.

Study packs were sent in chronological order, with mothers of children approaching their fifth birthday being posted packs first. Packs contained an invitation letter, information sheet and consent form. All invited women were provided with the option of being interviewed by the lead researcher (DM) who is NZ European/Pākehā (non-Māori) or a Māori member of the study team. Simultaneous recruitment and data collection started in August 2015 and finished in February 2016, at which point no new concepts were raised in interviews.

7.1.3.2 Procedures

Face-to-face, semi-structured individual interviews were conducted by DM and audio recorded. One participant requested to be interviewed by a Māori researcher; however, because of time availability, she subsequently opted to be interviewed by DM. Women were given a \$20 gift voucher, stickers and a picture book for their child, and a packet of cookies in appreciation of their participation. Each mother completed a brief questionnaire about herself (ethnicity, education, NZiDep), her *Moe Kura* child (age, sex, ethnicity), her household (membership, number of bedrooms), her preschooler's sleep environment (bed or bedroom sharing) and potential sleep problems ('how much of a

problem for you is the time it takes your child to fall asleep?', 'how much of a problem for you is your child's sleeping patterns or habits?': no problem/small problem/moderate problem/large problem).

To facilitate maternal-led discussion, an interview guide was used (Appendix 10) which included the questions: 'how would you describe (*Moe Kura* child's sleep)?' and 'what do you think makes a difference to (*Moe Kura* child's) sleep?' Interviews took approximately half an hour. Notes were made during each interview and, once completed, more detailed field notes and reflections were documented by DM. A formal reflexivity statement was prepared at the completion of the interviews (not shown).

7.1.3.3 Data analysis

Descriptive statistics of pre-interview questionnaire data were produced using IBM SPSS software (version 23.0). A professional service transcribed interviews verbatim and DM checked, amended, and de-identified transcripts. Women were offered the option of receiving a copy of their transcript, either as a personal record or to provide feedback. Less than half of participants requested copies (Māori=7, non-Māori=6) and none returned comments.

DM analysed interview data using Braun and Clarke's method of thematic analysis, which is a 6-phase iterative process (Braun & Clarke, 2013). After checked transcripts were reread and field notes and reflections reviewed, complete coding was conducted in nVivo software (version 11). Codes were generated based on text content relevant to the study's aims and data excerpts pertaining to each code were collated. Mind maps of codes were created to identify patterns across the dataset, which DM reviewed with the authors and an independent qualitative researcher. Candidate themes, consisting of groups of codes that shared a central organising concept, were developed and thematic maps of candidate

themes were drafted. The study's theoretical view of sleep (Grandner, 2017; L. Hale & Hale, 2010; Howden-Chapman & Tobias, 2000; C. Jackson et al., 2015; Solar & Irwin, 2010) informed analyses, whereby the focus was on factors influencing child sleep at multiple contextual levels. Authors discussed and reviewed the candidate themes, which informed theme refinement by DM. The final phase was writing the manuscript, which included selecting data excerpts to illustrate themes. Research rigour was ensured by using this systematic, iterative, and reflexive method of analysis (Braun & Clarke, 2013).

7.1.4 Results

Response rates were 47% for Māori women with low SEP, 62% for Māori women with high SEP, 50% for non-Māori women with low SEP and 82% for non-Māori women with high SEP.

7.1.4.1 Participant characteristics

Characteristics of the women who were interviewed, and their *Moe Kura* child, are summarised in Table 13. On average, Māori mothers were younger than non-Māori mothers and all women had some form of educational qualification. The majority of women lived with a partner (73% Māori, 88% non-Māori; no same-sex partners) and 3 Māori women lived with at least one of their preschooler's grandparents.

Table 13. Demographic, Child Sleep and Household Characteristics of the Sample Based on Pre-Interview Questionnaires, Reported by Maternal Ethnicity

	Māori mothers n = 15	Non-Māori mothers n = 16	Māori versus Non-Māori ^a <i>p</i>
Maternal demographic characteristics:			
Age in years (mean [SD])	32.7 (5.8)	38.1 (5.5)	.01
Age in years (range)	20 - 42	27 - 46	
SEP based on NZiDep scores (n [%])			.87
High SEP ^b (score 1 - 2)	8 (53%)	9 (56%)	
Low SEP (score 3 - 5)	7 (47%)	7 (44%)	
Highest educational qualification (n [%])			.13
Secondary school qualification	5 (33%)	2 (13%)	
Tertiary qualification	7 (47%)	13 (81%)	
Professional, trade, technical or other	3 (20%)	1 (6%)	
Child demographic and sleep characteristics:			
Child ethnicity (n [%])			<.01
Māori	15 (100%)	1 (6%)	
Non-Māori	0 (0%)	15 (94%)	
Child sex (n [%])			.87
Female	8 (53%)	9 (56%)	
Male	7 (47%)	7 (44%)	
Children that child shares a bedroom with (n [%])			.37
0	9 (60%)	12 (75%)	
1	6 (40%)	4 (25%)	
Time Moe Kura child takes to fall asleep (n [%])			.27
No problem	7 (47%)	12 (75%)	
Small problem	6 (40%)	3 (19%)	
Moderate problem	2 (13%)	1 (6%)	
Large problem	0 (0%)	0 (0%)	
Moe Kura child's sleeping patterns or habits (n [%])			.86
No problem	8 (53%)	8 (50%)	
Small problem	6 (40%)	6 (38%)	
Moderate problem	1 (7%)	2 (13%)	
Large problem	0 (0%)	0 (0%)	
Household characteristics:			
Number of adults living at home (median [range])	2 (1 - 3)	2 (1 - 2)	.54
Number of children living at home (median [range])	2 (1 - 4)	2 (1 - 3)	.67
Number of bedrooms in the home (median [range])	3 (2 - 5)	3 (2 - 7)	.57

^aIndependent *t*-test for comparison of means, Mann-Whitney *U* test for comparison of medians and Pearson chi-square for comparison of proportions between Māori and non-Māori mothers; ^bAll women in the High SEP group had NZiDep scores of 1 at the time of interviews, except for 2 women (1 Māori, 1 non-Māori) who had NZiDep scores of 1 (no deprivation characteristics) in *Moe Kura* questionnaires and increased scores of 2 (1 deprivation characteristic) in pre-interview questionnaires.

All mother-child pairs shared the same Māori/non-Māori ethnic group, except for one dyad consisting of a non-Māori mother and a Māori child. Children were aged 4, except for 2 Māori and 2 non-Māori children who turned 5 the week of interviews. Three quarters (73%) of preschoolers of Māori mothers and half (50%) of preschoolers of non-Māori mothers had at least one younger sibling. All preschoolers had their own beds and the majority had their own bedrooms. In pre-interview questionnaires, no mothers reported that their child had a large sleep problem.

7.1.4.2 Themes

Four themes were identified: “health, activity and diet”; “sleep promoting physical environments”; “consistency”; and “doing it our way”.

Theme: Health, activity and diet

Preschoolers’ health and development influenced their sleep and many mothers used sleep supporting strategies based on activity and diet. Broader contextual influences, including access to financial resources and the role of early childhood education (ECE) services were evident in some accounts (the NZ government funds 20 hours per week of ECE services and Kōhanga Reo total immersion Māori ‘language nests’ for all 3 to 5 year olds).

When preschoolers were physically unwell, or during an exacerbation of a chronic health condition, they experienced difficulties initiating or maintaining sleep.

He has eczema so that has destroyed his sleep a lot. . . . The nights that he has really bad itching he can be up anywhere from 2 to 3 hours scratching and kind of rubbing and dozing off and rubbing again. So he’s just miserable the next day.

Non-Māori mother (nm13), high SEP

Sleep was often facilitated by addressing the health issue, however mothers' abilities to purchase items that supported children's health, and subsequently sleep, varied by SEP. A number of women with high SEP were able to independently purchase sleep supporting products for children, whereas some women with low SEP had restricted purchasing power.

When he was sick I found the one thing that helped the most is one of those [steam] vaporisers. Those are like a gift from God. Every time I hear of someone that's sick I'm like "you need to go and get one", because you can hire them from the pharmacy too. . . . Yeah it's like \$110 or something. His grandparents ended up getting one when he was little, because I was always saying "can you hire it for me, can you hire it for me?"

Māori māmā (m7), low SEP

We've invested in things like a bigger bed so that we can all sleep comfortably and high quality bedding so that the kids don't have the issue with dust mites and that kind of stuff, to try and get that sleep environment really calm and healthy. That has been the key.

Non-Māori mother (nm13), high SEP

Many mothers made the connection between preschoolers sleeping well and being physically active, cognitively stimulated, eating "good", healthy foods and going to bed without feeling hungry. Conversely, insufficient activity, activity too late in the evening, not eating a sufficient dinner, and consuming junk food, sugary foods and drinks were viewed as negatively influencing children's sleep, particularly in relation to difficulties falling asleep.

If she hasn't had enough exercise during the day, it might be half an hour or more where she's going "I can't sleep", calling me back in every 5 minutes and finding every excuse in the book.

Non-Māori mother (nm4), high SEP

Accordingly, many mothers implemented strategies that included regular physical activity, managing the timing of activities to ensure adequate wind down time, healthy diets, healthy bedtime snacks and minimising sugar and junk food. For some families, ECE services played a positive role by providing activities during the day that were mentally stimulating and physically demanding, and, in some instances, promoted healthy eating.

I used to make all of her food from scratch and there were kids coming to Kōhanga [Reo] with bags of lollies and doughnuts and all of this stuff that you wouldn't expect to be feeding to a 2 or 3 year old or even a 4 year old. But then they brought in this healthy food initiative and since then I think the whole Kōhanga has grown. The kids are more focussed. . . . So I think it makes a big difference with sleep, eating the right food.

Māori māmā (m6), high SEP

He sleeps better being out at childcare. If he has a day off . . . he tends to stay up later. He's a bit bored and there's less stimulus during the day and he's not tired out.

Non-Māori mother (nm2), low SEP

Consistent with child sleep development (Mindell & Owens, 2015), many preschoolers experienced night time fears, nightmares and sleep terrors, and across the sample children were at various stages of transitioning out of napping and bedwetting. Although these sleep behaviours were not necessarily modifiable, women implemented strategies to

minimise negative impacts on children, including investing in bedwetting and toilet training products and providing emotional comfort and reassurance.

I don't make him feel bad about it [bed wetting]. I mean, you can't.

Māori māmā (m14), high SEP

Theme: Sleep promoting physical environments

Physical places and spaces where children slept and lived, ranging from bedrooms to wider neighbourhoods, played a role in supporting or inhibiting children sleeping well. Patterns of experiences differed by SEP in relation to the degree of control that some mothers had over bedroom spaces and housing quality, which in turn influenced children's sleep.

Many women described sleep promoting bedrooms as being temperate and including comfortable beds and bedding, comfort objects and lighting that met children's needs, such as a night light to allay fears of the dark.

Now she's got a super duper bed. . . . She's got a lovely nice cushy one. It actually could be improving her sleep. . . . She's got a stinky old caterpillar . . . and she used to suck on its nose when she was little, [there's] something about it. Whenever she's upset or tired, here you go and she's all sorted. . . . I think her room makes it easier for her to sleep because she's got blackout curtains. The only thing is upstairs, the whole hall is like windows so it's still really light. . . . But I think the darker it is the easier it is to get her to sleep, or she stays asleep longer in her room.

Māori māmā (m9), high SEP

Having choice and mastery over their bedroom environment supported some preschoolers' sleep, such as having a say in how their room was decorated or having control over light when they were afraid of the dark.

He likes his room. Once we decided they've got to go into their own rooms, he had more of a say in decorating it. So he's got a Thunderbird poster up and stuff like that. . . . I think he is a good sleeper because he has his own identity in his room and he's having a lot more play dates, so he wants to show kids his room.

Māori māmā (m3), high SEP

A number of mothers had rules around not allowing technology, including televisions and portable screen devices, in children's bedrooms, to support sleep.

She wants to go to bed with the phone, she tries to sneak the phone in there. She will put it in her underwear if she wears a nightie to bed. So the phone would be one [thing that makes sleep difficult], but she is not allowed it because she will stay up until like midnight, just on YouTube watching My Little Pony or something, or Netflix.

Māori māmā (m2), low SEP

There's no electronics upstairs [in the bedrooms].

Non-Māori mother (nm5), low SEP

A number of mothers and children preferred bedroom doors to remain open when children slept, to help maintain contact. Noise was not often reported as being a barrier to sleep and, for some children, a degree of noise created a sense of connection with family, which supported their sleep.

We've got dogs next door and people talking, so they don't seem that bothered by other noise and because it's a relatively small house they can hear if we've got the radio or TV on, or if we're clattering the dishes. It doesn't seem to bother them. . . . They don't like having their door shut. . . . So they kind of like to have the contact, being able to hear that we're there.

Non-Māori mother (nm4), high SEP

Some women with high SEP acknowledged the privilege of being able to provide children with sleep promoting environments, including good quality bedding and warm sleeping spaces, and being able to offer children the choice of having their own bedroom.

We are very fortunate in that respect, that we've got access to good bedding and good pyjamas and heaters and a moderately warm house, even though it's not fully insulated. I don't know how people do it without that.

Non-Māori mother (nm13), high SEP

A number of women with high SEP described having invested in a large parental bed that was big enough for children to sleep in when they wanted to. In contrast, for a number of women with low SEP, limited housing space meant that children did not have the option of having their own bedroom.

Definitely his own room I think would be a big thing [to help sleep]. But I just haven't got that at the moment.

Non-Māori mother (nm2), low SEP

This resulted in some families developing creative solutions to minimise sleep disruptions from siblings sharing a room.

We did have them going to sleep [at the same time] in the same room, but they were just bouncing off each other. So when she's not there (younger sibling) goes to sleep straight away and she's been hanging out in our bedroom and reading and just chilling out in there. [Then we transfer her] when he's calmed down.

Māori māmā (m4), low SEP

For some women with low SEP, poorer quality housing had negative flow on effects to children's health and sleep.

(*Moe Kura* child) had been very sick during the winter, just from a cold house. And it took us about three years for the landlord to actually do something about it. So this winter, he would have had probably two colds out of the whole year which was totally different. We went to the extent of actually finding the information ourselves and handing it to the landlord because it took so long. . . . Well with us it was having a warmer house. I'd say the majority of the time it was warmer to be outside, so we would go out and do the gardening or go out for walks just to keep warm. And they would come home, go to bed, but sort of on and off they would toss and turn. I mean you can put all of the blankets on and think "now I'm hot and now I'm cold". So I'm thankful.

Māori māmā (m11), low SEP

Theme: Consistency

Regular bedtime routines and consistent people in children's lives supported many preschoolers to sleep well, whereas inconsistency created barriers to regular sleep patterns. Family support, financial resources, parental workplaces and ECE environments influenced this.

Most mothers described implementing bedtime routines, often involving dinner in the late afternoon or early evening, playtime, a bath or shower, brushing teeth, songs, prayers and emotional and physical comforting from parents, such as cuddles and kisses. For the majority of families, stories were a regular part of bedtime rituals, which children and parents often enjoyed.

We always read her a story. She chooses stories and you sit and read it to her, which she always really likes.

Non-Māori mother (nm12), low SEP

Consistent and calm routines and environments provided reassurance and security.

It's the same sort of routine I think [that supports his sleep]. And knowing that someone is there, he doesn't like thinking he is alone.

Māori māmā (m3), high SEP

On the other hand, disrupted or delayed routines made it more difficult for many children to sleep.

Routine, routine, yeah definitely routine. Doing the same thing. She is very much a routine sort of a child. And if the routine changes then, even if you stay up a little bit later than normal, that just puts her out of whack.

Māori māmā (m8), high SEP

Some women with low SEP described financial restrictions influencing their options for supporting children's sleep.

We're just trying to figure out another [strategy to help child not wake too early]. There's a clock, it doesn't have numbers, it's got a light and it's got stars and the moon and stuff. So there'd be lots of stars at night time and then over the night

they'd gradually go away and the sun is on it. But they're just really expensive. . . .

So we'll figure something out for him.

Māori māmā (m13), low SEP

[Bedtime routine includes] no bath every night . . . but probably every second night. It is not quite as nice a bathroom as we're used to and we are also trying to save a little bit of money.

Non-Māori mother (nm6), low SEP

Technology use too close to bedtime made it more difficult for preschoolers to wind down and sleep.

If she watches it [TV] before going to sleep it takes a lot longer for her to go to sleep. Where if she watches a bit of TV like ages before and then has time to settle in bed, read a book, sing a song, she goes to bed a lot faster.

Māori māmā (m8), high SEP

To maintain consistency, and minimise sleep disruptions, a number of women had rules around the type, duration and timing of technology use before bedtime.

If I let him play Xbox right before bed then he won't want to go to bed. He's just sort of like wired and he doesn't want to sleep. So I tried to stop that but if he's just watching a movie or something then he's usually fine as long as he can finish the end of it, then he'll happily go to bed afterwards.

Non-Māori mother (nm15), low SEP

Some Māori women received support from their own parents with whom they lived, which helped to maintain their children's sleep/wake routines.

Having the support from Mum and Dad helps with (*Moe Kura* child). To be honest I could not have done it without them.

Māori māmā (m8), high SEP

And, across the sample, a number of women described sharing child sleep-related tasks with their partners, which supported preschoolers' sleep and provided opportunities for mothers to have a break.

We take turns [with the bedtime routine], so we give each other a night off.

Non-Māori mother (nm3), high SEP

People and places outside of the home also influenced sleep. A number of Māori women reported having regular arrangements with extended family to have preschoolers sleep over, which was a positive part of children's sleeping and waking routines.

They usually would spend a night, every week or every fortnight on a Friday night with their grandparents. . . . Yeah, it's great.

Māori māmā (m4), low SEP

A number of women who were sole parents reported disruptions to their preschooler's sleep, and sometimes their own, when children's fathers who were living outside of the home were inconsistently involved or managed sleep differently when children stayed with them.

Every time she comes home from her father's she's always really emotional. Cries all the time and yes I think it's because she's tired. But if I make sure she gets enough sleep she'll be pretty much better. . . . I've noticed that she's always bad when she first gets back from her father's but I don't know what goes on there. I

don't think he puts them to bed very early. And I also know he gives them heaps of lollies and things I don't feed them.

Non-Māori mother (nm9), low SEP

Parents working irregular hours or doing shiftwork made consistent sleep routines challenging.

It's become easier over the years I think, learning tips and strategies to make her bedtime routine better. And it made it a lot easier with me coming off shiftwork. So it was a constant routine that I was losing.

Māori māmā (m8), high SEP

I've found with (*Moe Kura* child) it helps to keep things as regular as possible. I know that there's that ad on TV, the phone ad with the two flight attendants, that says our lives may be chaotic but she's got her routine. Yeah that is basically it. (Husband) and I have our shifts, our working schedule may be all over the place, but these guys can rely on certain things. They have their routines.

Non-Māori mother (nm7), high SEP

When napping policies at ECE were incongruent with children's developmental stage of napping, or nap management at home, issues arose.

[Now] that she's not sleeping during the day it's heaps better, because at daycare they had a compulsory sleep. We stopped the daytime napping in the weekend way before they stopped the daycare naps and they were just very reluctant to, because obviously they had everyone else asleep. But she'd sleep for two hours which meant she was still up at 9.30pm. So now she's in a different (ECE) and they don't sleep. They might have a rest time but it's heaps better. . . . The day sleeping

at (daycare) is probably the thing that was the hardest because it affected how tired she was when we were tired.

Māori māmā (m9), high SEP

On the other hand, consistent approaches to napping at ECE environments and home meant that children's sleep patterns remained stable across the week.

I always make sure they have some down time. . . . If we are out and about I'll make sure they have a video or just some time at home to calm down before we ramp it up again. And they do that at daycare too.

Non-Māori mother (nm5), low SEP

Theme: Doing it our way

This theme centred around women having the confidence, experience, knowledge and support to develop and use strategies to support their preschoolers' sleep in ways that worked for their family, regardless of what others thought. Sleep strategies were often viewed as needing to be fluid over time, to meet children's changing needs.

You just kind of work out what is ok for you and that this is how your family functions and actually this is ok. And we're doing the best job we can and you can't beat yourself up about stuff. . . . I probably wasted more hours not sleeping worrying about what people think rather than actually worrying about the actual issue of sleep because really it's not an issue.

Māori māmā (m9), high SEP

I think the big thing I've learnt about kids' sleep from having your first child and not knowing anything and therefore trying to make sure you are doing the right thing, to having your second child and just being glad when they sleep, is that we don't even care what anyone else thinks anymore. We just do whatever works. . . .

We're conscious that (*Moe Kura* child) should be sleeping in his own bed but at the moment it works for him to sleep with us. . . . So we've got that kind of mentality, this works for us.

Non-Māori mother (nm13), high SEP

Women described gaining confidence over time, often learning from experience with their first child. Many narratives incorporated the importance of recognising and responding to children's needs.

You learn from the first time. You learn a lot more. . . . I think the easiest way for us was their pattern came first so they sort of taught us, like I'm tired or I'm hungry, and we sort of just ran with that. Yeah, I have to teach you but they actually taught us as well.

Māori māmā (m11), low SEP

I think because we've kind of worked with her together, instead of forcing her to sleep in her own bed. She's kind of made those decisions herself.

Non-Māori mother (nm12), low SEP

Some women described framing sleep positively to their children, which supported preschoolers to view sleep favourably and begin to self-manage their sleep and wellbeing.

[If] we've been out in the morning and we're tired she'll often say to me "I need to have a sleep to make me feel better". I told her that when she was younger because when I could tell she was tired and upset I would say "maybe if you have a sleep you'll feel better" and at that time she was having naps regularly so she'd go and have a nap and then she'd wake up and I'd say "how do you feel?" and she goes "I feel much better". And now she knows if she's feeling like that then maybe it means she needs to have a sleep.

Māori māmā (m6), high SEP

Child sleep information and advice came from sources including family, friends and online articles. Some women reflected on having had negative experiences with health professionals when children were babies or toddlers, involving feeling judged, not feeling listened to and being given advice that did not fit with their parenting views, which deterred future help seeking.

I think the only time . . . was in that first year and I think it was part of Plunket [free early childhood health service], they had that sleep training nurse . . . and she visited and it was just a really traumatic experience. She tried to make me put him in the room to cry it out and we sat in the lounge for 40 minutes and he's just screaming in the room, and I felt like, I was crying in the end. And she's like "no you've got to be strong. . . . I bet you when I go he's going to fall asleep" and he didn't. It just didn't work for him, he kept screaming and screaming. . . . It was a nightmare, yeah a bad experience. Well I learnt for next time round for (younger sibling), I'm not going through that again.

Non-Māori mother (nm14), low SEP

And the doctor just said "well you should just do cry it out and I'll give you sleeping tablets" and I kind of looked at her and I walked out. And that's the only time I ever sought [help] and I just dealt [with it]. I did say to her I don't do that and she was like "well I did it with my kids". Yeah she kind of just wasn't really [being] a doctor.

Non-Māori mother (nm12), low SEP

The importance of reducing financial barriers and providing sleep support services with a commitment to Māori were highlighted in views expressed by one Māori mother about participating in the *Moe Kura* study.

I'm not going to pay money to [get advice] and because I thought I was in a study with (*Moe Kura* child) so no, I thought I would ask you guys for advice because it's associated with Māori things.

Māori māmā (m12), low SEP

Drawing on the four themes of our study, Figure 9 depicts a socioecological model of identified factors that contribute toward preschoolers' sleep.

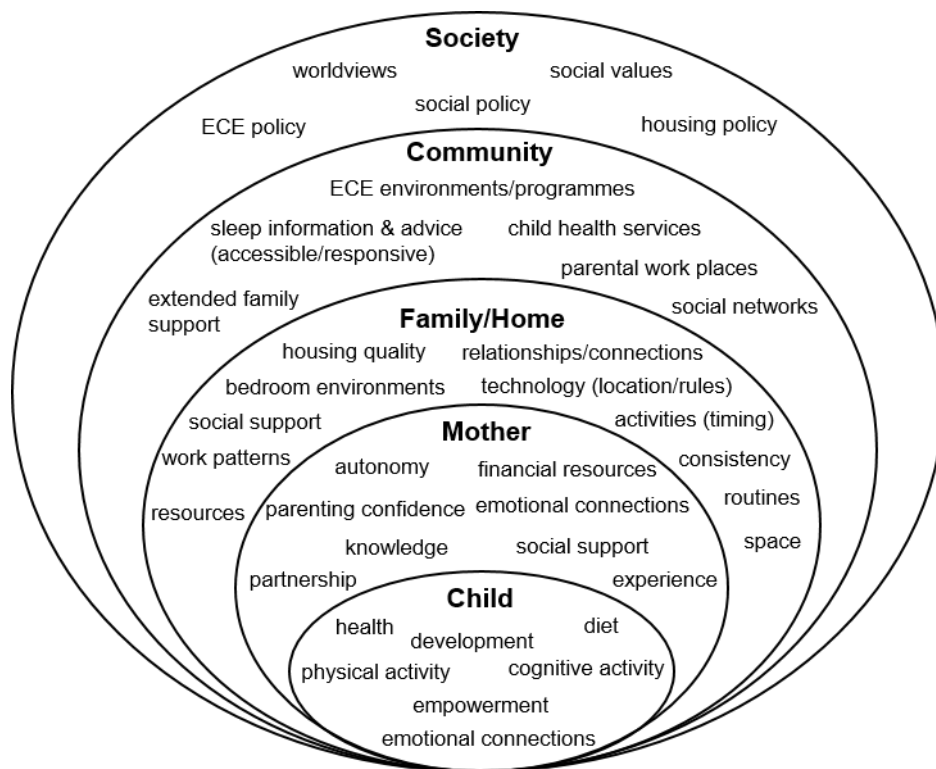


Figure 9. Socioecological model of factors influencing preschoolers' sleep, derived from the four themes of the study and based on socioecological models of sleep by Grandner (2017) and Jackson et al. (2015)

7.1.5 Discussion

This is the first qualitative study to explore mothers' experiences of facilitators and barriers to preschool-aged children sleeping well in NZ. It is novel, in that it provides rich information from indigenous Māori and non-Māori women from both low and high SEP. Patterns of shared experiences in regard to factors that influence sleep at the individual child level were identified across the sample. However, the broader social and built contexts in which children and their families lived, played, learned, worked and connected, impacted preschoolers' sleep as did the degree of autonomy that mothers had over supporting children to sleep well (L. Hale & Hale, 2010). Thus, we add a unique contribution to the literature by elucidating some of the mechanisms through which a mother's position in society can influence her child's sleep.

At the individual-level, mothers' experiences of facilitators to preschoolers' sleep were largely consistent with common sleep supporting recommendations such as physical activity, healthy and caffeine-free diets, consistent bedtime routines and temperate, dark, technology-free, comfortable bedrooms (Allen et al., 2016; Galland & Mitchell, 2010). A novel finding was that for a number of families, a degree of noise was comforting for children and helped them to feel connected to their family and thus sleep better. This highlights some of the nuances around supporting children's sleep, which must be considered when developing sleep health promotion material. It also points to a cross over between the physical and social home environment meeting children's sleep needs.

Poor health had a negative impact on preschoolers initiating or maintaining sleep. Chronic conditions, such as eczema, affected children's and parents' sleep on a regular basis, even when medical treatments and low allergen environments were used, which is consistent with previous research (Camfferman, Kennedy, Gold, Martin, & Lushington, 2010). Our findings highlight the clinical importance of monitoring sleep when treating chronic

paediatric health conditions, which in NZ disproportionately affect Māori children and those from low SEP (Duncanson et al., 2017; Simpson et al., 2017). Addressing the social determinants of health is critical, as children burdened by poor health may also experience poorer sleep.

Support and advice from partners, family and friends, and experience gained over time, enhanced mothers' confidence to support their preschooler's sleep in ways that worked for them and their family. Māori women, in particular, described regular extended family support as having a positive impact on children's sleep and wellbeing, as well as their own. Extending beyond the nuclear family unit, the Māori collective concept of 'whānau' can be viewed and defined in multiple, non-mutually exclusive ways, including shared ancestry (whakapapa whānau) and a group of people with a common purpose (kaupapa whānau) (Lawson-Te Aho, 2010). One interpretation of our findings is that social policy that values, supports and empowers social cohesion and community and family networks, including whānau, is likely to be beneficial for young children's sleep.

A number of mothers supported their preschooler's sleep in a way that empowered their child to drive what they needed to sleep well and to help children at this early age to view sleep as a positive way of managing wellbeing. However, the degree of control that mothers had over supporting their child's sleep varied depending on a number of external factors.

Some sole parenting mothers faced challenges with supporting their children's sleep due to irregular involvement from, and differing approaches to sleep by, children's fathers. Ensuring that fathers and other caregivers have access to information and advice on child sleep may help to minimise sleep disruptions when children sleep across different households. Recognising the additional challenges faced by sole parents is also important when providing clinical advice or sleep health promotion messages, so as not to

inadvertently burden parents with individual-level recommendations which do not take into account the wider social context. Our findings also raise the broader question of how sole parents are viewed in society and what policies and practices can be put in place to better support them.

ECE services that provided physical and cognitively stimulating activities and healthy eating programmes, and implemented flexible napping policies, supported preschoolers to sleep well at home. In keeping with previously reported data (Iglowstein et al., 2003; Weissbluth, 1995), napping patterns of preschoolers ranged from napping at least part of the week to having completely stopped. Consistent with previous research (Sinclair et al., 2016), when naps were enforced at ECE services but had stopped at home, children had difficulties initiating sleep at night which was stressful for families. Our findings indicate the importance of ECE napping policies incorporating flexible approaches to napping, which are responsive to children's individual sleep needs (Staton, Smith, & Thorpe, 2015) and involve good communication between the ECE and family. Ensuring that children's needs are at the centre of decision making around napping and empowering parents/caregivers to drive the process is imperative. Professional development for ECE teachers and support staff that includes sleep health education (Bonuck, Schwartz, & Schechter, 2016) and a review of ECE policies at the national-level is recommended, to ensure preschoolers' sleep needs can be met in a responsive fashion.

Women with high SEP, in particular, were able to invest in child sleep promoting resources, indicating that access to financial resources is, in itself, a facilitator of preschoolers sleeping well. Addressing societal drivers of poverty and income inequities is therefore a vital step in tackling child sleep inequities. In NZ, Māori children and children living in sole parent homes are disproportionately burdened by poverty compared to European/Pākehā children and children living with two parents (Duncanson et al., 2017;

Perry, 2017). Our findings indicate that these children may be disadvantaged in sleep via a lack of financial resources available to their families to provide sleep supporting bedrooms, which in turn may have detrimental impacts on health longer term.

Cold, damp, poorly insulated houses had a direct, detrimental impact on preschoolers' sleep, as well as an indirect influence on sleep via negative impacts on children's health. Limited space also meant that some children did not have the choice of having their own bedroom and experienced sleep disruptions due to sharing rooms with siblings. Targeted financial support for low income families with young children, affordable housing and improved rental housing quality may therefore be ways of supporting the sleep of preschoolers of families with low SEP. In NZ, a rental housing Warrant of Fitness tool has been developed, which assesses housing on 29 quality criteria, in order to address the extant issue of low quality private rental housing (Telfar-Barnard et al., 2017). Findings from the present study indicate that, although not an outcome measure in the Warrant of Fitness trial, young children's sleep may benefit from such a scheme.

Parental shiftwork and inconsistent work patterns also made implementing consistent preschooler sleep routines challenging. Mothers described having to work hard at finding ways of maintaining regular sleep/wake routines for children around changing work patterns. Young children living in shiftworking households may therefore be at a higher risk of night-to-night sleep variability or obtaining insufficient sleep. To date, research in this area is limited and results are varied. One study of 5 year olds (n = 1,818) found that maternal work patterns involving non-standard hours were not predictive of insufficient sleep durations in children (Kalil, Dunifon, Crosby, & Su, 2014). In school-aged children, associations have been found between non-standard maternal work hours and children having longer sleep durations on week nights and later bedtimes on weekends (C. Magee, Caputi, & Iverson, 2012). Parental shiftwork has also been associated with children

sleeping longer on weekends than children of parents with regular work hours (Muller, Signal, Elder, & Gander, 2017). Further investigation is needed to inform support strategies for families with non-standard work patterns, given emerging research highlighting relationships between the variability in week night to weekend sleep duration and child adiposity (Stoner et al., 2018). In NZ, Māori are more likely to be involved in night work (Paine et al., 2004) or temporary work (casual, fixed-term, seasonal or temporary agency work: 13.0% Māori vs 8.2% European) (Welch, 2013) and may therefore be at greater risk of disruption to their preschoolers' sleep routines due to employment factors such as changeable work hours with limited notice. Addressing the socio-political drivers of why some social groups are more likely to be involved in non-standard work hours and ensuring equitable education and work opportunities for all members of society may help prevent sleep inequities starting in early childhood.

A number of mothers did not feel listened to by health professionals and felt forced to 'manage' children's sleep in ways that did not align with their parenting views, which was disempowering and lessened the likelihood of accessing support in the future. Responsiveness to Māori and affordability were also raised as important aspects of sleep services being accessible and useful. It is therefore vital that health professionals receive comprehensive training on cultural safety, implicit bias (FitzGerald & Hurst, 2017) and child sleep, including a range of sleep supporting approaches and education on the societal influences on child sleep. It is also important that indigenous sleep services are developed and that sleep support is accessible for families via existing free child health services. Given that online sleep information was accessed by a number of mothers, accurate, culturally relevant, electronic sleep resources that are freely available to parents are necessary.

Several limitations of this study must be kept in mind. Because of the qualitative nature and aims of our study, results cannot be generalised to all contexts. In pre-interview questionnaires no children were reported to have a large sleep problem, therefore women's experiences may not be transferable to mothers of children with severe sleep problems. Families in the study predominantly lived in urban areas, so experiences in rural communities may differ. We recognise that mothers' lived experiences can only be partially understood via their narratives and that the sleep facilitators and barriers identified in our study are not exhaustive. For example, children or siblings at varying stages of development or family members with mental and physical health conditions may also influence sleep in some families. As only mothers were interviewed on this occasion, fathers' perspectives and those of other family members cannot be commented on. Data collection and analysis were influenced by DM's identity as a non-Māori woman and mother and there was a potential power imbalance between DM as an "expert" in sleep and participants, which may have impacted mothers' accounts. Strengths of our study include the sample size, the novelty of our approach to understanding experiences and worldviews of indigenous and non-indigenous mothers, the inclusion of women who hold low SEP who are often not included in research, and the depth of understanding gained from using qualitative methodology.

7.1.6 Conclusions

Children being healthy and active, sleep conducive bedroom spaces, consistent routines and supportive social environments facilitated preschoolers in our study to sleep well. It was clear that mothers were indeed 'doing the best job' they could to facilitate their preschoolers to sleep well, however not all mothers had the same degree of autonomy over supporting their children's sleep in ways that worked for them and their family. External influences beyond women's control included access to financial resources,

parental work patterns, ECE service practices, access to quality housing, and affordable, culturally responsive and respectful professional sleep advice. Efforts aimed at facilitating healthy sleep among preschoolers and effective sleep interventions must go beyond simply recommending individual- or family-level sleep promoting tips to include actions on the socio-political drivers that create inequities in the social determinants of sleep.

Acknowledgements

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7.2 Personal Reflections on the Qualitative Study

The thing that struck me most during the qualitative study is the generosity of all of the women who took part. It was with trepidation that I posted out the first study packs inviting women to participate, wondering if anyone would think it was worthwhile even considering taking part. From that moment forward there was no looking back, as responses rolled in from mothers who had very busy, and sometimes very challenging lives, but were willing to give up their time and share their personal experiences with me in order to help with the study.

Reading back over the notes I made after each interview, time and again what I had scribbled down centred around women working hard and doing all that they could for their children and their families, not only in relation to sleep but to general wellbeing. It

was clear that mothers put their children before themselves and wanted only the very best for them. It was also clear that some women had 'less', through no fault of their own. Less support, less money, less respect from others, less opportunities, and yet they had no less care or aspirations for their children.

I came away from interviews with no doubt in my mind that the 'less' needs to change and that change is not about individuals or families 'doing better' for their children's sleep. Families are already doing their best. It is very clear to me after hearing women's stories that sleep supporting tips (or so called 'sleep hygiene' which in itself has connotations of doing sleep 'right' or 'wrong') at the individual level can only do so much. They may even run the risk of victim blaming if not delivered in a sensitive, non-prescriptive, non-judgemental way, taking into account a multitude of worldviews and social circumstances. It is the system and the structure of NZ society that is letting parents and children down in regards to sleep, and indeed many other aspects of wellbeing. That is what needs to be addressed. That is what needs to change.

Conducting this qualitative study also led me to reflect on my own position in NZ society. I was acutely aware of my Pākehā, 'middle class' identity when I conducted each interview. I do not take my privileged position lightly. While I have not always lived in the same socioeconomic circumstances that I do now, I have never been judged or discriminated against because of the colour of my skin and nor have my children. Not every mother in NZ can say the same. While I was fortunate enough to have the support of Tiffany Te Moananui to interview women if they chose, for the one mother who requested this the practicalities of arranging an interview day and time when both parties were available did not work. I recognise that this is likely to have influenced what was shared in the interview that I ended up conducting.

From start to finish the qualitative study was a lengthy process, which I significantly under-estimated. Naively I thought that once the data were collected the bulk of the work was over, but in fact it had just begun. Comparing the first draft of the two manuscripts I prepared to the ones in this thesis is testimony to Braun and Clarke's (2013) description of thematic analysis being an iterative process. Now I get it.

The knowledge I have gained from developing and conducting this qualitative research is immense. I understand the value of qualitative research and the power of participants' voices more than ever before. I close this chapter with the aim of embarking on future qualitative research with a similar focus and, from a practical perspective, will be factoring in much longer timeframes and endeavouring to secure resourcing to ensure co-leadership with a Māori researcher.

CHAPTER 8 DISCUSSION

The main aim of this thesis was to explore social determinants of preschoolers' sleep health in NZ, using a mixed methods study design. This chapter summarises key findings in relation to the quantitative and qualitative research questions and integrates the quantitative and qualitative results in relation to the overarching mixed methods research question of the thesis (Figure 10). Implications of the findings are discussed, followed by a personal reflection on the research process, limitations and strengths of the study, recommendations for future research and conclusion of the thesis.

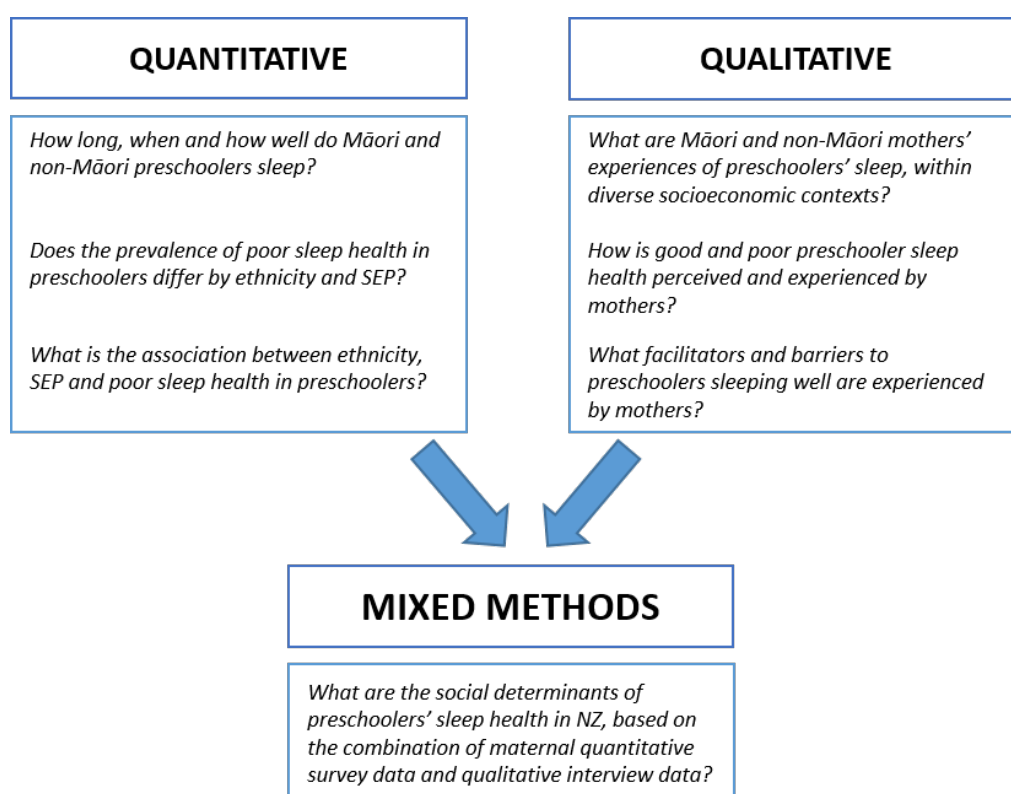


Figure 10. Quantitative, qualitative and mixed methods research questions of the thesis

8.1 Summary of Quantitative Results

8.1.1 How long, when and how well do Maori and non-Maori preschoolers sleep?

This thesis presents some of the first normative data on the sleep duration, timing and quality of Māori and non-Māori 3 to 4 year olds in NZ, based on quantitative analysis of *Moe Kura* data (Chapters 4 and 5). As detailed in Chapter 4, average sleep durations per 24 hours (including naps) on week days and weekends fell within the recommended range of 10 to 13 hours for preschoolers (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015; Paruthi et al., 2016b), but were shorter for Māori than non-Māori children. Average nighttime sleep duration on weeknights (Sunday to Thursday night) was slightly less than 11 hours and similar for Māori and non-Māori children. In contrast, on the weekend (Friday and Saturday night) average nighttime sleep duration was shorter for Māori than non-Māori children. In addition, a smaller proportion of Māori (19%) than non-Māori (36%) preschoolers had stopped napping completely and average difference between weekday and weekend sleep duration per 24 hours was less than an hour but larger for Māori than non-Māori preschoolers.

As described in Chapter 5, Māori and non-Māori children's average bedtimes on weeknights were earlier than the NZ Ministry of Health guideline of 8pm (Ministry of Health, 2017b). Children tended to go to bed later on the weekend and average weekend bedtimes of Māori and non-Māori children were earlier than 9pm, consistent with common bedtime recommendations for children of this age (Allen et al., 2016). Average bedtimes and wake times on weekdays and weekends were later for Māori preschoolers than non-Māori preschoolers. The average difference between weeknight and weekend midsleep time was less than half an hour and larger for Māori than non-Māori preschoolers (21 minutes vs 13 minutes, $p < .01$). Average CSHQ total scores were larger

for Māori than non-Māori children, indicative of greater sleep disturbance (Owens, Spirito, & McGuinn, 2000).

8.1.2 Does the prevalence of poor sleep health in preschoolers differ by ethnicity and SEP?

When categorical sleep variables were compared between Māori and non-Māori preschoolers and stratified by NZDep quintile and NZiDep score (Appendices 13 – 17; 19 – 28), it was evident that the prevalence of poor sleep health differed by ethnicity and SEP. A greater proportion of Māori preschoolers had short sleep duration (<10hrs, including naps) during the week and on the weekend compared to non-Māori preschoolers. Week/weekend sleep duration difference of >1 hour was more prevalent for Māori than non-Māori children, as was social jetlag ≥ 1 hour, a CSHQ total score ≥ 41 indicative of problematic sleep and maternal report of a moderate or large problem falling asleep. A greater proportion of Māori children also had late bedtimes on weeknights and weekends, based on both the NZ Ministry of Health recommendation that preschoolers go to bed no later than 8pm (Ministry of Health, 2017b) and on common sleep support recommendations that children go to bed by 9pm (Allen et al., 2016).

In addition, a pattern was observed for both Māori and non-Māori preschoolers, whereby greater area- and individual-level socioeconomic deprivation corresponded with a higher proportion of children with short, inconsistent and problematic (CSHQ total score ≥ 41) sleep and with later bedtimes, indicative of socioeconomic inequities in sleep health. In a number of instances, poor sleep health outcomes were also more prevalent for Māori than non-Māori preschoolers at equivalent levels of area- or individual-level deprivation.

8.1.3 What is the association between ethnicity, SEP and poor sleep health in preschoolers?

In multivariate regression analyses, independent relationships were found between ethnicity, SEP and child sleep health (Chapters 4 and 5). Māori children were more likely to have short sleep, week/weekend sleep duration difference >1 hour, social jetlag ≥ 1 hour, a moderate or large problem falling asleep and later bedtimes than non-Māori children, independent of child gender and socioeconomic deprivation. Similarly, children of Māori mothers were more likely to have short sleep, sleep duration difference >1 hour between the week and weekend, CSHQ total scores ≥ 41 , problems at least once a week with sleep patterns or falling asleep and later bedtimes than children of non-Māori mothers, independent of maternal age and deprivation.

A dose response relationship was observed between area-level deprivation and children's sleep duration and bedtimes in child and maternal models, with increasing deprivation associated with a greater prevalence of short sleep and later bedtimes, independent of ethnicity, individual-level deprivation, child gender (child model) and maternal age (maternal model). High area-level deprivation was also associated with week/weekend sleep duration difference >1 hour, independent of other child and maternal model covariates. In addition, preschoolers of Māori mothers living in the least deprived areas were more likely to have a problem falling asleep than preschoolers of non-Māori mothers living in the least deprived areas.

While fewer relationships were found between individual-level deprivation and sleep, individual deprivation was independently associated with short sleep duration on the weekend and problems falling asleep in child and maternal models. Individual-level deprivation was also associated with CSHQ scores ≥ 41 , independent of maternal model

covariates. Considered together, these results clearly indicate that both ethnic and socioeconomic inequities exist in preschoolers' sleep health in NZ.

8.2 Summary of Qualitative Results

8.2.1 What are Maori and non-Maori mothers' experiences of preschoolers' sleep, within diverse socioeconomic contexts?

As detailed in Chapters 6 and 7 and outlined below in relation to the sub-questions of the qualitative study, mothers valued their preschooler's sleep and did all that they could to support their child to sleep well. However, women's economic and social circumstances influenced their experience of being able to support their child's sleep in a way that worked for them and their family.

8.2.2 How is good and poor preschooler sleep health perceived and experienced by mothers?

Good sleep health included preschoolers obtaining sufficient, good quality sleep, at times and in locations that met children's needs and aligned with mothers' views of sleep (Chapter 6). Some aspects of what constituted good sleep health varied, such as differing views on whether bed sharing was indicative of good or poor preschooler sleep, and external factors such as employment also influenced mothers' experiences of the impact of their preschooler's sleep. Regardless of such differences, mothers perceived preschoolers' sleep as influencing child, maternal and family wellbeing, as incorporated in the four identified themes 'child happiness and health', 'maternal wellbeing', 'comfort and connection' and 'family functioning and harmony'.

'Child happiness and health' centred around mothers' perceptions and experiences of good sleep health as positively influencing preschoolers' mental and physical health and

behaviour. When preschoolers slept well they felt good in themselves, interacted positively with others and had the physical energy and emotional capacity to engage in purposeful activity within and outside of the home. In contrast, not sleeping well could make it difficult for children to cope with daily demands and many mothers observed negative behavioural changes. How well preschoolers slept also influenced mothers' own sleep, mental and physical health and ability to function during the day, as described in the theme 'maternal wellbeing'. Some women described negative experiences of feeling judged or misunderstood by others in regards to how their child was sleeping or the approach that they took to support their preschooler's sleep, highlighting the potential impact of external views on sleep. Sleep-related activities, including bedtime routines, bed sharing and mothers providing reassurance when children woke during the night, could enhance a sense of emotional connectivity between children and mothers, as captured in the theme 'comfort and connection'. As described in the theme 'family functioning and harmony', how well a preschooler slept also had the potential to impact fathers' sleep and waking functioning and interactions between preschoolers and their siblings.

Thus, across the qualitative sample of Māori and non-Māori mothers with low and high SEP, women valued and placed importance on their preschooler sleeping well and viewed good sleep health in a variety of ways. Findings indicate that good preschooler sleep health is important for child, maternal and family wellbeing and potentially for family resilience (Mackay, 2003; Walsh, 2003) and highlight the importance of all preschoolers being provided the opportunity to obtain good sleep health and its associated benefits.

8.2.3 What facilitators and barriers to preschoolers sleeping well are experienced by mothers?

Women's experiences shed light on a number of facilitators and barriers to preschoolers sleeping well, which were incorporated in the four themes 'health, activity and diet', 'sleep

promoting physical environments', 'consistency' and 'doing it our way' (Chapter 7). The theme 'health, activity and diet' was based on maternal experiences of preschoolers' health and development influencing sleep and of mothers using activity- and diet-based strategies to support preschoolers to sleep well. Being physically unwell could result in altered sleep patterns and difficulties initiating or maintaining sleep, therefore supporting children's physical health was one aspect of supporting good sleep health. Consistent with commonly recommended sleep support strategies (Allen et al., 2016), engaging in physical activity during the day and consuming healthy food and drinks were also viewed by mothers as sleep-supporting.

Incorporated in the theme 'sleep promoting physical environments', children's built environments influenced how well preschoolers slept. Again, in line with typical sleep promoting advice, this included things such as temperate bedrooms, comfortable bedding and lighting levels that met children's needs. In contrast to the recommendation that bedrooms be quiet (Allen et al., 2016), some mothers reported children liking a degree of noise when going to bed, which created a sense of connection with family and helped children to fall asleep. Warm, dry, sufficiently spacious housing facilitated sleep, whereas cold, damp houses and restricted bedroom spaces created barriers to preschoolers sleeping well.

The theme 'consistency' related not only to consistent activities and bedtime routines that supported children's sleep, but also to significant people in children's lives being consistently involved and using similar approaches to sleep to enable children to have consistent sleep patterns. Support from partners, such as taking turns with the bedtime routine, and extended family involvement, such as regular sleepovers with grandparents, enabled children to sleep well and mothers to feel supported. Family rules around the location and use of technology also played a role in bedtime routines and consistent

preschooler sleep patterns. Whereas disrupted preschooler sleep could result from inconsistency associated with parental work patterns such as shift work, ad hoc involvement from fathers who were living elsewhere, napping practices at ECE services that were misaligned with napping at home, and limited financial resources to carry out the same bedtime routine every night such as having a bath.

The theme 'doing it our way' highlighted how maternal confidence, experience, knowledge and support could translate into mothers being able to support their preschooler to sleep well in a way that met the needs of their child, their family and themselves, regardless of others' opinions. Facilitators included ensuring that financial barriers did not impede mothers' access to child sleep support services and the provision of child sleep services with a commitment to Māori. Barriers to women being able to do so included negative experiences of sleep advice from health professionals when children were younger, which deterred future seeking of advice and support.

While all women worked hard at supporting their preschooler to sleep well, social and economic factors influenced the amount of choice and control that mothers had to be able to support their child's sleep in a way that worked for them and their family. These included access to material and financial resources; the degree of social support that mothers had; information and advice from family, friends and health professionals; input from fathers who did not live with children; approaches to napping, food and activity in ECE services; housing quality and tenancy rights; and parental work patterns. Thus, external factors impacted maternal autonomy and, subsequently, preschoolers' sleep health.

8.3 Mixed Methods Results

8.3.1 What are the social determinants of preschoolers' sleep health in NZ, based on the combination of maternal quantitative survey data and qualitative interview data?

It was evident from the quantitative study that ethnic and socioeconomic inequities exist in preschooler sleep health in NZ. Children who are Māori, whose mothers are Māori and who experience greater socioeconomic deprivation are at a greater risk of poor sleep health than children from non-Māori and less socioeconomically deprived families. It was also clear from the qualitative study that Māori and non-Māori mothers, who experienced both greater and lesser degrees of deprivation at the individual-level, valued their preschoolers' sleep and did all that they could to support their child to sleep well. The difference lay in how much autonomy women had over being able to provide their preschooler with sleep supporting strategies and resources that met the needs of their child, themselves and their family, due to social and economic factors.

Integrated results relating to the mixed methods research question of the thesis are summarised in Figure 11. A number of findings converged to shed light on social and economic factors that influenced preschoolers' sleep health. Aspects of quantitative and qualitative study results also provided additional coverage, whereby strengths of these respective approaches resulted in additional findings (Morgan, 2014a). This enhanced the breadth and depth of understanding of social determinants of preschoolers' sleep.

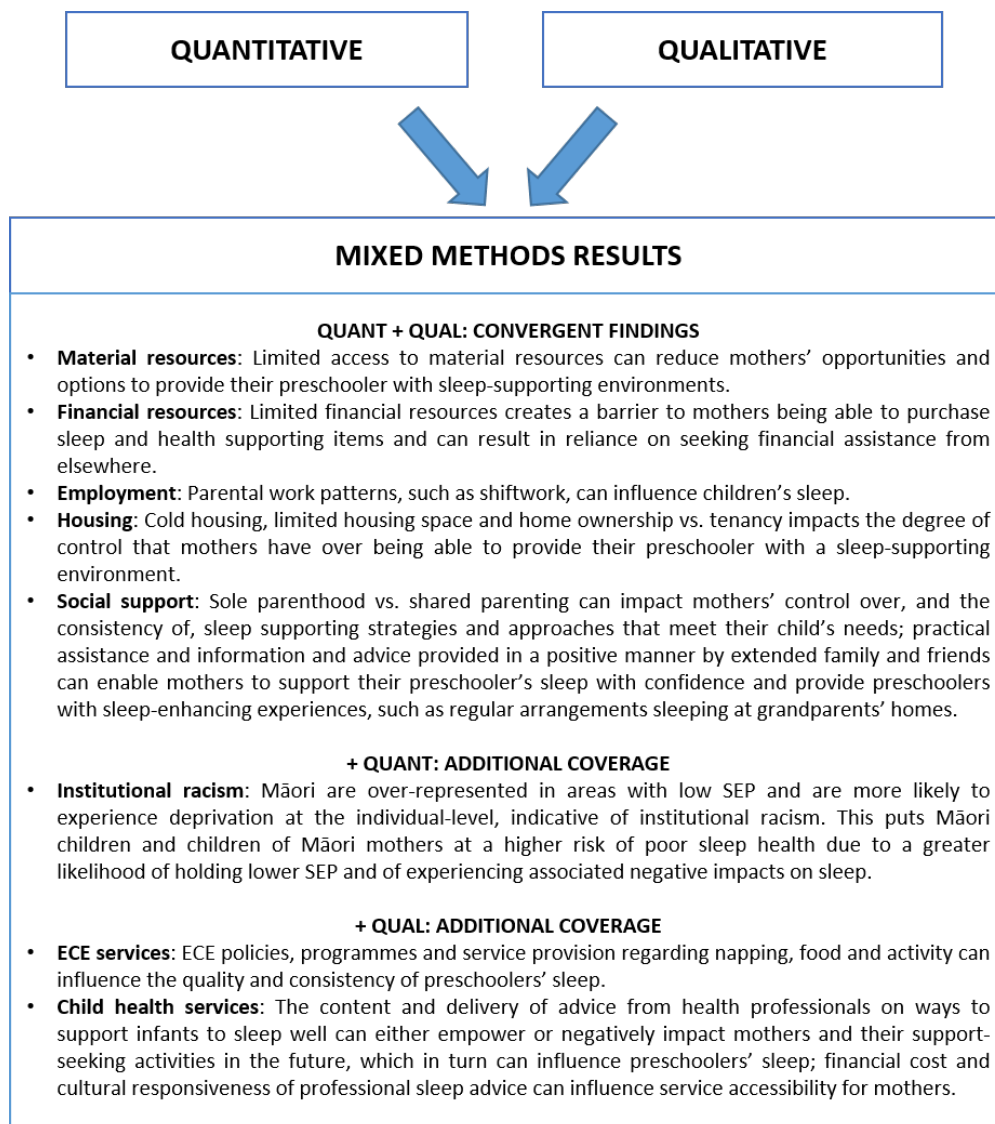


Figure 11. Summary of mixed methods study findings

Convergent findings indicated that financial and material resources mattered for children’s sleep. The NZDep2013 and NZiDep composite measures of socioeconomic deprivation incorporated, amongst other things, income and access to material resources necessary for daily living such as food and home heating (Atkinson et al., 2014; Salmond et al., 2006). The importance of financial and material resources was also clear from patterns identified across the qualitative dataset, whereby women talked of being able to afford

material items such as a comfortable bed and good quality bedding, as supporting children to sleep well. Having sufficient financial resources to purchase healthy food and to adequately heat homes was also woven into women's accounts of supporting children's sleep. In contrast, not having access to adequate financial or material resources resulted in limited autonomy and reliance on help from others, such as extended family members.

Parental paid employment was also captured in the quantitative deprivation measures utilised in this study (Atkinson et al., 2014; Salmond et al., 2006) and was a component of women's reported experiences in the qualitative study. Employment patterns, particularly shift work, influenced how easy it was to maintain consistent routines and sleep patterns at home. Housing space, home ownership and housing temperature were also aspects of the deprivation measures (Atkinson et al., 2014; Salmond et al., 2006) and reported by mothers as facilitators and barriers to their preschooler sleeping well. Adequate housing space, home ownership and living in a house that is sufficiently insulated and able to be adequately heated supported children to sleep well compared to limited bedroom space, having limited control over housing quality due to renting and cold housing. The degree of control that mothers had over housing ultimately influenced their perceptions of their preschooler's opportunity for good sleep health.

Alongside economic factors, social factors were also significant in both the quantitative and qualitative studies. Social support and sole parenthood are incorporated in the area-level NZDep2013 measure (Atkinson et al., 2014) and were also raised by women in interviews. Relationships with partners that involved the sharing of responsibilities for childcare, including sleep related tasks, and consistent, practical support and advice from extended family and friends made a positive difference to children sleeping well. In contrast, limited social support including sole parenting and inconsistent involvement from fathers sometimes put women in a position of having to manage the negative impact

this had on their child's sleep and limited the opportunities for the load to be shared by others. Comments from family and friends on how preschoolers were sleeping or the strategies that mothers used to support their child's sleep resulted in some women feeling judged and less supported with helping their preschooler to sleep well.

Quantitative results provided additional coverage, in relation to racism and sleep. The over-representation of Māori children and mothers in more socioeconomically deprived areas and the greater proportion of Māori children and children of Māori mothers that experienced individual-level deprivation is indicative of institutional racism (Jones, 2000; Krieger, 2010). As outlined in Chapter 1, the differential socioeconomic deprivation profile of Māori and non-Māori in NZ stems from colonisation, including Māori being forced from traditional lands, asset base loss and rapid urbanisation (Harris et al., 2006a; Reid & Robson, 2007; Te Puni Kokiri, 2000). The ongoing systematic, structural bias experienced by Māori maintains these inequities (Reid & Robson, 2007).

Ethnicity was consistently associated with poor sleep health in almost all quantitative multivariate analyses, indicating systematic disadvantage for Māori children and children of Māori mothers being able to sleep well. The fact that SEP was controlled for in models using two comprehensive measures of deprivation indicates that, over and above the disadvantage of inequitable SEP, the experience of being a Māori child or having a Māori mother put preschoolers at a greater risk of experiencing poor sleep health. As ethnicity is a social not biological construct, the fact that ethnicity remained significant after controlling for SEP does not point to potential biological differences between groups. It is clear, however, that socioeconomic deprivation is not the sole contributor to ethnic inequities in preschoolers' sleep health. It may be that other forms of racism also impacted children's sleep, such as personally-mediated (Jones, 2000) or vicarious racism via mothers or other caregivers (Heard-Garris, Cale, Camaj, Hamati, & Dominguez, 2018).

Interpersonal and vicarious experiences of racism are associated with poor child mental and physical health outcomes (Priest et al., 2013) and sleep difficulties in school-aged children (Shepherd et al., 2017). While not directly examined, experiences of personally-mediated and vicarious racism and associated stress may be one explanatory pathway between ethnicity and short and disturbed sleep of preschoolers observed in this study. Nonetheless, findings signify an urgent need to address the root causes of the unjust and unfair social disadvantage experienced by Māori preschoolers and their mothers, including institutional racism (D. Williams & Mohammed, 2013), and the associated risk of poor sleep health.

Additional coverage was also provided by qualitative study findings on women's experiences of ECE and health services. Mothers perceived ECE services as playing a role in how well their preschooler slept, with the provision of physical and cognitively challenging activities and healthy food initiatives viewed as supporting good sleep health. Consistent approaches to napping at ECE and home supported preschoolers to maintain regular sleep patterns across the week, however issues arose when there was dissonance between the two. In line with previous research (Sinclair et al., 2016), enforced napping at ECE resulted in children experiencing difficulties getting to sleep at night if they had stopped napping at home, which was stressful for families. This led to a number of women needing to advocate for alternatives to compulsory naps, such as rest time or quiet activities. Findings highlighted the importance of children's individual needs being at the centre of napping protocols at ECE services and of mothers being listened to and collaborated with, to ensure their preschooler's sleep needs were met.

Similarly, when health professionals delivered sleep advice in a prescriptive manner and did not listen to women's opinions this created stress for mothers and deterred future help seeking. Other factors identified as playing a role in whether mothers sought

professional advice about their preschooler's sleep was financial cost and whether or not services were committed to meeting the needs of Māori.

To summarise, the mixed methods results of this thesis indicate that social determinants of preschooler sleep health include a range of factors at multiple levels, including institutional racism, material and financial resources, parental employment, housing quality, social support and ECE and child health service provision. While mothers valued their preschooler's sleep and did all that they could to support their child to sleep well, broader societal influences beyond mothers' control had a 'trickle down' effect on preschoolers' sleep health. Therefore, an expansive view must be taken that goes beyond an individual approach to sleep (Knutson, 2013). A victim-blaming approach to preschooler sleep which does not take into account the broader societal context and places blame and burden on mothers not 'managing' their child's sleep 'properly' must be rejected. It must also be noted that these findings are not exhaustive and that other social determinants, not captured in this study, may have influenced preschoolers' sleep.

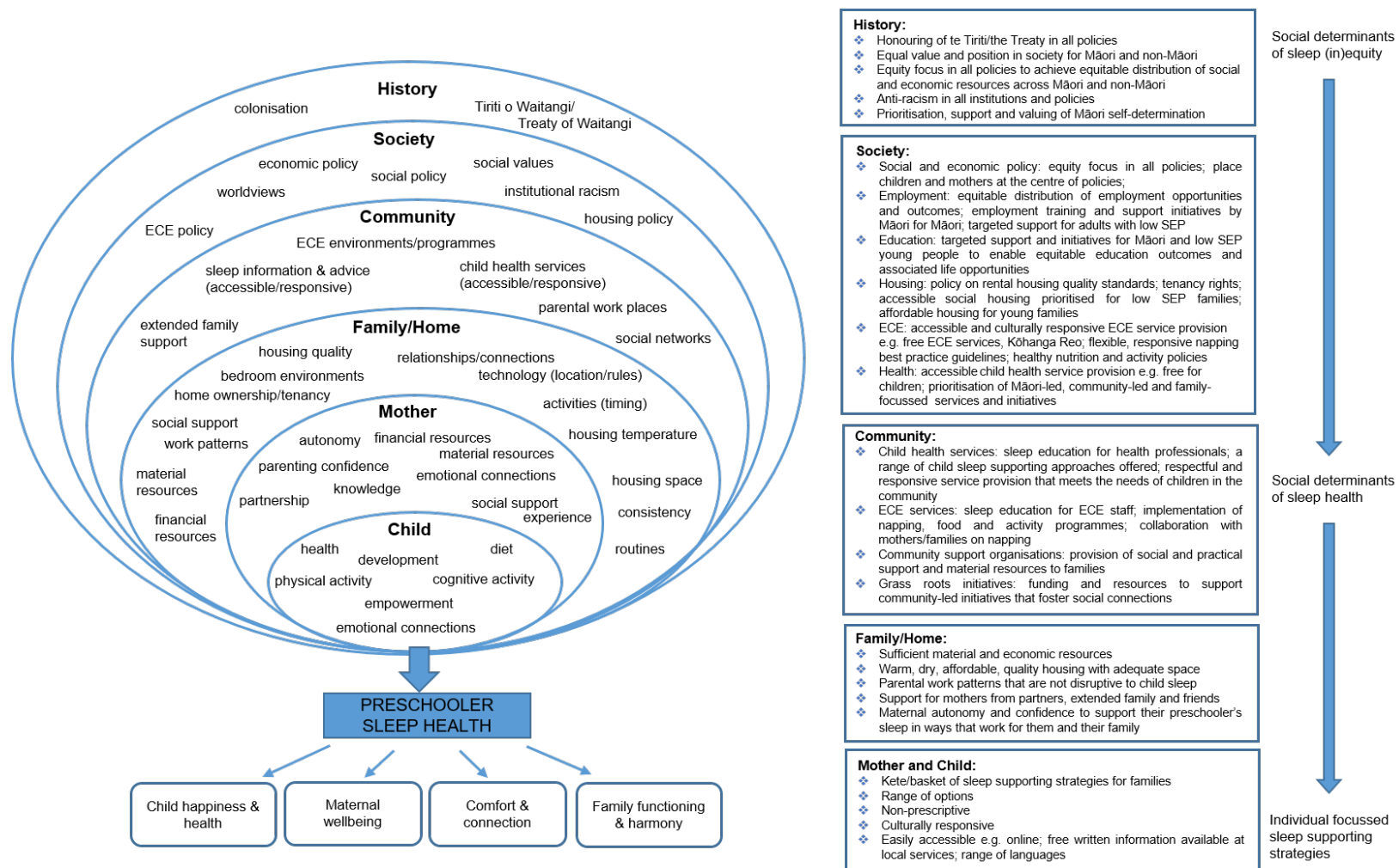
8.4 Contribution of this Research

This research contributes to the NZ sleep health literature by providing some of the first normative data on Māori and non-Māori preschoolers' sleep duration, timing and problems and adds to the significant body of literature on ethnic and socioeconomic inequities in adult sleep health (Paine & Gander, 2013, 2016; Paine et al., 2004, 2005; Paine et al., 2016, 2017; Paine, Harris, & Mihaere, 2011). It provides a novel contribution by shedding light on the sleep of indigenous and non-indigenous children in early childhood and highlights that inequities in child sleep health mirror those in adult sleep health and exist as early as the first 3 to 4 years of life in NZ.

This research also adds to international literature on social determinants of children's sleep health (L. Hale et al., 2015; L. Hale, Parente, et al., 2013) and the sleep of children from indigenous populations (Attard, Clarkson, & Blunden, 2017), providing further evidence of children from minoritised racial/ethnic and low socioeconomic groups experiencing the greatest burden of poor sleep health. A novel aspect of this research was the use of a mixed methods study design, which enabled both breadth and depth of understanding to be gained in this area. In addition, the overarching paradigm informed the interpretation of results in relation to their practical application in the 'real world', as detailed below.

8.5 Translating Results into Action

Moving beyond an individual approach to sleep, Figure 12 depicts an interpretation of the mixed methods findings as a socioecological model of preschooler sleep health in NZ and, consistent with the pragmatic paradigm of this thesis (Greene & Hall, 2010; Johnson & Onwuegbuzie, 2004; Johnson et al., 2007; Morgan, 2007, 2014b), a multi-level action plan to achieve sleep health equity.



Note. Based on socioecological models of sleep (Grandner, 2017; Grandner et al., 2010; Jackson et al., 2015) and social determinants of health frameworks (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010)

Figure 12. Socioecological model of preschooler sleep health and action plan to achieve sleep equity based on mixed methods findings
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Building on the socioecological model of facilitators and barriers to preschoolers sleeping well developed in Chapter 7, Figure 12 contextualises children's sleep within an outer layer of 'history'. As highlighted in Chapter 1, one of the founding documents of NZ is the Tiriti o Waitangi/the Treaty of Waitangi (Kingi, 2007; Orange, 2011) which formalised a sharing of power and authority between Māori and the British Crown in 1840 (Waitangi Tribunal, 2014). However post-Tiriti/Treaty British colonisation, which is based on the ideology of racism (Paradies, 2016), resulted in unequal power relationships between Māori and non-Māori which are entrenched in NZ society (Robson & Harris, 2007). In the words of Nancy Krieger, "we cannot escape history - or pretend that it has not happened" (Krieger, 2010, p.228). Therefore, any examination of social determinants of preschoolers' sleep must take into account NZ's history of colonisation and Tiriti o Waitangi/Treaty of Waitangi Crown obligations (Howden-Chapman & Tobias, 2000).

Institutional racism, based on the interpretation of observed ethnic inequities in SEP, is included in the model at the society-level. In addition, the mixed methods findings that financial resources are a determinant of preschoolers' sleep health is reflected at the society-level, in the form of economic policy (i.e. the political driver of the distribution of economic resources), as well as at the family- and mother-levels. The four themes from Chapter 6 form the lower section of the socioecological model, to demonstrate the value that mothers placed on good preschooler sleep health and the impact that preschooler sleep has on the wellbeing of children, mothers and families.

Findings of this thesis mirror the social determinants of, and inequities in, child health more generally (D'Souza, Turner, Simmers, Craig, & Dowell, 2012; Ministry of Health, 2015; Simpson, Duncanson, et al., 2016; Simpson et al., 2017; Simpson, Oben, et al., 2016). Therefore, actions on the right hand side of Figure 12 are informed by literature on social determinants of health and health inequities (CSDH, 2008a, 2008b; Jones, Jones, Perry,

Barclay, & Jones, 2009; Marmot, 2007; Moore, McDonald, Carlon, & O'Rourke, 2015). Social determinants of inequity are “systems of power that determine the range of social contexts and the distribution of populations into those social contexts” (Jones et al., 2009, p.8). The Commission on Social Determinants of Health (CSDH) have identified three principles of action to achieve health equity: (1) improve daily living conditions, which are “the circumstances in which people are born, grow, live, work, and age”; (2) address structural drivers of conditions of daily life by tackling “the inequitable distribution of power, money, and resources”; and (3) measure and understand the problem and evaluate the impact of action (CSDH, 2008b, p.2).

In regard to the CSDH action principle (3), this research has measured and increased understanding of the problem by investigating social determinants of preschoolers' sleep health and identifying that sleep inequities exist in early childhood in NZ. This is a vital first step, as not doing so runs the risk of a “no data, no problem” (Krieger, 1992, 2010) scenario of avoidance and inaction.

CSDH action principle (2) relates to the necessity to tackle the “causes of the causes”, which are “the fundamental structures of social hierarchy” (Marmot, 2007, p.1153), to eliminate inequities. Approaches that do not address social determinants of inequity can inadvertently exacerbate disparities (Frohlich & Potvin, 2008). Therefore, the ‘social determinants of sleep (in)equity’ section of Figure 12 relates to the responsibility that lies with government to take action to eliminate disparities in the distribution of power, privilege and resources via multi-sectoral, redistributive public policy (CSDH, 2008a, 2008b; Gore & Kothari, 2012). This includes meeting obligations of te Tiriti/the Treaty including the right to Māori self-determination, ensuring that social and economic resources are equitably distributed across society for Māori and non-Māori and tackling institutional racism. It involves all social and economic policy being socially just, having an

equity focus, and a commitment to the wellbeing of children and mothers (D'Souza et al., 2012). The mixed methods findings from this thesis support the need to take action and invest in policy on employment, housing, education and ECE. In addition, qualitative findings indicate the need for napping best practice guidelines for ECE services to be developed that incorporate child-centred, flexible approaches to children's sleep needs that can be delivered via accessible, culturally responsive ECE services, in conjunction with healthy nutrition and activity policies.

CSDH action principle (1) relates to the 'social determinants of sleep health' section of Figure 12, which focuses on children's conditions of daily living. Mixed methods results suggest that the provision of child health services, ECE services and family support organisations in the community that are accessible and responsive to children's and families' needs, as well as funding and resources being made available to support grass roots initiatives that foster social connections in communities, are likely to support good preschooler sleep health. In addition, they indicate a need for the provision of sleep education for health professionals so that they are well equipped to provide a range of sleep support strategies and advice to families in a respectful and responsive manner. Sleep education for ECE staff is also warranted, so that ECE workers are informed and supported to be able to implement flexible napping policy in collaboration with children and their families.

Mixed methods findings highlight the need for all young children and their mothers to have the opportunity and support to be able to live in home environments that meet their social and physical needs and, in turn, which support preschoolers to sleep well. This includes mothers/caregivers having access to sufficient material and economic resources to meet their family's needs; housing that is affordable, accessible, high quality, warm, dry and sufficiently spacious; employment opportunities and working conditions that support

family wellbeing (including not disrupting children's sleep); and emotional, financial and practical support for mothers so that they are empowered to support their preschooler's sleep and wellbeing in a way that works for them and their family.

It was evident from the results of the qualitative study that individual sleep supporting strategies have an important role to play in helping preschoolers to sleep well. However, it was also clear that the availability of social and economic resources impacted how much control mothers had over being able to implement such strategies. Without political action to address the inequitable distribution of power across society and provision of accessible and responsive community-based services and home environments that meet children's and families' needs, sleep supporting strategies alone cannot be the answer to supporting all preschoolers to achieve good sleep health.

As well as discrepancies in the autonomy women had over being able to implement strategies to support their child's sleep due to differential resource accessibility, mothers' experiences highlighted that families need the latitude to choose their own approach to managing their child's sleep. It is therefore imperative that a range of sleep support information is offered in a non-prescriptive way that provides mothers with choice. One such approach could be a sleep information resource in the form of a kete/basket of sleep support strategies that mothers could choose from. Removing barriers to mothers being able to access information is also important, therefore such a tool would need to be made available via a range of media (e.g. online and in hard copy), at no cost and promoted through multiple sources (e.g. marae, community health and child services). It would also need to be provided in a range of languages.

In summary, mixed methods results indicate that a comprehensive, multi-level, social determinants of health approach is required to support all preschoolers to achieve good sleep health. This aligns with the Child and Youth Wellbeing Strategy that is currently

being developed by the NZ government (Department of the Prime Minister and Cabinet, n.d.). Potential focus areas of the proposed strategy include, amongst other things, children and their whānau and families living in affordable, quality housing; reducing child poverty; improved equity of outcomes for children via multi-sectoral services and systems helping to address impacts of poverty, low socioeconomic status and disadvantage; children being free from racism and discrimination; cultures of children and their whānau and families being recognised, enhanced and supported; children and their whānau and families being empowered to make healthy lifestyle decisions; and children thriving emotionally, socially and developmentally in the early years. Findings from this thesis suggest that the effective implementation of such a strategy is likely to support children's sleep health and help address child sleep inequities. The monitoring of outcomes should therefore include child sleep to ensure that this is the case.

8.6 Personal Reflections on the Research Process

Identifying as a NZ European/Pākehā woman, I did not take the responsibility of doing justice to the experiences of both Māori and non-Māori children and mothers in the study lightly. Upon reflection, I believe that consultation and mentorship, theory and reflexivity were crucial to being able to conduct this research in a socially just and ethical manner.

Consultation with Māori research experts at the front end of the study design and analysis planning phases was essential. This helped me to bring Māori children and mothers to the centre of my research, both conceptually and practically, and to understand how to position ethnicity and SEP within my study design and analyses. Consultation with qualitative researchers enhanced my understanding of qualitative inquiry, which translated practically into the development and use of processes that supported research rigour. Consulting with a non-Māori researcher working in the ethnic inequity, social

determinants of health and qualitative research space in NZ was invaluable. This reassured me that, as a non-Māori researcher, I could conduct this research in an appropriate and respectful manner provided I maintained open communication and did not work in isolation.

Crucial to being able to do so was the mentorship that I received from my supervisory team. Co-principal investigators and guardians of the *Moe Kura* study, my primary supervisor Associate Professor Leigh Signal and co-supervisor Dr Sarah-Jane Paine facilitated discussion and debate throughout my research to ensure the wellbeing of Māori and non-Māori *Moe Kura* children and women remained at the centre of the research and that the ethos of *Moe Kura* was honoured. Co-supervisor Dr Lora Wu, a psychologist and sleep researcher originating from the US, brought additional theoretical and practical perspectives to the table. The combined mentorship from my three supervisors meant that at each stage questions were asked, issues were debated and decisions were made in a safe and supportive environment.

Theory also mattered. The Kaupapa Māori epidemiology principles of the *Moe Kura* research programme (Paine et al., 2013) guided how data were collected, analysed and, in conjunction with the social determinants of health (Howden-Chapman & Tobias, 2000; Solar & Irwin, 2010) and socioecological (Grandner, 2017; Grandner et al., 2010; C. Jackson et al., 2015) theoretical lenses, interpreted. These theoretical perspectives were complementary in that they encompassed the importance of considering preschoolers' sleep within the broader societal context, shared concepts of social justice and empowerment and, from a practical perspective, provided a framework within which to work.

It is widely accepted that reflexivity is an essential element of robust qualitative research (Tracy, 2010). I now believe that reflexivity of one's own worldviews, social position and

personal values is also necessary when conducting quantitative or mixed methods research that has an equity or social determinants focus. This view is supported by Paula Braveman who stated “it should be more widely understood that the concepts of health equity and health disparities are not value-neutral, but specifically address social justice in the realm of health” (Braveman, 2014b, p.371). Interestingly, while my worldview and position in society influenced what it was that I set out to do in this thesis and how I did it, I now realise that conducting this research has also influenced my worldview.

In summary, while I do not represent Māori nor do I understand the experience of ‘being Māori’, consultation, mentorship, theory and reflexivity enabled me to conduct mixed methods research which I hope has honoured both Māori and non-Māori participants. My advice to non-indigenous students and researchers wanting to work in this field is that while it can feel uncomfortable and challenging, it is also a worthwhile and rewarding endeavour if you are prepared to seek counsel, be guided by theory and own your own position within the research.

8.7 Limitations

This thesis research had a number of limitations. As outlined in Chapters 4 and 5, limitations of the quantitative study included the cross-sectional design which impeded the ability to establish causal relationships (Bailey, Vardulaki, Langham, & Chandramohan, 2005). Systematic errors in data collection, or information bias, may have occurred due to the use of subjective measures (Hennekens, Buring, & Mayrent, 1987; Porta, 2014; Rothman, Greenland, & Lash, 2008). Parents have been shown to over-estimate child sleep duration compared to objectively measured sleep using actigraphy (Iwasaki et al., 2010), therefore estimated proportions of preschoolers obtaining sufficient sleep (10 – 13 hours) may have been inflated compared to objectively measured sleep. However, as current

sleep duration guidelines are predominantly based on parent-report (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015), the subjective sleep measures used in this thesis are considered appropriate. Mothers were asked to report on their preschooler's usual sleep duration, timing and habits based on the past week, which may have introduced recall bias. Misclassification bias may also have been introduced because preschoolers' sleep durations were grouped without regard to individual variability in sleep need. Some children with sleep durations in the NSF 'may be appropriate' range of 8 to 9 or 14 hours (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, Hazen, Herman, Katz, et al., 2015) may have obtained adequate sleep for their individual needs but were categorised as having sub-optimal (short or long) sleep duration in analyses.

The CSHQ has been shown to be a useful screening tool for sleep problems of toddlers, preschoolers (Goodlin-Jones et al., 2008) and school-aged children (Owens, Spirito, & McGuinn, 2000) in the US, but information on its use in minoritised racial/ethnic samples is limited (Sheares et al., 2013). The CSHQ has not been validated in NZ and the cut-off score of 41 may be inappropriate. Therefore, caution must be taken in interpreting and comparing prevalence estimates of sleep problems based on CSHQ scores in the thesis to those reported elsewhere. In addition, the use of non-standardised wording for sleep problem questions may have influenced the reporting of problems in relation to children's sleep habits or patterns and the time that children took to fall asleep, depending on how mothers interpreted questions. Mothers' own sleep quality may also have influenced their perception of their child's sleep and whether or not it was problematic (Ronnlund, Elovainio, Virtanen, Matomaki, & Lapinleimu, 2016), which was not accounted for in analyses.

The use of paper and pencil questionnaires meant that errors could occur due to participants misinterpreting instructions and providing incorrect answers and data entry errors may have compromised data quality. To minimise this, comprehensive data entry rules were developed, 10% of data were double-scored and compared, and errors ($\leq 1\%$) identified and rectified.

The distribution of NZiDep scores of mothers in the sample did not reflect the NZ distribution (Salmond et al., 2005). This is likely to have impacted the generalisability of findings. While two comprehensive measures of SEP were covariates in models, residual confounding from other aspects of SEP not included in these indexes may have occurred. In addition, while the sample was a reasonable size the small number of children with sleep durations >13 hours, usual weeknight bedtimes later than 9pm and social jetlag ≥ 1 hour limited the ability to fully examine these measures.

Response rates for Māori women (70%) were lower than for non-Māori women (84%), based on study packs sent to women enrolled in the *E Moe, Māmā* study and completed consent forms and questionnaires returned (Chapter 3). This may have introduced non-response bias to results (Bailey et al., 2005). Sampling bias may also have been introduced, due to women invited to participate already being enrolled in a programme of research on sleep and health in the perinatal period. Therefore mothers may have had a greater awareness of or focus on sleep, including that of their children, than the general population.

The qualitative study also had a number of limitations, as described in Chapters 6 and 7. Due to the qualitative nature of inquiry, results are not necessarily generalisable across other contexts. All women who participated lived in the wider Wellington region of NZ and most in an urban area, which may limit the transferability of findings to other cities, rural locations and countries. Most women had more than one child, therefore their experiences

of their preschooler's sleep were intertwined with the sleep of siblings, although this was telling in itself and highlighted how sleep in families was inter-connected. Pre-interview questionnaire responses indicated that no preschooler had a large sleep problem, therefore mothers' experiences may not be transferable to women who have preschoolers with more severe sleep issues. As in any experiential study, mothers' lived experiences could not be fully understood via their words. Information that was shared in interviews may also have been influenced by the potential power imbalance between myself as the research "expert" and the woman being interviewed, as well as my identity as a non-Māori woman and mother.

As a whole, the mixed methods study had several limitations. The social determinants of preschoolers' sleep that were examined are not exhaustive and further research is warranted in areas such as neighbourhood safety, green space, housing density, noise, pollution and social cohesion (L. Hale et al., 2015; L. Hale, Hill, et al., 2013; Knutson, 2013; Singh & Kenney, 2013). As only maternal data were analysed, relationships between fathers' and other caregivers' ethnicity, social and economic resources and day-to-day experiences were not examined in relation to preschoolers' sleep. The mechanisms involved in relationships between ethnicity and SEP and preschoolers' sleep health require further investigation, including experiences and impacts of racism, the potential mediating role of stress and quantitative associations between housing quality, bedroom environments and preschoolers' sleep.

Additional challenges associated with the mixed methods methodology included the amount of time required to conduct both quantitative and qualitative studies and skill development in quantitative and qualitative data analysis and mixed methods integration techniques (Bryman, 2007; Fetters, Curry, & Creswell, 2013; Woolley, 2009).

8.8 Strengths

This thesis research also had a number of strengths. As outlined in Chapters 4 and 5, a strength of the quantitative study was the large sample size which, due to the design and Kaupapa Māori epidemiology principles of the *Moe Kura* study (Paine et al., 2013), comprised a relatively large proportion of Māori children (37%) and mothers (32%). The structuring of univariate analyses by child ethnicity and the inclusion of child and maternal ethnicity in multivariate models utilised the statistical power that this provided and enabled the examination of the sleep of both Māori and non-Māori children. In contrast, grouping all children together would have resulted in data on Māori preschoolers' sleep being 'lost' and an inability to examine potential ethnic inequities in child sleep.

Examining sleep using categorical, rather than continuous, variables ensured that children with the greatest risk of experiencing poor sleep health were able to be identified. The concurrent examination of ethnicity and SEP in models enabled the independent contribution of these factors in relation to preschoolers' sleep to be investigated. Other strengths included the examination of multiple aspects of preschoolers' sleep health (Buysse, 2014) as opposed to simply sleep duration, the narrow age range of children in the sample which minimised confounding of results due to developmental stage, and the nationally recruited cohort which had an NZDep profile that aligned with the NZ general population (Signal et al., 2016).

As described in Chapters 6 and 7, strengths of the qualitative study included the relatively large sample size, the study design which prioritised collecting data on experiences and views of both Māori and non-Māori mothers and women who hold both low and high SEP, thus ensuring that the voices of women often not included in research were heard. To minimise the potential researcher-participant power imbalance, women were offered the

option of being interviewed by a Māori researcher; interviews were conducted with sensitivity and respect; reciprocity was built into the study design in the form of koha/ gift of appreciation for participating and the option to receive child sleep information; women were provided the option of receiving a copy of their interview transcript to comment on or for their personal records; and a summary brochure was sent to each participant informing them of study results.

The mixed methods study also had a number of strengths. It is the first comprehensive investigation of social determinants of preschoolers' sleep health in NZ, using both quantitative and qualitative research methods. The study design enabled ethnic and socioeconomic inequities in preschoolers' sleep to be identified along with a greater understanding of mothers' experiences and perceptions of preschooler's sleep and factors that support or inhibit children sleeping well on a day-to-day basis. The concurrent quantitative and qualitative studies provided both breadth and depth of information respectively, resulting in a comprehensive picture of the social determinants of preschoolers' sleep health that was greater than the sum of quantitative and qualitative parts (Cresswell & Plano Clark, 2011). Another strength is the translation of mixed methods findings into a comprehensive action plan incorporating policy and other interventions, which addresses an identified need in the field of sleep health research (L. Hale et al., 2015).

8.9 Future Research

To build on the findings of this thesis, recommendations for future research include:

- Research across childhood and young adulthood to investigate longitudinal relationships between ethnicity (child and maternal), SEP (child and maternal) and child sleep, to track how associations between child factors and child sleep

and maternal factors and child sleep may change over time as children become more independent.

- Validation study of the CSHQ for use with children in NZ, to identify reliability, validity and potential adaptations.
- Qualitative research examining fathers' and other caregivers' perspectives and experiences of preschoolers' sleep.
- Mixed methods research on experiences of interpersonal and vicarious racism (via caregivers) and their relationship to children's sleep health cross-sectionally and longitudinally.
- Mixed methods research with a specific focus on housing (quality, space, density) and child sleep health.
- Mixed methods research investigating potential pathways linking ethnicity, SEP and preschoolers' sleep health (e.g. stress experienced by children, mothers, fathers and other caregivers due to toxic living conditions), incorporating actigraphic sleep measures.
- Qualitative research on school-aged and teenaged children's perceptions of sleep and experiences of facilitators and barriers to good sleep health.
- Research on whether sleep mediates the relationship between ethnicity, SEP and child health, cross-sectionally and longitudinally.

8.10 Conclusion

In NZ, preschooler sleep health is a socially determined phenomenon. Ethnic and socioeconomic inequities exist in preschoolers' sleep that mirror inequities in child health, with children from Māori and low SEP families experiencing the greatest burden of poor sleep health. This is a societal problem requiring a societal solution. Therefore, we must move beyond a simplistic, prescriptive, and potentially victim-blaming, individual

approach to child sleep that places responsibility for preschoolers sleeping well with mothers, without taking into account the historical and societal context and associated social position of children and mothers. As a matter of social justice, action must be taken to redress inequitable power, privilege and resources across society, to ensure all preschoolers are afforded their right to experience social and physical conditions of daily living that support their sleep, and therefore their wellbeing, and that of their family.

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PUBLICATIONS AND PRESENTATIONS

Peer-Reviewed Publications:

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). How long do preschoolers in Aotearoa/New Zealand sleep? Associations with ethnicity and socioeconomic position. *Sleep Health*. doi: 10.1016/j.sleh.2019.05.004

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). "Their sleep means more harmony": Maternal perspectives and experiences of preschoolers' sleep in ethnically and socioeconomically diverse families in Aotearoa/New Zealand. *Qualitative Health Research*. doi: 10.1177/1049732319842156

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). "We're doing the best job we can": Maternal experiences of facilitators and barriers to preschoolers sleeping well in Aotearoa/New Zealand. *Sleep Health*. doi: 10.1016/j.sleh.2019.01.005

Stoner, L., Castro, N., Signal, L., Skidmore, P., Faulkner, J., Lark, S., Williams, M., **Muller, D.**, & Harrex, H. (2018). Sleep and adiposity in preadolescent children: The importance of social jetlag. *Childhood Obesity*, 14(3). doi: 10.1089/chi.2017.0272

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Refereed Conference Proceedings:

Muller, D., Paine, S-J., Signal, L., Sweeney, B., Priston, M., Huthwaite, M., Lee, K., & Gander, P. (2015). Population-level socio-demographic factors associated with infants' sleep patterns and environments in Aotearoa/New Zealand. Poster presentation at *Sleep 2015, the 29th Annual Meeting of the Associated Professional Sleep Societies*, June 6 – 10. *Sleep*: 38 (Abstract supplement) p. A27

Sweeney, B., Signal, L., Paine, S-J., **Muller, D.**, Priston, M., Huthwaite, M., Lee, K., & Gander, P. (2015). Magnitude and chronicity of changes in sleep quantity and quality are associated with postnatal depression. Oral presentation at *Sleep 2015, the 29th Annual Meeting of the Associated Professional Sleep Societies*, June 6 – 10. *Sleep*: 38 (Abstract supplement) p. A408

Muller, D., Sweeney, B., Signal, T. L., Paine, S-J., Priston, M., Smith, A., Huthwaite, M., Lee, K., & Gander, P. (2014). Changes in sleep across the pre- and peri-natal period for Māori and non-Māori women in Aotearoa/New Zealand. Poster presentation at *Australasian Sleep Association and Australasian Sleep Technologists Association 26th Annual Scientific Meeting*. Perth, Australia, October 9 – 11. *Sleep and Biological Rhythms*: 12 (Supplement S1) p. 75

Signal, L., Paine, S-J., Sweeney, B., **Muller, D.**, Priston, M., Smith, A., Huthwaite, M., Lee, K., & Gander, P. (2014). Depressive symptoms in late pregnancy are associated with sleep duration, quality, and symptoms of sleep disorders. Poster presentation at *Australasian Sleep Association and Australasian Sleep Technologists Association 26th Annual Scientific Meeting*. Perth, Australia, October 9 – 11. *Sleep and Biological Rhythms*: 12 (Supplement S1) p. 57

Invited Oral Presentations:

Muller, D. (2016). Children's sleep: An overview. Invited oral presentation at the *SPELD Waikato regional professional development meeting*, 28 November

Muller, D. (2016). Preschool children's sleep: An overview of sleep and napping in young children. Invited oral presentation at the *Mana Atua, Health and Wellbeing: The Heart of the Early Childhood Curriculum symposium*. Auckland University of Technology, 25 – 26 November

Muller, D. (2016). Listening to parents: A qualitative perspective on mothers' experiences of young children's sleep. Invited oral presentation at the symposium People who say "sleeping like a baby" don't have one: Parental perspectives on sleep management. *Australasian Sleep Association and Australasian Sleep Technologists Association 28th Annual Scientific Meeting*. Adelaide, Australia, 20 – 22 October

Other Forms of Dissemination:

Martin H (2017). Screen-time before bed linked to sleep deprivation and behaviour issues. Interviewed for and quoted in the *Dominion Post* and *Stuff* (www.stuff.co.nz), April 23.

Muller, D., Paine, S-J., Signal, L., Sweeney, B., Priston, M., Huthwaite, M., Lee, K., & Gander, P. (2015). Population-level socio-demographic factors associated with infants' sleep patterns and environments in Aotearoa/New Zealand. Poster presentation at the *Wellington Health and Biomedical Research Society Poster Meeting*. Victoria University, Wellington, 9 July

Muller, D. (2014). Profiled in the Research and Innovation Column by Graham, F. *OT Insight: Magazine of Occupational Therapy New Zealand*, p. 6

**APPENDIX 1: MOE KURA CHILD SLEEP AND HEALTH
QUESTIONNAIRE**

E Moe, Māmā

Your Child's Sleep and Health at 3 Years

This questionnaire is about your “E Moe, Māmā” child (the child you were pregnant with when you first started this study).

This questionnaire should be completed when your “E Moe, Māmā” child is 3 years of age.

Please complete it **no earlier** than one month before their 3rd birthday or **no later** than one month after their 3rd birthday.

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. When was **your child** born?

D	D	M	M	Y	Y	Y	Y
---	---	---	---	---	---	---	---

2. Is **your child**: Male Female

Where your E Moe, Māmā child lives

3. Where does your child usually live?
(If your child lives in more than one house, write the address where they spend **most of their time**):

NUMBER & STREET NAME

SUBURB OR RURAL DELIVERY NO.

CITY, TOWN OR DISTRICT

POSTCODE

4. **a:** During a **normal week**, how many nights does your child sleep in the same house as you? (Please **tick one** option)

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	1	2	3	4	5	6	7

If less than seven nights please continue to question 4b, otherwise please go to question 4d.

b: Where does your child sleep on the other nights of a **normal week**?

- Their father's house
- Their aunt/uncle's house
- Their grandparent/s' house
- Family friend's house
- Other (Please specify)

PLEASE SPECIFY

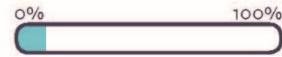
c: Why does your child sleep at a different house during a **normal week**?

(e.g. my husband and I work a night-shift)

PLEASE SPECIFY

E Moe, Māmā

Your Child's Sleep and Health at 3 Years



4. *Cont'd.* **d:** Are there any other regular **overnight** arrangements to share the care of your child?
(this could be a shared-custody arrangement or an informal agreement)

Yes No Don't know

If you answered 'No' or 'Don't know' please go to question 5, if 'Yes' continue to question 4e.

e: What arrangement is that?
(e.g. every second weekend they live with their father)

PLEASE DESCRIBE ARRANGEMENT

Your child's sleep

When answering the following sleep questions please think only about when your child sleeps at your house.

5. How many **other children** share the room your child sleeps in?

0 1 2 3 4 5 more than 5

6. How many **adults** share the room your child sleeps in?

0 1 2 3 4 5 more than 5

7. **a:** Where does your child usually sleep?
(Please tick as many boxes as apply)

Own bed
 Sibling(s) bed
 Parent(s) bed
 Other *(Please specify)*

PLEASE SPECIFY

b: How many people usually share the bed with your child?

0 1 2 3 4 more than 4

If you answered '0' please answer question 7c, otherwise go to question 8.

c: How old was your child when he or she began to sleep alone in their own bed?

YEARS & MONTHS

E Moe, Māmā

Your Child's Sleep and Health at 3 Years



Questions 8 to 24 ask about your child's sleep habits over the **past seven days**.

8. What time did your child usually **go to bed**:

a: During the week?

(Sunday night to Thursday night)

HH:MM AM/PM

b: During the weekend?

(Friday and Saturday night)

HH:MM AM/PM

9. What time did your child usually **go to sleep**:

a: During the week?

(Sunday night to Thursday night)

HH:MM AM/PM

b: During the weekend?

(Friday and Saturday night)

HH:MM AM/PM

10. What time did your child usually **wake up**:

a: During the week?

(Monday morning to Friday morning)

HH:MM AM/PM

b: During the weekend?

(Saturday and Sunday morning)

HH:MM AM/PM

11. What is the longest time your child slept in the night **without waking**?

a: During the week?

(Sunday night to Thursday night)

HOURS

&

MINUTES

b: During the weekend?

(Friday and Saturday night)

HOURS

&

MINUTES

12. How many naps did your child usually have during the daytime?

a: during the week?

(Monday to Friday)

0 1 2 3 4 or more

b: during the weekend?

(Saturday and Sunday)

0 1 2 3 4 or more

c: Is your child transitioning away from napping (now not needing a nap every day)?

- Yes (does not nap every day)
- No (naps every day)
- Has stopped napping completely
- Don't know

E Moe, Māmā

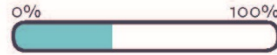
Your Child's Sleep and Health at 3 Years



13. How many nights in the last week have you given your child something to help them sleep?
- 1-2 nights
- 3-4 nights
- 5-6 nights
- 7 nights
- none at all *(Please go to question 15)*
14. What was used to help your child sleep?
- PLEASE SPECIFY
15. Did your child have a snack within the hour before going to bed?
- Never
- 1-2 nights a week
- 3-4 nights a week
- 5-6 nights a week
- Every night
16. In the hour before bedtime, did your child engage in stimulating activities such as rough play or sport?
- Never
- 1-2 nights a week
- 3-4 nights a week
- 5-6 nights a week
- Every night
17. In the hour before bedtime, did your child engage in relaxing activities such as reading or listening to calming music?
- Never
- 1-2 nights a week
- 3-4 nights a week
- 5-6 nights a week
- Every night
18. How often did your child consume foods or drinks containing caffeine after 5pm (such as chocolate, coca-cola, tea, hot chocolate, milo)?
- Never
- 1-2 nights a week
- 3-4 nights a week
- 5-6 nights a week
- Every night
19. Did your child typically have a bedtime routine in which the same activities occurred most nights?
- Yes No
20. How many times in the last seven days did your child exercise for more than 20 minutes?
- (e.g. swimming, sports, running, skipping, jumping, ball games, scooting, bike riding)*
- Never
- 1-2 times
- 3-4 times
- 5-6 times
- 7 or more times

E Moe, Māmā

Your Child's Sleep and Health at 3 Years



21. Did you usually do any of the following activities with your child at bedtime?
(Please tick as many boxes as apply)
- Tell stories to your child
 - Listen to music together
 - Sing to your child
 - Say rhymes or do action songs with your child
 - None of the above
 - Other *(Please specify)*

PLEASE SPECIFY

22. How often was your child read to in the half hour before they went to sleep?
- Never
 - 1-2 nights a week
 - 3-4 nights a week
 - 5-6 nights a week
 - Every night

23. How often did your child have a bath or shower in the hour before they went to bed?
- Never
 - 1-2 nights a week
 - 3-4 nights a week
 - 5-6 nights a week
 - Every night

24. How did your child usually fall asleep?
- With the main lights on
 - With a lamp on
 - With a night light on
 - With a hall light on
 - With no lights on

Technology

25. Does your child have the following technology in their 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 tablet)*
 - e-reader **without** a bright screen *(e.g. non-backlit Kindle)*
 - Other technology *(Please specify)*

PLEASE SPECIFY

- None

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Your Child's Sleep and Health at 3 Years



26. How frequently does your child do the following in the **hour before** going to sleep?

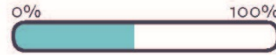
	Every night or almost every night	A few nights a week	A few nights a month	Rarely	Never
Watch movies or television <i>(e.g. on TV, portable DVD player, iPad, laptop, computer)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listen to radio or music <i>(e.g. using radio, CD or MP3 player)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Play games <i>(e.g. using a computer, phone or gaming console)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader with a bright screen <i>(e.g. Kobo, iPad, other tablet)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader without a bright screen <i>(e.g. non-backlit Kindle)</i>	<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					

27. How frequently does your child do the following to **help them fall asleep**?

	Every night or almost every night	A few nights a week	A few nights a month	Rarely	Never
Watch movies or television <i>(e.g. on TV, portable DVD player, iPad, laptop, computer)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listen to radio or music <i>(e.g. using radio, CD or MP3 player)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Play games <i>(e.g. using a computer, phone or gaming console)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader with a bright screen <i>(e.g. Kobo, iPad, other tablet)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader without a bright screen <i>(e.g. non-backlit Kindle)</i>	<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					

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Sleep Habits

- The following statements (questions 28 to 32) are about your child's sleep habits and possible difficulties with sleep.
- Think about the **past week** in your child's life when answering the questions.
- If last week was unusual for a specific reason (such as your child had an ear infection and did not sleep well or the TV set was broken), choose the **most recent typical week**.
- Answer **USUALLY** if something occurs five or more times in a week; answer **SOMETIMES** if it occurs two to four times in a week; answer **RARELY** if something occurs never or only one time during a week.
- Please indicate whether or not the sleep habit is a problem by circling "Yes", "No", or "Not applicable" (N/A).

28. Bedtime	Usually	Sometimes	Rarely	Problem?		
	(5-7 nights)	(2-4 nights)	(0-1 nights)	(Please circle)	Yes	No
Child goes to bed at the same time every night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child falls asleep within 20 minutes after going to bed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child falls asleep alone in bed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child falls asleep in parent's or sibling's bed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child falls asleep with rocking or rhythmic movements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child needs special object to fall asleep (doll, special blanket, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child needs parent in the room to fall asleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child is ready to go to bed at bedtime	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child resists going to bed at bedtime	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child struggles at bedtime (cries, refuses to stay in bed, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child is afraid of sleeping in the dark	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child is afraid of sleeping alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A

29. Sleep behaviour

a: What is your child's usual amount of sleep each **week** day/night, i.e. Sunday to Thursday night? (combining night time sleep and naps)

b: What is your child's usual amount of sleep each **weekend** day/night, i.e. Friday and Saturday? (combining night time sleep and naps)

HOURS

&

MINUTES

HOURS

&

MINUTES

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29.
Cont'd.

c: Sleep behaviour

	Usually (5-7 nights)	Sometimes (2-4 nights)	Rarely (0-1 nights)	Problem? (Please circle)
Child sleeps too little	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child sleeps too much	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child sleeps the right amount	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child sleeps about the same amount each day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child wets the bed at night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child talks during sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child is restless and moves a lot during sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child sleep walks during the night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child moves to someone else's bed during the night (parent, brother, sister, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child reports body pains during sleep (if so, where?)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
PLEASE SPECIFY				
Child grinds teeth during sleep (your dentist may have told you this)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child snores loudly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child seems to stop breathing during sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child snorts and/or gasps during sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child has trouble sleeping away from home (visiting relatives, holiday)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child complains about problems sleeping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child awakens during night screaming, sweating and inconsolable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child awakens alarmed by a frightening dream	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A

30.

Waking during the night

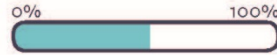
	Usually (5-7 nights)	Sometimes (2-4 nights)	Rarely (0-1 nights)	Problem? (Please circle)
Child awakes once during the night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child awakes more than once during the night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A
Child returns to sleep without help after waking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes No N/A

Please write how many minutes a night wake usually lasts:

MINUTES

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31. Morning waking

	Usually (5-7 mornings)	Sometimes (2-4 mornings)	Rarely (0-1 mornings)	Problem? (Please circle)		
Child wakes up by her/himself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child wakes up with alarm clock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child wakes up in negative mood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Adults or siblings wake up child	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child has difficulty getting out of bed in the morning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child takes a long time to become alert in the morning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child wakes up very early in the morning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child has a good appetite in the morning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A

32. Daytime sleepiness

	Usually (5-7 days)	Sometimes (2-4 days)	Rarely (0-1 days)	Problem? (Please circle)		
Child naps during the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child suddenly falls asleep in the middle of active behaviour	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A
Child seems tired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	No	N/A

During the past week, has your child appeared very sleepy or fallen asleep during the following:

	Not Sleepy	Very Sleepy	Falls Asleep
Play alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watching TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Riding in car	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eating meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Going to sleep and staying asleep

Please think about **your child's sleep in general** when answering questions 33 to 39.

33. Why do you think your child wakes at night? (Please tick as many boxes as apply)

- | | | |
|---|--|---|
| <input type="checkbox"/> My child doesn't wake at night | <input type="checkbox"/> Too hot | <input type="checkbox"/> Pets |
| <input type="checkbox"/> Nightmare | <input type="checkbox"/> Too cold | <input type="checkbox"/> Breathing difficulties |
| <input type="checkbox"/> Sleep walking | <input type="checkbox"/> Hungry or thirsty | <input type="checkbox"/> Snoring |
| <input type="checkbox"/> Sleep talking | <input type="checkbox"/> Noise | <input type="checkbox"/> Other (Please specify) |
| <input type="checkbox"/> Night terrors | <input type="checkbox"/> Light | |

PLEASE SPECIFY

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34. **How often** do you feel the following is a problem for you?
(Please **tick one** option per statement)

	Never	Occasionally	1-3 times per week	4-6 times per week	Every night
The time it takes my child to fall asleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child's sleeping patterns or habits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

35. **How much** of a problem is the following for you?
(Please **tick one** option per statement)

	No problem	Small problem	Moderate problem	Large problem
The time it takes my child to fall asleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child's sleeping patterns or habits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

36. Do you feel anxious or worried about...
(Please **tick as many boxes as apply**)

- Your child's bedtime routine
 How much sleep your child gets
 Your child's night waking
 Your child's early waking
 Other sleep-related behaviour
(Please specify)

PLEASE SPECIFY

- None of these

Support and advice

37. Have you sought advice about your child's sleep from a health professional or other provider?
Yes No

If 'Yes', which type of health professional/provider did you seek advice from?

(Please **tick as many boxes as apply**)

- GP
 Plunket nurse/Well Child provider
 Paediatrician
 Homeopath
 Other (Please specify)

PLEASE SPECIFY

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38. Have you followed any tips or tried any particular **techniques or strategies** when it comes to helping your child's sleep?

Yes No

If 'Yes', please specify which tips/ techniques you have used. Please tick (✓) any strategies that were useful and cross (X) any you tried but did not find helpful (e.g. ✓ same bedtime every night, X using a nightlight)

PLEASE SPECIFY TECHNIQUES AND IF THEY WERE HELPFUL

39. Which **sources of information** about your child's sleep have you used, and were they useful?

(Please tick as many boxes as apply)

Books
Useful? Yes No

PLEASE SPECIFY RESOURCE

Internet
Useful? Yes No

PLEASE SPECIFY RESOURCE

Parenting magazines
Useful? Yes No

PLEASE SPECIFY RESOURCE

Advice from friends/whānau/family
Useful? Yes No

PLEASE SPECIFY RESOURCE

Other (please specify)
Useful? Yes No

PLEASE SPECIFY RESOURCE

None

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Your Child's Sleep and Health at 3 Years



Ethnicity

40. Which ethnic group does **your child** belong to?

Mark the space or spaces which apply to **your child**:

- New Zealand European
- Māori
- Samoan
- Cook Island Māori
- Tongan
- Niuean
- Chinese
- Indian
- Other such as DUTCH, JAPANESE, TOKELAUAN. Please state:

PLEASE SPECIFY

41. How common are insults or attacks in your neighbourhood to do with someone's ethnicity?

- Not at all common
- Not very common
- Fairly common
- Very common

42. Has your child ever been treated unfairly **because of his/her ethnicity** in New Zealand?

- Yes
- No
- Don't know

43. Has your child seen someone from their own ethnic group treated unfairly **because of their ethnicity** in New Zealand?

- Yes
- No
- Don't know

If 'Yes', who was this?

(e.g. friend, family member, neighbour)

PLEASE SPECIFY

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Childcare

44. In the **past week**, which type of arranged childcare was your child in, and for how long?
Please tick as many options that apply and write the total hours for each service used in the past seven days.

A babysitter, family member or friend in **my** home

TOTAL HOURS IN PAST 7 DAYS

A babysitter, family member or friend in **their** home

TOTAL HOURS IN PAST 07 DAYS

A nanny or early childcare worker in **my** home

TOTAL HOURS IN PAST 7 DAYS

A nanny or early childcare worker in **their** home

TOTAL HOURS IN PAST 7 DAYS

44. cont'd.

A childcare education centre or crèche

TOTAL HOURS IN PAST 7 DAYS

A kindergarten

TOTAL HOURS IN PAST 7 DAYS

Te Kohanga Reo or Pacific Language Group

TOTAL HOURS IN PAST 7 DAYS

Other childcare arrangement (Please specify)

PLEASE SPECIFY

TOTAL HOURS IN PAST 7 DAYS

No arranged care

Don't know

45. How old was your child when he/she started to receive the following childcare?

	Age when started receiving childcare		Don't know	N/A
	YEARS	& MONTHS		
A babysitter, family member or friend in my home			<input type="radio"/>	<input type="radio"/>
A babysitter, family member or friend in their home			<input type="radio"/>	<input type="radio"/>
A nanny or early childcare worker in my home			<input type="radio"/>	<input type="radio"/>
A nanny or early childcare worker in their home			<input type="radio"/>	<input type="radio"/>
A childcare education centre or crèche			<input type="radio"/>	<input type="radio"/>
A kindergarten			<input type="radio"/>	<input type="radio"/>
Te Kohanga Reo or Pacific Language Group			<input type="radio"/>	<input type="radio"/>
Other childcare arrangement (Please specify)			<input type="radio"/>	<input type="radio"/>
PLEASE SPECIFY				

OR

My child has never been in any type of childcare

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Health

46. What is your child's height and waist measurement?

(Using the **tape measure** provided, please measure your child's height and waist **three times**. This helps ensure we have an accurate measure.)

To measure your child's height:



Please ask your child to take off their shoes and stand flat on the ground with their heels against a wall or door frame.

Place your hand, a book, or piece of card flat on their head.

Measure from the point where your hand, book or card touches the wall to the floor (see diagram).

Write down the height measurement in **cm**.

Repeat twice more.

To measure your child's waist:



Please ask your child to stand in a relaxed position.

Take the tape measure and pass it around their waist (at the narrowest point) so it sits firmly.

Write down the waist measurement in **cm**.

Repeat twice more.

Height	1:	HEIGHT IN CM	2:	HEIGHT IN CM	3:	HEIGHT IN CM
Waist	1:	WAIST IN CM	2:	WAIST IN CM	3:	WAIST IN CM

47. How much does your child weigh **now**?

(Please record the weight in **kg** that your child is now, if you have access to scales)



WEIGHT IN KGS

If you do not know how much your child weighs now, please answer question 48.

48. Think about the **last time your child was weighed**:

How much did your child weigh then?

WEIGHT IN KGS

How old was he/she when they were weighed?

YEARS & MONTHS

49. Do you think your child is:

- Very underweight
- Underweight
- Neither underweight nor overweight
- Overweight
- Very overweight
- Don't know

50. In general, would you say your child's health is: (Please **tick one** option that best describes your child's health)

- Poor
- Fair
- Good
- Very good
- Excellent
- Don't know

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51. Have you ever been told by a doctor that your child has a health condition that has or is expected to last more than six months, such as those listed below?

Please tick as many boxes as apply

Asthma

Eczema

Allergy lasting six months or more
(Please specify)

PLEASE SPECIFY

Birth condition (e.g. spina bifida, congenital heart defect, intellectual disability) *(Please specify)*

PLEASE SPECIFY

Diabetes

Cancer *(Please specify)*

PLEASE SPECIFY

Rheumatic heart disease

Epilepsy

Autism

Depression

Anxiety

Attention deficit disorder (ADD) or attention deficit hyperactivity disorder (ADHD)

Permanent hearing problems

Vision problems that **cannot be corrected** with glasses

Something else *(Please specify)*

PLEASE SPECIFY

Don't know

52. Does anyone smoke **inside your house**?
(Please tick one option)

Yes

No

Sometimes

Don't know

53. Thinking about the **car** that your child usually travels in, does anyone smoke in that car?
(Please tick one option)

Yes

No

Sometimes

Don't know

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Your Child's Sleep and Health at 3 Years



Physical functioning

Please think about your child's physical abilities, that is how able they are to perform certain tasks physically, when answering question 54.

54. In the past **one month**, how much of a **problem** has your child had with:

(Please **tick one** option per statement)

	Never	Almost never	Sometimes	Often	Almost always
Walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Running	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participating in active play or exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lifting something heavy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bathing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Helping to pick up his or her toys	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having hurts or aches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low energy level	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Nutrition

55. a: Has your child ever been breastfed?

Yes No Don't know

If you answered 'Yes' please answer question 55b, if 'No' or 'Don't know' go to question 56.

b: What age was your child when he or she stopped breastfeeding?

Please write the age your child stopped breastfeeding OR tick one option:

My child stopped breastfeeding at the age of:

YEARS & MONTHS & WEEKS

OR

My child is currently breastfed

OR

Don't know

56. In the past 7 days, how many mornings has your child eaten breakfast at home?

(Please **tick one** option).

- 0 mornings
- 1 morning
- 2 mornings
- 3 mornings
- 4 mornings
- 5 mornings
- 6 mornings
- 7 mornings

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Development

57. How old was your child when they first crawled?

MONTHS

58. How old was your child when they took their first steps?

YEARS & MONTHS

59. Answer all items as best you can even if you are not absolutely certain. Please give your answers on the basis of your child's behaviour over the **last 6 months**.

For each item listed in this question, please **tick one** option.

	Not true	Somewhat true	Certainly true
Considerate of other people's feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Restless, overactive, cannot stay still for long	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often complains of headaches, stomach-aches or sickness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shares readily with other children, for example toys, treats, pencils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often loses temper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rather solitary, prefers to play alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Generally well behaved, usually does what adults request	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Many worries or often seems worried	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Helpful if someone is hurt, upset or feeling ill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Constantly fidgeting or squirming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has at least one good friend	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often fights with other children or bullies them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often unhappy, depressed or tearful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Generally liked by other children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Easily distracted, concentration wanders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nervous or clingy in new situations, easily loses confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kind to younger children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often argumentative with adults	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Picked on or bullied by other children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often offers to help others (parents, teachers, other children)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can stop and think things out before acting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be spiteful to others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gets along better with adults than with other children	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Many fears, easily scared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good attention span, sees work through to the end	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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60. Overall, do you think that your child has **difficulties** in one or more of the following areas: emotions, concentration, behaviour or being able to get on with other people?

- No → *If you answered 'No' please go to question 65*
- Yes – minor difficulties
- Yes – definite difficulties
- Yes – severe difficulties
→ *If you answered 'Yes' please continue to questions 61–64*

61. How long have these difficulties been present?

- Less than a month
- 1–5 months
- 6–12 months
- Over a year

62. Do the difficulties upset or distress your child?

- Not at all
- Only a little
- Quite a lot
- A great deal

63. Do the difficulties interfere with your child's everyday life in the following areas?

	Not at all	Only a little	Quite a lot	A great deal
Home life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friendships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leisure activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

64. Do the difficulties put a burden on you or the family as a whole?

- Not at all
- Only a little
- Quite a lot
- A great deal

E Moe, Māmā

Your Child's Sleep and Health at 3 Years



65. Please reflect on the degree to which each of the following statements currently applies to your relationship with your child.

Please **tick one** circle on each line.

	Definitely does not apply	Not really	Neutral, not sure	Applies somewhat	Definitely applies
I share an affectionate, warm relationship with my child.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child and I always seem to be struggling with each other.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If upset, my child will seek comfort from me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child is uncomfortable with physical affection or touch from me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child values his/her relationship with me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I praise my child, he/she beams with pride.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child spontaneously shares information about himself/herself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child easily becomes angry at me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easy to be in tune with what my child is feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child remains angry or is resistant after being disciplined.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dealing with my child drains my energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When my child is in a bad mood, I know we're in for a long and difficult day.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child's feelings toward me can be unpredictable or can change suddenly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child is sneaky or manipulative with me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child openly shares his/her feelings and experiences with me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

66. How would you rate your current relationship with your child? Please **tick one** option.

Poor Fair Good Very good Excellent

67. Date questionnaire completed

E Moe, Māmā

Your Child's Sleep and Health at 3 Years

0% 100%

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, Well Child/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 2: MOE KURA MATERNAL SLEEP AND
HEALTH QUESTIONNAIRE**

E Moe, Māmā

Your Sleep and Health

This questionnaire is about **your** sleep and health.

This questionnaire should be completed when your “E Moe, Māmā” child is **3 years of age**.

Please complete it **no earlier** than one month before their 3rd birthday or **no later** than one month after their 3rd birthday.

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?

About your sleep

2. How many hours sleep, including naps, do you usually get in 24 hours?

(Just think about the last week)

3. In the last week, how often did you get a good night's sleep? *(Please tick one option)*

No nights 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 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:

(Please specify a m/pm)

b. To wake up I need:

c. I regularly wake up:

Before the alarm
 With the alarm
 Don't use an alarm

d. I am fully awake from:

(Please specify a m/pm)

e. I have an energy dip at:

(Please specify a m/pm)

f. On nights before scheduled (e.g. work) days, I go to bed at: *(Please specify a m/pm)*

E Moe, Māmā

Your Sleep and Health



5. *cont'd.* g. To fall asleep when I go to bed takes me:

h. If I get the chance, I like to take a nap:

Yes No

i. If **yes**, I like to nap at:
(Please specify am/pm)

for:

6. 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:
(Please specify am/pm)

b. I normally wake up at:
(Please specify 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:

e. I am fully awake from:
(Please specify am/pm)

6. *cont'd.* f. I have an energy dip at around:
(Please specify am/pm)

g. On nights before free days, I go to bed at:
(Please specify am/pm)

h. To fall asleep when I go to bed takes me:

i. If I get the chance, I like to take a nap:

Yes No

j. If **yes**, I like to nap at:
(Please specify am/pm)

for:

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:

but I normally fall asleep after a maximum of:

2

E Moe, Māmā

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 Moa, Māmā

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
- sleep less
- have more refreshing sleep
- go to sleep earlier
- go to sleep later
- get up earlier
- get up later

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 Moe, Māmā

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 tablet)
- 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 Moe, Māmā

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 <i>(e.g. on TV, portable DVD player, iPad, laptop, computer)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listen to radio or music <i>(e.g. using radio, CD or MP3 player)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Play games <i>(e.g. using a computer, phone or gaming console)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader with a bright screen <i>(e.g. Kobo, iPad, other tablet)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read using an e-reader without a bright screen <i>(e.g. non-backlit Kindle)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surf internet or use social media <i>(e.g. Facebook/texting)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other activities using technology <i>(Please specify)</i>	<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 Moe, Māmā" child
- With other children
- With a pet
- Or with someone or something else?
(Please specify)

PLEASE SPECIFY

E Moe, Māmā

Your Sleep and Health



18. How often in the **last week** did you:

(Please circle one number in every row)

*No days/
no nights*

*Every day/
every night*

Have difficulty getting to sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Wake up during your sleep period	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Wake up too early at the end of a sleep period	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Feel rested upon awakening at the end of a sleep period	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Sleep poorly	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Feel sleepy during the day	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Struggle to stay awake during the day	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Feel irritable during the day	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Feel tired or fatigued during the day	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Feel satisfied with the quality of your sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Feel alert and energetic during the day	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Get too much sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Get too little sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Take a nap at a scheduled time	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Fall asleep at an unscheduled time	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Drink an alcoholic beverage to help you get to sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Use tobacco to help you get to sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Use a herbal product to help you get to sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Use an over-the-counter sleeping pill to help you get to sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Use a prescription sleeping pill to help you get to sleep	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Use any pain medication to help you get to sleep (e.g. Panadol)	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7
Take anything else to help you sleep (please specify)	<input type="radio"/>	1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7

PLEASE SPECIFY

E Moe, Māmā

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 Moe, Māmā" 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

E Moe, Māmā

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 nights	1	2	3	4	5	6	7	Every night
Loud snoring	<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"/>
Long pauses between breaths while asleep	<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"/>
Legs twitching or jerking while you sleep	<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"/>

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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficulty staying asleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problem waking too early	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25. How **satisfied/dissatisfied** are you with your **current** sleep pattern?

(Please **circle one**)

Very satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very dissatisfied
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

E Moa, Māmā

Your Sleep and Health



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 Moe, Māmā

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

PLEASE SPECIFY

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. a. 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 Moe, Māmā

Your Sleep and Health



34. *Cont'd.* **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 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 Moe, Māmā" child affect...
(Please circle one number in every row)

	No nights/ days							Every night/ day
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"/>
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"/>
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"/>
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"/>
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"/>
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"/>
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"/>

36. If you have other children, how much does their sleep affect...
(Please circle one number in every row)

	No nights/ days							Every night/ day
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"/>
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"/>
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"/>
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"/>
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"/>
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"/>
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"/>

E Moe, Māimā

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

E Moe, Māmā

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)

Perfectly happy Extremely unhappy

0 1 2 3 4 5 6 7 OR not applicable

42. Do you have the following types of support?

(Please tick one circle on each line)

	I don't need any support	I would like a lot more support	I would like some more support	I have enough support
Financial support	<input type="radio"/>	<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"/>	<input type="radio"/>
Advice (e.g. someone you can go to for information or guidance)	<input type="radio"/>	<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"/>	<input type="radio"/>

E Moe, Māhā

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...

44. *Cont'd.*

- \$50,001 – \$60,000
- \$60,001 – \$70,000
- \$70,001 – \$100,000
- \$100,001 – \$150,000
- \$150,001 or more
- Don't know

45. 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?

- 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

E Moe, Māmā

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*)
- PLEASE SPECIFY
- Other secondary school qualification gained overseas

E Moe, Māhā

Your Sleep and Health



48. 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)

- 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

Paid work

(These questions refer to your work in the last week):

50. Do you currently work for pay, profit or income?

- Yes, one paid job
- Yes, more than one paid job
- No

COMMENTS WELCOME

If you answered 'No' please go to question 54, if 'Yes' go to question 51.

51. In the **last week**, how many **hours** did you work for pay, profit or income?

HOURS

52. In the **last week**, on how many **nights** did you work for pay, profit or income for at least three hours between midnight and 5am?
(Please circle one)

No nights Every night

0 1 2 3 4 5 6 7

53. 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?

- Very dissatisfied
- Dissatisfied
- Neither satisfied nor dissatisfied
- Satisfied
- Very satisfied

Please now go to question 55.

E Moe, Māori

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, Māmā

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, Māmā" baby?

- Yes No

If 'Yes', please specify the dates of birth:

Baby 1

D D M M Y Y Y Y

Baby 2

D D M M Y Y Y Y

Baby 3

D D M M Y Y Y Y

Baby 4

D D M M Y Y Y Y

E Moe, Māmā

Your Sleep and Health



65. In general, would you say that your health is:

- Excellent
- Very good
- Good
- Fair
- Poor
- 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="radio"/>	<input type="radio"/>	<input type="radio"/>
Stroke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Asthma	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arthritis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spinal disorder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Osteoporosis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anxiety (Please describe)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PLEASE DESCRIBE			
Depression	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other mental illness (Please state)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PLEASE STATE			
Chronic pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High blood pressure (hypertension)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High cholesterol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low iron or anaemia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Allergies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thyroid problem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Respiratory illness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (Please state)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PLEASE STATE			

E Moe, Māmā

Your Sleep and Health



67. Since your “E Moe, Māmā” 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

68. 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. Postpartum psychosis

Cont'd.

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 Moa, Māmā

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 peri-menopause, 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 76)*
 - 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 Moe, Māma

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 Healthline 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

Feelings

80. In the past 30 days how often:
- a. Did you feel tired out for no good reason?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time
- b. Did you feel nervous?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time
- c. Did you feel so nervous that nothing could calm you down?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time
- d. Did you feel hopeless?
- All of the time
 - Most of the time
 - Some of the time
 - A little of the time
 - None of the time

E Moa, Māmā

Your Sleep and Health



80.
Cont'd.

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.
Cont'd.

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 Moe, Māmā

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@cd-risc.com. Copyright © 2001, 2003, 2007, 2011 by Kathryn M. Connor, M.D. and Jonathan R.T. Davidson, M.D.

E Moa, Māmā

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

D D M M Y Y Y Y

E Moe, Māmā

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 3: CONTENTS OF THE MOE KURA STUDY
INFORMATION PACK**



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

<date>

Tēnā koe «Mama_FirstName»,

*E ngā waka, e ngā mana, e ngā reo,
e ngā kārangatanga maha o ngā hau e whā,
kō tēnei te mihi atu ki a koutou.
Tēnā koutou hoki i roto i ngā āhuatanga o tēnei wā.
Nō reira, tēnā koutou, tēnā koutou, tēnā koutou katoa.*

Sleep is very important for our health. The Sleep/Wake Research Centre is a multi-disciplinary research team who are committed to improving the health, performance, safety, and well-being of New Zealanders through a better understanding of links between sleep and waking function. Dr. Leigh Signal and Dr. Sarah-Jane Paine (Tūhoe) are the Principal Investigators on this study. Other members of the research team include: Ms. Diane Muller, Ms. Bronwyn Sweeney, Ms. Sophie McCashin, Dr. Alexander Smith, Prof. Philippa Gander (all Sleep/Wake Research Centre), Dr. Mark Huthwaite (University of Otago, Wellington), Dr. Mona Jeffreys (University of Bristol, Bristol), Associate Professor Harriet Hiscock (Murdoch Childrens Institute, Melbourne), and Prof. Kathy Lee (University of California, San Francisco).

We are writing to you as a participant in the “*E Moe, Māmā study*” which investigated the relationship between sleep in late pregnancy and early postpartum and the impact on maternal health, wellbeing and mood. The *E Moe, Māmā study* has provided us with valuable information about how sleep changes for mothers in the early weeks and months after their babies are born. However, very little is known in this country or overseas about how sleep changes for mothers and their children in the first few years of life together.

We would like to invite you and the child you were pregnant with in the *E Moe, Māmā study* to take part in a **new programme of research** that would investigate the sleep of the women and children in that study and how sleep affects their health and wellbeing. This would be the first programme of research of its kind in New Zealand. The information is important for developing services to support mothers and children. We hope to collect information from as many previous participants as possible.

In this study pack you will find an information sheet that explains the study in more detail. If you choose to participate in the study after reading the information sheet, please complete the consent form, maternal questionnaire, and child questionnaire. Please return these using the enclosed self-addressed reply envelope to the research team. A \$40 voucher will then be posted to you in appreciation of your time.

You can contact any member of the research team directly with any concerns or queries about the survey at the address and phone numbers given.

Thank you for your consideration of this study.

Nō reira, noho ora mai ra
Nā mātou noa, nā

Encl (Consent form, Information sheet, Maternal Questionnaire, Child Questionnaire, Post-paid return envelope, measuring tape)

Sleep/Wake
Research Centre
Moe Tika, Moe Pai

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Wellington Campus
Private Box 756
Wellington 6140
New Zealand

Administration
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Study enquiry line
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Direct Fax
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Internet
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University of Bristol

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Sleep/Wake Research Centre

Sophie McCashin
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Professor Kathy Lee
Dept of Family Health Care Nursing
University of California

Prof Philippa Gander
Sleep/Wake Research Centre

Sleep/Wake Research Centre – Moe Tika, Moe Pai

Cover letter M V2.1 P24/01/13 Wellington 6140, Aotearoa / New Zealand T +64 4 380 0603 E swrc@massey.ac.nz <http://sleepwake.massey.ac.nz>



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

<date>

Dear «Mama_FirstName»,

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Thank you for your consideration of this study.

Sincerely,

Encl (Consent form, Information sheet, Maternal Questionnaire, Child Questionnaire, Post-paid return envelope, measuring tape)

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MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

INFORMATION SHEET

Maternal and Child Sleep, Health and Wellbeing in Aotearoa/New Zealand

This study is being conducted by a team of researchers hosted by the Sleep/Wake Research Centre (School of Public Health) Massey University. Dr. Leigh Signal and Dr. Sarah-Jane Paine (Tūhoe) are the Principal Investigators on this study. Other members of the research team include: Ms. Diane Muller, Ms. Bronwyn Sweeney, Ms. Sophie McCashin, Dr. Alexander Smith, Prof. Philippa Gander (all Sleep/Wake Research Centre), Dr. Mark Huthwaite (University of Otago, Wellington), Dr. Mona Jeffreys (University of Bristol, Bristol), Associate Professor Harriet Hiscock (Murdoch Childrens Institute, Melbourne), and Prof. Kathy Lee (University of California, San Francisco).

You have received this information because you are currently involved in a study that was designed to investigate the relationship between sleep, health and mood during late pregnancy and early postpartum (the "*E Moe, Māmā study*"). A total of 417 Māori women and 765 non-Māori women were involved in this study and we thank you for your time and contribution.

We would like to invite you and the child you were pregnant with in the *E Moe, Māmā study* to take part in a programme of research that would investigate mother and child sleep, explore the factors that affect mother and child sleep and find out how sleep impacts mother and child health and wellbeing. This would be the first programme of research of its kind in New Zealand. The information is important for developing services to support mothers and children. We hope to collect information from as many previous participants as possible.

Your involvement in this study is completely voluntary and you are free to withdraw at any time.

About the programme

The overall aims of this programme are:

- 1) To understand the relationships between sleep and health, wellbeing and disease in Māori and non-Māori women and their children over time;
- 2) To investigate the biological, social, economic and political pathways that contribute to these relationships;
- 3) To explore how maternal and child sleep, health and wellbeing are interconnected;
- 4) To develop novel interventions to improve sleep and reduce health disparities between Māori and non-Māori women and their children.
- 5) To inform policy development that recognises the important role of sleep in the development and progression of sleep, health and wellbeing

Information sheet V2 19/12/12

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P0 Box 756, Wellington 6140, Aotearoa / New Zealand T +64 4 380 0603 E swrc@massey.ac.nz <http://sleepwake.massey.ac.nz>

Health research in New Zealand relies heavily on external funding and so the timing of new studies will depend on when we are able to access sufficient resources to undertake a study to the best of our ability. Our intention is to continue to develop new studies to be able to meet the aims listed above. We will contact you when new studies are developed and provide you with information so that you can decide whether or not you want to be involved at that particular time.

Our main method of gathering information will be using questionnaires similar to those you completed as part of the *E Moe, Māmā* study. You will be able to complete these questionnaires in your own time and in your own home. As in the *E Moe, Māmā* study you will be able to return the questionnaire in the post, or complete a questionnaire with a member of the research team over the phone. We are also developing an online system which will allow participants to complete their questionnaires securely over the internet. Because we are interested in the sleep of you and your child you will be asked to complete two questionnaires in each study. You will be provided with a koha in appreciation of the time and effort involved in completing and returning the questionnaires to the research team.

We may also use other methods of collecting information in some studies, such as conducting focus groups or one-on-one interviews, or monitoring your sleep at home using specialised equipment. You will be provided with a full explanation of the procedures we intend to use in each new study so that you can make an informed decision about participating at that time.

Each new study will be focussed on what is happening when the children in this programme reach a certain age. For example, at age 3 years or at age 5 years. Questionnaires will be sent to you one month before your child's birthday and these questionnaires can be answered by you in your own time and in your own home.

If a new study involves any other method of data collection (for example, taking part in a focus group or having your sleep monitored using special equipment) or requires you to meet a researcher at a location outside your home we will let you know when and where this needs to occur and work with you to find a time and place that is most convenient for you and your family. We will also give you an indication of the time that is involved in each study. In some instances we may be able to reimburse you for your time or travel.

Who can be involved?

Women who were enrolled in the *E Moe, Māmā* study and the child who they were pregnant with at the time are invited to take part in this research programme. As your children are too young to answer the questions themselves we would ask that you complete your child's questionnaire on their behalf.

What's next?

The next stage of this programme will focus on sleep, health, wellbeing and development at the time of your child's third birthday. The aims of the "Age 3 Study" are:

- (1) To investigate the relationship between mother and child sleep and identify the factors that affect mother and child sleep
- (2) To investigate the relationship between the mother's sleep and her health, wellbeing and mood
- (3) To investigate the relationship between the child's sleep and their health, wellbeing and development
- (4) To investigate whether there are differences in sleep, health, wellbeing, mood and development between Māori and non-Māori, mothers and children.

What's involved?

If you decide to take part in the Age 3 Study you will be asked to:

- Complete and return a questionnaire about your sleep, health and wellbeing. The questionnaire takes approximately 30 minutes to complete.
- Complete and return a questionnaire about the sleep, health, wellbeing and development of your *E Moe, Māmā* child. This will take about 30 minutes.

Collection of information from other sources

With your permission, we will access information about you and your child from other sources. Information from other sources is sometimes more detailed than what you are able to supply by memory. Please remember that all of the information you share with us will be subject to strict security measures to maintain confidentiality. Other sources of your information could include: Government Ministries (e.g. the Ministry of Health, Ministry of Education, Ministry of Social Development), hospital records and your Plunket/Wellchild provider.

To be able to access information from other sources we will need your permission to provide your name, address and date of birth and the name, address and date of birth of your child to make sure that we obtain the correct information. **No other information that you provide us in the questionnaires will be seen by anyone else outside the research team.**

Please remember that you and your child can still participate in this study even if you do not give us permission to access information from other sources

Updating contact details

We would like your permission to keep and use your contact details so that we can let you know about our plans for this research programme, to tell you about new studies as they occur and to send you results as they become available. We realise that moving house is a regular part of life for many people, therefore it would be very helpful if you could let us know the names and contact details for at least two other people whom we could get in touch with if we need to get hold of you about this research programme. **Your contact details will be kept separately from your questionnaire information so no one will be able to link your name with your answers. We will keep the contact details of your friends and/or family strictly confidential and will only be made available to members of the research team for the purposes of contacting you about the research programme.**

Data management

None of the data collected will have your name recorded on it. Instead we will use confidential study identification numbers. All data will be stored in secure facilities at the Sleep/Wake Research Centre. Only approved researchers will have access to the data.

The findings of the study will be distributed in scientific journals and meetings. It is important that the knowledge that is gained from this study is shared with the public so we will also present information through the media and in public forum. Students who are involved in the study may present information from this research programme in a thesis, dissertation or report as part of their course work. No material which could personally identify you or your child will be used in any reports on the study.

On completion of the research programme the data will be archived securely for ten years at the Sleep/Wake Research Centre.

Benefits, risks and safety

If you choose to receive the results of the study, you will have an opportunity to learn about sleep and the changes to sleep that occur at each age.

There is a minor inconvenience associated with the time required to complete the questionnaires. You will, however, be provided with a small koha each time you return a completed questionnaire.

Participants rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any stage;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

Code of Practice

The research team are developing a Code of Practice which sets out a number of policies that inform how this programme of research is conducted. For example, this Code of Practice will include protocols for the collection and analysis of data from questionnaires and sharing the study findings with the wider scientific community and general public. The research team are committed to the principles of the Treaty of Waitangi and have developed policies and procedures that ensures that the research programme provides information that is useful and relevant for Māori and non-Māori. The Māori research team members and study advisors have a role of providing kaitiakitanga (guardianship) for all aspects of the study related to Māori.

Research Programme Non-Intervention Policy

Our current policy is not to intervene in people's lives except in two exceptional circumstances where an individual is deemed to be:

- 1) an immediate threat to themselves; or
- 2) an immediate threat to the safety of others.

Thankfully, these situations hardly ever occur, but we have procedures in place should they be required. We do not provide participants with formal feedback about their individual data collected during the study. However, we will continue to provide you with information and contact details for support services (e.g. addresses for GP's or specialised clinics and services) if you want this.

General

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. You can also visit our study website: www.mumsleep.co.nz

If I need an interpreter, can one be provided?

Yes, but only to translate study material and questions into Māori. Study documents and questionnaires will normally be provided in English. It is a study requirement that you are able to complete the questions in either of these languages.

You may have a friend, family or whānau 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. You can also complete the questionnaire over a number of sessions.

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:

Free phone: 0800 555 050

Free fax: 0800 2 SUPPORT (0800 2787 7678)

Email: advocacy@hdc.org.nz

Results

You will receive a summary of the findings of the study and have access to a copy of any publications. Please be aware that there will be a delay between data collection and the publication of the final results. There is a two-year age gap for the children involved in this research programme. Therefore it will take the research team a minimum of 3-years to undertake each study (i.e. 2 years to collect information from everyone and 1 year to analyse the data and report back).

Ethics

This study has received ethical approval from the Central Health and Disability Ethics Committee, ethics reference number (CEN/09/09/070).

What do I do now?

If you would like to stay involved in this research programme after reading this information sheet, please complete the attached consent form and questionnaires, and return them to the research team using the self-addressed envelope provided.

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 about this study, or you can email them at mumsleep@massey.ac.nz, or phone them on 0800 MUMSLEEP (0800 686 7537).

ID: «MamaID»



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University of California

Prof Philippa Gander
Sleep/Wake Research Centre

CONSENT FORM

Please complete and return this consent form and enclosed questionnaires in the envelope provided.

- I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.
- I understand that taking part in this study is voluntary (my choice), and that I may withdraw from the study at any time.
- 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 consent to my contact details being kept by the research team for the purposes of getting in contact with me about this research programme. YES NO
- I consent to my contact details being kept by the research team for the purposes of getting in contact with me about future research. YES NO
- I consent to the research team using my nominated contacts (see overleaf) if they are unable to contact me using the information I have provided. YES NO
- I consent to myself and my child taking part in the Age 3 Study under the conditions set out in the information sheet. YES NO
- I consent to my name, address, birth date and National Health Index (NHI) number being passed to other sources for the purpose of obtaining information about my medical history, health and wellbeing. I understand that this information will be linked with data collected in this programme. YES NO

If you ticked 'Yes' please write your NHI number here if you know it:

--	--	--	--	--	--	--	--	--	--

- I consent to my child's name, address, birth date and National Health Index (NHI) number being passed to other sources for the purpose of obtaining information about their health and wellbeing. I understand that this information will be linked with data collected in this programme. YES NO

If you ticked 'Yes' please write your child's NHI number here if you know it:

--	--	--	--	--	--	--	--	--	--

Your full name: _____

Your child's full name: _____

Your signature: _____ Date: _____

A photocopy of the completed consent form will be returned to you.

Please turn over the page to complete the contact record sheet. Thank you.

ID: «MamaID»

Contact Record Sheet**What are your current contact details?**

Address: _____ Phone (home): _____

Phone (work): _____

Cell phone: _____

Postcode: _____
Email: _____

Please provide us with the contact details of at least 2 people who a member of the research team could contact if we are unable to get in touch with you using the details you have provided above. Your nominated contacts can be a friend, family member, neighbour or work mate.

Nominated contact 1:

Name: _____ Relationship to you: _____
Address: _____ Phone (home): _____

Phone (work): _____

Cell phone: _____

Postcode: _____
Email: _____

Nominated contact 2:

Name: _____ Relationship to you: _____
Address: _____ Phone (home): _____

Phone (work): _____

Cell phone: _____

Postcode: _____
Email: _____

APPENDIX 4: CHILDREN'S SLEEP HABITS QUESTIONNAIRE SCORING PROTOCOL

Subscale Items Children's Sleep Habits Questionnaire (CSHQ)

Numbers in parentheses refer to CSHQ item number

1. Bedtime Resistance (6 items)

Goes to bed at same time (1) (R) ^A
Falls asleep in own bed (3) (R)
Falls asleep in other's bed (4)
Needs parent in room to sleep (5)
Struggles at bedtime (6)
Afraid of sleeping alone (8)

2. Sleep Onset Delay (1 item)

Falls asleep in 20 minutes (2) (R)

3. Sleep Duration (3 items)

Sleeps too little (9)
Sleeps the right amount (10) (R)
Sleeps same amount each day (11) (R)

4. Sleep Anxiety (4 items)

Needs parent in room to sleep (5)
Afraid of sleeping in the dark (7)
Afraid of sleeping alone (8)
Trouble sleeping away (21)

5. Night Wakings (3 items)

Moves to other's bed in night (16)
Awakes once during night (24)
Awakes more than once (25)

6. Parasomnias (7 items)

Wets the bed at night (12)
Talks during sleep (13)
Restless and moves a lot (14)
Sleepwalks (15)
Grinds teeth during sleep (17)
Awakens screaming, sweating (22)
Alarmed by scary dream (23)

7. Sleep Disordered Breathing (3 items)

Snores loudly (18)
Stops breathing (19)
Snorts and gasps (20)

8. Daytime Sleepiness (8 items)

Wakes by himself (26) (R)
Wakes up in negative mood (27)
Others wake child (28)
Hard time getting out of bed (29)
Takes long time to be alert (30)
Seems tired (31)
Watching TV (32)
Riding in car (33)

Total Sleep Disturbance Score (33 items)^B

Scoring: Usually = 3 Sometimes = 2 Never/Rarely = 1

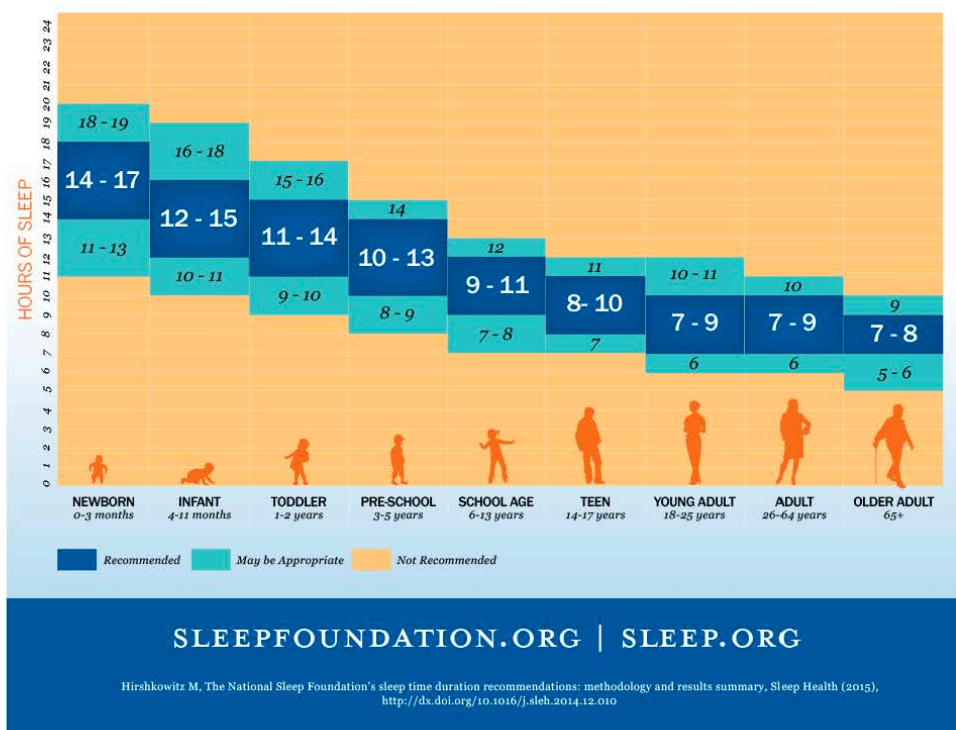
^A Note: Some items (R) should be reversed in scoring, so that a higher score reflects more disturbed sleep behavior.

^B Note: The Total Sleep Disturbance Score: Consists of all 33 subscale items instead of 35 (although items 5 and 8 are on both the Bedtime Resistance and Sleep Anxiety scales, they should be included only once in the total score)

APPENDIX 5: QUALITATIVE STUDY SLEEP INFORMATION SHEETS



SLEEP DURATION RECOMMENDATIONS



Preschooler sleep: what to expect

*Adapted from information by
Raising Children Network*



Preschoolers often need around 11-13 hours of sleep a night, with perhaps an hour's nap during the day.

Sleeping well is important for children's health, growth and development.

Your preschooler's imagination is developing and your child might start having nightmares. Children need your reassurance and help to learn that monsters are make-believe.

A regular bedtime routine can help improve sleeping patterns, for example:

- 6.30 pm: prepare for bed.
- 6.45 pm: read a book or tell a story.
- 7 pm: kiss goodnight.

Tips for sleeping through

- Avoid boisterous play before bedtime.
- Make sure your child has everything needed, and that the bedroom is quiet and dark.
- Try not to respond to your child's calls after lights out.
- Remind your child that you are just next door.
- Use a night light if your preschooler is scared of the dark.

This article is an extract only. For more information, visit: raisingchildren.net.au/sleep/preschoolers_sleep.html.

Sourced from the Raising Children Network's comprehensive and quality-assured Australian parenting website, www.raisingchildren.net.au.

IF YOU HAVE CONCERNS ABOUT YOUR CHILD'S SLEEP OR HEALTH IT IS RECOMMENDED THAT YOU DISCUSS THESE WITH YOUR DOCTOR OR HEALTH PROFESSIONAL



Sleep Tips for Children



1 Establish a regular sleep pattern

Regular hours of sleep are important. It will help your child understand when it is time to sleep. Also, your child will have better sleep. Bed time should not vary by more than an hour between school and non-school nights. The same goes for the time your child wakes up.

2 A consistent bedtime routine

It is good to have the same routine before bed each night. This will help prepare for sleep. Quiet activities are good e.g. reading a book or being read to or having a bath or shower. In the half hour before bed, there are some things you don't want your child to do. These are more active games, playing outside, TV, internet or mobile phone social networking and computer games.

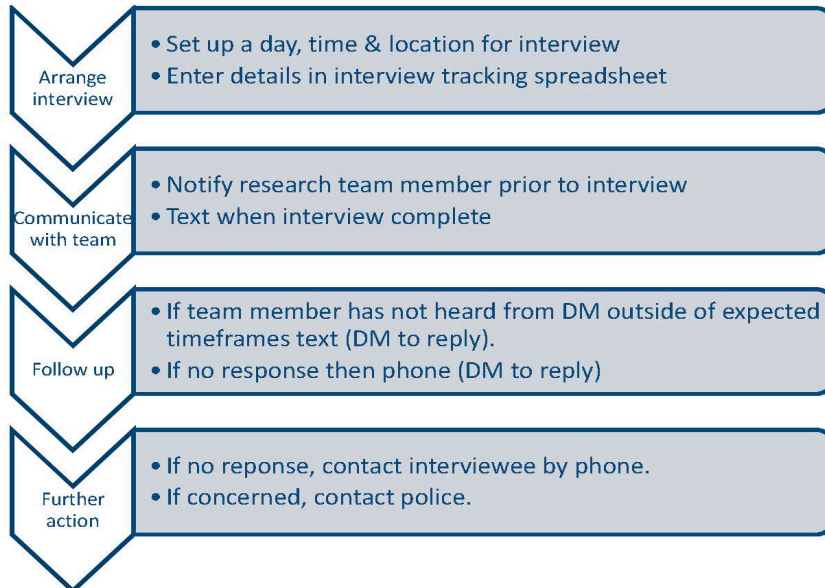
3 Make sure the bedroom is comfortable

The bedroom should be a quiet, comfortable and dark. Some children like a night light. This is fine. Make sure your child sees the bedroom as a good place to be. You can help do this by not using it as a place for punishment.

4 Bed is for sleeping, not entertainment

TV, computers, mobile phones and other things that distract your child are not good for their sleep. Keep them out of the bedroom. "Needing" the TV to go to sleep is a bad habit. This can easily develop, but you don't want it to happen. It's also better if you can check on what your child is watching.

APPENDIX 6: QUALITATIVE STUDY SAFETY PROTOCOL



**APPENDIX 7: CONTENTS OF THE QUALITATIVE STUDY
INFORMATION PACK**



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

<date>

Tēnā koe

I am a PhD (Public Health) student at the Sleep/Wake Research Centre, Massey University, Wellington. I have also been a member of the *E Moe, Māmā/Moe Kura* study team since 2010.

Firstly, thank you for previously taking part in the *E Moe, Māmā* and *Moe Kura* studies of sleep, health and wellbeing of mothers and children. We have finished collecting data from the 'Age 3' phase of the study and are now preparing this for analysis. We will distribute our findings once we have compiled our results.

I previously worked as an occupational therapist before joining the Sleep/Wake Research Centre team eight years ago. I have two school-aged children and am interested in the way that the environment may influence child sleep and health, which has led me to start my PhD.

I am interested in talking with women from our study to hear about their experiences of their children's sleep, to find out what makes it easier or more challenging for children to sleep in different families, and what this may mean for children's wellbeing. I would therefore like to invite you to take part in an interview to talk about your child's sleep. In this pack is an information sheet that explains my study in more detail.

If, after reading the information sheet, you would like to participate in the study **please complete the consent form and return it in the pre-paid envelope**. I will also contact you by phone or email over the next week to answer any questions you may have. If you are interested in taking part, an interview will be arranged for a day, time and place that suits you, to the best of my ability.

If you have any questions please don't hesitate to contact me (email: d.p.muller@massey.ac.nz or phone: 04 801 5799 xt 63261)

Thank you very much for considering my request.

Nāku noa, nā

Diane (Dee) Muller
PhD candidate



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

<date>

Dear

I am a PhD (Public Health) student at the Sleep/Wake Research Centre, Massey University, Wellington. I have also been a member of the *E Moe, Māmā/Moe Kura* study team since 2010.

Firstly, thank you for previously taking part in the *E Moe, Māmā* and *Moe Kura* studies of sleep, health and wellbeing of mothers and children. We have finished collecting data from the 'Age 3' phase of the study and are now preparing this for analysis. We will distribute our findings once we have compiled our results.

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If you have any questions please don't hesitate to contact me (email: d.p.muller@massey.ac.nz or phone: 04 801 5799 xt 63261)

Thank you very much for considering my request.

Yours sincerely

Diane (Dee) Muller
PhD candidate



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

Social determinants of pre-school children's sleep in Aotearoa/New Zealand

Information Sheet

*He taonga te tamaiti
Every child is a treasure*

This study is being carried out by Diane (Dee) Muller, who is a student at the Sleep/Wake Research Centre, Massey University, Wellington. Dee is studying towards a PhD in Public Health and is being supervised by Dr Leigh Signal and co-supervised by Dr Sarah-Jane Paine (Tuhoe), who are both Associate Directors of the Sleep/Wake Research Centre and Principal Investigators of the *E Moe*, *Māmā* and *Moe Kura* studies.

Project description

Sleep is important for children's health, development and general wellbeing. It is important to understand what can be done to support children to get the sleep they need and to find out what may make sleep more difficult, so changes can be made in areas such as healthcare services and social policy.

There are many things that may make a difference to children's sleep. The aim of this project is to find out about factors that may influence children's sleep in Aotearoa/New Zealand, using a model that looks at different aspects of the environment.

This study uses a mixed methods design, which means using responses from questionnaires (the number of people answering a question in a certain way) and people's comments, thoughts and ideas. Part of this study will use data already collected from *E Moe*, *Māmā* and *Moe Kura* questionnaires. Extra information will be collected by interviewing women about their experiences of their children's sleep.

Invitation

As a woman who has already provided valuable information in the *E Moe*, *Māmā* and *Moe Kura* questionnaires about you and your child, you are invited to be involved in this study by taking part in an interview about your child's sleep.

Participant identification and recruitment

The aim is to interview up to 32 women and their children who have already taken part in *E Moe*, *Māmā* and *Moe Kura*. As children in the study are too young to answer questions themselves, we ask that women take part in the interviews and provide information about their children on their behalf.

It is important to hear about the experiences of women and children living in a variety of situations, to better understand the possible broad range of factors that may influence children's sleep. So, women living in a range of communities will be invited to take part. We offer women the option of

1

being interviewed by Dee (Tuiwi) or a Māori member of our research team, Tiffany Te Moananui (Ngati Tamatera me Tainui), accompanied by Dee.

What is involved?

If you decide to take part in this study, you will be asked to:

- Complete the consent form in this study pack and return it in the pre-paid envelope
- Meet with Dee (as well as a Māori member of our research team if you would prefer) and fill in a brief demographic information sheet about your household (this will take about 5 – 10 minutes).
- Be interviewed about your experiences of your child's sleep (this will take about one hour) which will be sound recorded. You can decide if you would prefer to be interviewed at Massey University or somewhere else convenient to you, such as your local library.

Data management

All data will be stored in secure facilities at the Sleep/Wake Research Centre, Massey University, Wellington. A confidentiality agreement will be signed by any person outside of the research team who may be used to type up the recorded interview. Only approved researchers will have access to the data. **No material which could personally identify you or your child will be used in any reports on the study.**

The findings of the study will be distributed in scientific journals and meetings and will form the PhD thesis of Diane (Dee) Muller. It is important that the knowledge that is gained from this study is shared with the public so we will also present information through the media and in public forums.

Once the study has finished, the data will be archived securely for ten years at the Sleep/Wake Research Centre, Massey University, Wellington.

Benefits, risks and safety

If you choose to take part, you will receive a koha of a \$20 gift voucher for yourself and a picture book and stickers for your child, in acknowledgement of your time taken to participate. An information sheet on children's sleep will also be available, as will information on who you can contact if you have any concerns about your child's sleep, if you so wish.

There is a minor inconvenience associated with the time needed to complete the consent form, the demographic sheet and the interview. To minimise this inconvenience, the interview will be scheduled for a day, time and location that suits you, to the best of the researcher's ability.

Participant's rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any particular question;
- Withdraw from the study at any stage;
- Ask for the recorder to be turned off at any time during the interview;
- Ask any questions about the study at any time during participation;
- Provide information on the understanding that your name will not be used unless you give permission to the researcher;
- Be given access to a summary of the project findings when it is concluded.

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:

Free phone: 0800 555 050

Free fax: 0800 2 SUPPORT (0800 2787 7678)

Email: advocacy@hdc.org.nz

Project contacts

If you have any questions about this study, you can contact Dee or her supervisors:

Dee Muller (email: d.p.muller@massey.ac.nz phone: 04 801 5799 ext 63261)

Dr Leigh Signal (email: t.l.signal@massey.ac.nz)

Dr Sarah-Jane Paine (email: s.j.paine@massey.ac.nz)

Results

You will receive a written summary of the findings from the qualitative (interview) study, which is expected to be completed in 2016. A brochure summarising results from the full mixed methods study will also be made available, with the aim of the study being completed in 2017.

Ethics

This study has received ethical approval from the Central Health and Disability Ethics Committee, ethics reference number CEN/09/09/070/AM05.

What do I do now?

If you would like to take part after reading this information sheet, please complete the consent form included in this pack and return it using the pre-paid envelope provided.

Thank you for taking the time to consider being involved in this study. Please do not hesitate to contact us if you have any questions.



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

Social determinants of pre-school children's sleep in Aotearoa/New Zealand

Information Sheet

This study is being carried out by Diane (Dee) Muller, who is a student at the Sleep/Wake Research Centre, Massey University, Wellington. Dee is studying towards a PhD in Public Health and is being supervised by Dr Leigh Signal and co-supervised by Dr Sarah-Jane Paine (Tuhoē), who are both Associate Directors of the Sleep/Wake Research Centre and Principal Investigators of the *E Moe*, *Māmā* and *Moe Kura* studies.

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What is involved?

If you decide to take part in this study, you will be asked to:

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If you choose to take part, you will receive a koha of a \$20 gift voucher for yourself and a picture book and stickers for your child, in acknowledgement of your time taken to participate. An information sheet on children's sleep will also be available, as will information on who you can contact if you have any concerns about your child's sleep, if you so wish.

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Dr Leigh Signal (email: t.l.signal@massey.ac.nz)

Dr Sarah-Jane Paine (email: s.j.paine@massey.ac.nz)

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You will receive a written summary of the findings from the qualitative (interview) study, which is expected to be completed in 2016. A brochure summarising results from the full mixed methods study will also be made available, with the aim of the study being completed in 2017.

Ethics

This study has received ethical approval from the Central Health and Disability Ethics Committee, ethics reference number CEN/09/09/070/AM05.

What do I do now?

If you would like to take part after reading this information sheet, please complete the consent form included in this pack and return it using the pre-paid envelope provided.

Thank you for taking the time to consider being involved in this study. Please do not hesitate to contact us if you have any questions.

**Social determinants of pre-school children's sleep in Aotearoa/New Zealand
Consent Form**

Please fill in and return this consent form in the pre-paid envelope provided.

- I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.
- I understand that taking part in this study is voluntary (my choice), and that I may withdraw from the study at any time.
- I understand that taking part 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 consent to participating in this study under the conditions set out in the Information Sheet.
- I consent to the interview being sound recorded.
- I consent to information I provide about myself, and my child, during this study to be securely stored at the Sleep/Wake Research Centre, Massey University, Wellington.

- Would you like to receive a copy of the written version of your interview?
 Yes No

- Would you prefer to be interviewed by a Māori member of the research team?
 Yes No

MY full name: _____

My signature: _____

Date: _____

My contact details (so the research team can contact you about this study)

Home address: _____

Email: _____

Home phone: _____

Cell phone: _____

APPENDIX 8: QUALITATIVE STUDY EMAIL FOLLOW UP

Tēnā koe <name>

I am a PhD (Public Health) student at the Sleep/Wake Research Centre, Massey University, Wellington and a member of the *E Moe, Māmā/Moe Kura* study team who have been investigating the sleep, health and wellbeing of mothers and children.

I recently sent you a study pack inviting you to take part in an interview to talk about your child's sleep, which will form part of my PhD project. If, after reading the information sheet, you would like to participate it would be much appreciated if you could let me know either by replying to this email or completing and posting the consent form that was in the study pack.

Alternatively, if you do not wish to take part could you please let me know by email and I will not follow up any further. If I don't hear from you, I will phone next week to answer any questions you may have.

If you wish to discuss this further, please do not hesitate to phone me on (04) 801 5799 xt 63261, or email d.p.muller@massey.ac.nz.

Thank you very much for considering my request.

Ngā mihi

Dee Muller

(Massey signature)

Dear <name>

I am a PhD (Public Health) student at the Sleep/Wake Research Centre, Massey University, Wellington and a member of the *E Moe, Māmā/Moe Kura* study team who have been investigating the sleep, health and wellbeing of mothers and children.

I recently sent you a study pack inviting you to take part in an interview to talk about your child's sleep, which will form part of my PhD project. If, after reading the information sheet, you would like to participate it would be much appreciated if you could let me know either by replying to this email or completing and posting the consent form that was in the study pack.

Alternatively, if you do not wish to take part could you please let me know by email and I will not follow up any further. If I don't hear from you, I will phone next week to answer any questions you may have.

If you wish to discuss this further, please do not hesitate to phone me on (04) 801 5799 xt 63261, or email d.p.muller@massey.ac.nz.

Thank you very much for considering my request.

Kind regards

Dee Muller

(Massey signature)

**APPENDIX 9: QUALITATIVE STUDY DEMOGRAPHIC
INFORMATION SHEET**

ID: _____

Social determinants of pre-school children's sleep in Aotearoa/New Zealand

Demographic Sheet

YOUR Details

Name: _____

Date of birth: _____

Address: _____

Today's date: _____

YOUR ethnicity:

Which ethnic group do YOU belong to?

Mark the space or spaces which apply to you.

- New Zealand European
- Māori
- Samoan
- Cook Island Maori
- Tongan
- Niuean
- Chinese
- Indian
- other such as *DUTCH, JAPANESE, TOKELAUAN*. Please state: _____

YOUR education:

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

ID: _____

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)

- No qualification beyond secondary school
- Bachelors degree, for example BA, BSc
- Bachelors degree with honours
- Masters degree, for example MA, MSc
- PhD
- Diploma (**not** postgraduate)
- 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) _____

Your HOUSEHOLD income:

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?

- 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

Demographic Sheet_Aug2015

2

ID: _____

Your home:

TOTAL number of people who live in your home: _____

Number of ADULTS who live in your home: _____

Number of CHILDREN who live in your home: _____

How many BEDROOMS are in your home? (Count rooms or sleepouts furnished as bedrooms, and any caravan that your household uses as a bedroom): _____

The following few questions are designed to identify people who have had special financial needs in the last 12 months. Although these questions may not apply directly to you, for completeness we need to ask them of everyone.

1. 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
2. In the **last 12 months** have you been out of paid work at any time for more than one month?
 yes
 no
3. If you answered 'Yes' in question 2, was this due to being a full-time care-giver and/or home maker?
 yes
 no
4. In the **12 months ending today** did you **yourself** receive payments from any of these three benefits: Jobseeker Support, Sole Parent Support or Supported Living Payment?
 yes
 no
5. In the **last 12 months** have you **personally** put up with feeling cold to save heating costs?
 yes
 no
6. 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

ID: _____

7. In the **last 12 months** have you **personally** continued wearing shoes with holes because you could not afford replacement?
- yes
 no
8. 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
9. 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

Your CHILD'S Details

Your (E Moe Māmā) CHILD'S name: _____

Your CHILD'S date of birth: _____

Your CHILD'S age: _____

Your child's gender: Female Male**YOUR CHILD'S ethnicity:**

Which ethnic group does your child belong to?

Mark the space or spaces which apply to your child. New Zealand European Māori Samoan Cook Island Maori Tongan Niuean Chinese Indian other such as *DUTCH, JAPANESE,**TOKELAUAN.* Please state: _____

ID: _____

TOTAL number of siblings your child has: _____

Number of YOUNGER siblings your child has: _____

Number of OLDER siblings your child has: _____

Number of people your child shares a BEDROOM with: _____

Number of people your child shares a BED with: _____

YOUR CHILD'S sleep:

How much of a problem for you is the time it takes your child to fall asleep?

- No problem
- Small problem
- Moderate problem
- Large problem

How much of a problem for you is your child's sleeping patterns or habits?

- No problem
- Small problem
- Moderate problem
- Large problem

APPENDIX 10: QUALITATIVE STUDY INTERVIEW GUIDE

Qualitative Study Interview Guide

Ensure the interview is conducted about the child who has taken part in E Moe, Māmā/Moe Kura (have DOB details prior to interview and check demographic sheet).

Reiterate prior to starting the interview that there are no right or wrong answers and that women's experiences and opinions are valuable and valid.

Guiding Questions

Please tell me a little about your household and who lives in your home.

(Aim is to gain information about context);

Prompts:

How many people live in your home?

How many/who are the adults?

How many/who are the children?

Relationships to each other?

What are the day to day comings and goings?

Work roles/patterns?

School/preschool attendance/patterns?

Sleep environment – bedrooms/bed sharing

How would you describe (child)?

Prompts:

What things do they enjoy doing?

How are they with others?

How would you describe their personality?

Their health?

How would you describe (child)'s sleep?

Prompts:

What do you mean by?

Can you give an example of?

Changes over time?

What do you think makes a difference to (child)'s sleep?

Prompts:

What are the things that make it easier for child to get the sleep they need?

What makes it more difficult?

Individual, household, neighbourhood & wider social factor levels?

Now and as baby/changes over time?

How do you feel about (child)'s sleep?

Prompts:

If (child) sleeps well how is that for them?/mother?/others?

If worries/concerns raised, can you tell me a little more about that/give an example?

Is it something that is thought about?

Is help/support sought? If so, from where/whom?

Changes over time?

We've covered a lot. Is there anything else you'd like to mention or discuss about (child)'s sleep?

APPENDIX 11: QUALITATIVE STUDY TRANSCRIPTION CONFIDENTIALITY FORM

Social determinants of pre-school children's sleep in Aotearoa/New Zealand

Transcriber's Confidentiality Agreement Form

I (transcriber's full name – printed) agree to transcribe the recordings provided to me.

I agree to keep confidential all the information provided to me.

I will not make any copies of the transcripts or keep any record of them, other than those required for the project.

Signature: _____

Date: _____

APPENDIX 12: QUALITATIVE STUDY TRANSCRIPT FEEDBACK FORM

Social determinants of pre-school children's sleep in Aotearoa/New Zealand

Transcript Feedback Form

Attached is a copy of the interview transcript that you requested. We would like to give you the opportunity to read and comment on this if you wish.

If, after reading the transcript, you do NOT have any feedback then you DO NOT NEED TO DO ANYTHING ELSE.

If, after reading the transcript, you DO have feedback, please write your comments on the transcript, complete this form, and return the form and transcript in the enclosed pre-paid envelope by

We will send you a copy of your transcript that you have written on for your records.

Thank you

My full name: _____

My signature: _____

Date: _____

**APPENDIX 13 – 17: PREVALANCE ESTIMATES OF
PRESCHOOLERS' SLEEP DURATIONS**

Table A13.
Prevalence of Children's Weeknight Sleep Durations Across 24 Hours: Less Than 10 versus 10 to 13 Hours, by Child Ethnicity

	n	n	Less than 10 hrs % (95% CI)		10 – 13 hrs % (95% CI)		χ^{2c}	<i>df</i> ^d	<i>p</i>
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	149	270	15.4 (9.6 – 21.3)	4.4 (2.0 – 6.9)	84.6 (78.7 – 90.4)	95.6 (93.1 – 98.0)	15.15	1	<.001
Male	156	259	15.4 (9.7 – 21.1)	5.0 (2.3 – 7.7)	84.6 (78.9 – 90.3)	95.0 (92.3 – 97.7)	12.88	1	<.001
All	308	533	15.3 (11.2 – 19.3)	4.7 (2.9 – 6.5)	84.7 (80.7 – 88.8)	95.3 (93.5 – 97.1)	27.86	1	<.001
NZDep2013 quintiles ^e :									
Quintile 1	44	176	4.5 (0 – 11.0)	1.7 (0 – 3.6)	95.5 (89.0 – 100)	98.3 (96.4 – 100)	1.28	1	.26
Quintile 2	48	137	8.3 (0.2 – 16.4)	6.6 (2.4 – 10.8)	91.7 (83.6 – 99.8)	93.4 (89.2 – 97.6)	0.17	1	.68
Quintile 3	56	93	12.5 (3.6 – 21.4)	5.4 (0.7 – 10.0)	87.5 (78.6 – 96.4)	94.6 (90.0 – 99.3)	2.40	1	.12
Quintile 4	54	59	20.4 (9.3 – 31.5)	6.8 (0.2 – 13.4)	79.6 (68.5 – 90.7)	93.2 (86.6 – 99.8)	4.52	1	.03
Quintile 5	97	45	21.6 (13.3 – 30.0)	8.9 (0.2 – 17.5)	78.4 (70.0 – 86.7)	91.1 (82.5 – 99.8)	3.45	1	.06
NZiDep score ^f :									
1	86	297	11.6 (4.7 – 18.5)	3.4 (1.3 – 5.4)	88.4 (81.5 – 95.3)	96.6 (94.6 – 98.7)	9.20	1	.002
2	76	126	14.5 (6.4 – 22.6)	0.8 (0 – 2.4)	85.5 (77.4 – 93.6)	99.2 (97.6 – 100)	15.88	1	<.001
3	50	53	10.0 (1.4 – 18.6)	15.1 (5.1 – 25.1)	90.0 (81.4 – 98.6)	84.9 (74.9 – 94.9)	0.61	1	.44
4	59	39	20.3 (9.8 – 30.9)	5.1 (0 – 12.4)	79.7 (69.1 – 90.2)	94.9 (87.6 – 100)	4.44	1	.04
5	36	13	25.0 (10.1 – 39.9)	7.7 (0 – 24.5)	75.0 (60.1 – 89.9)	92.3 (75.5 – 100)	1.76	1	.18

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A14.
Prevalence of Children's Weekend Sleep Durations Across 24 Hours: Less Than 10 versus 10 to 13 Hours, by Child Ethnicity

	n		Less than 10 hrs % (95% CI)		10 – 13 hrs % (95% CI)		χ^2 ^c	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	152	268	15.8 (9.9 – 21.7)	5.2 (2.5 – 7.9)	84.2 (78.3 – 90.1)	94.8 (92.1 – 97.5)	13.16	1	<.001
Male	155	262	16.1 (10.3 – 22.0)	6.1 (3.2 – 9.0)	83.9 (78.0 – 89.7)	93.9 (91.0 – 96.8)	11.03	1	.001
All	310	535	15.8 (11.7 – 19.9)	5.8 (3.8 – 7.8)	84.2 (80.1 – 88.3)	94.2 (92.2 – 96.2)	22.95	1	<.001
NZDep2013 quintiles ^e :									
Quintile 1	47	175	10.6 (1.5 – 19.8)	2.9 (0.4 – 5.3)	89.4 (80.2 – 98.5)	97.1 (94.7 – 99.6)	5.21	1	.02
Quintile 2	47	138	6.4 (0 – 13.6)	8.0 (3.4 – 12.5)	93.6 (86.4 – 100)	92.0 (87.5 – 96.6)	0.13	1	.72
Quintile 3	55	94	16.4 (6.3 – 26.5)	6.4 (1.3 – 11.4)	83.6 (73.5 – 93.7)	93.6 (88.6 – 98.7)	3.82	1	.05
Quintile 4	55	56	14.5 (4.9 – 24.2)	7.1 (0.2 – 14.1)	85.5 (75.8 – 95.1)	92.9 (85.9 – 99.8)	1.58	1	.21
Quintile 5	97	47	22.7 (14.2 – 31.2)	10.6 (1.5 – 19.8)	77.3 (68.8 – 85.8)	89.4 (80.2 – 98.5)	3.01	1	.08
NZiDep score ^f :									
1	85	301	10.6 (3.9 – 17.3)	5.0 (2.5 – 7.5)	89.4 (82.7 – 96.1)	95.0 (92.5 – 97.5)	3.57	1	.06
2	78	125	11.5 (4.3 – 18.8)	0.8 (0 – 2.4)	88.5 (81.2 – 95.7)	99.2 (97.6 – 100)	11.83	1	<.001
3	52	50	9.6 (1.3 – 17.9)	16.0 (5.5 – 26.5)	90.4 (82.1 – 98.7)	84.0 (73.5 – 94.5)	0.93	1	.33
4	60	42	25.0 (13.7 – 36.3)	7.1 (0 – 15.3)	75.0 (63.7 – 86.3)	92.9 (84.7 – 100)	5.42	1	.02
5	34	12	32.4 (15.8 – 48.9)	8.3 (0 – 26.7)	67.6 (51.1 – 84.2)	91.7 (73.3 – 100)	2.65	1	.10

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A15.

Prevalence of Children's Weeknight Sleep Durations Across 24 Hours: Greater Than 13 versus 10 to 13 Hours, by Child Ethnicity

	n	n	Greater than 13 hrs		10 – 13 hrs		χ^{2c}	df ^d	p
			% (95% CI)		% (95% CI)				
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	137	270	8.0 (3.4 – 12.6)	4.4 (2.0 – 6.9)	92.0 (87.4 – 96.6)	95.6 (93.1 – 98.0)	2.19	1	.14
Male	141	259	6.4 (2.3 – 10.5)	5.0 (2.3 – 7.7)	93.6 (89.5 – 97.7)	95.0 (92.3 – 97.7)	0.33	1	.57
All	281	534	7.1 (4.1 – 10.1)	4.9 (3.0 – 6.7)	92.9 (89.9 – 95.9)	95.1 (93.3 – 97.0)	1.75	1	.19
NZDep2013 quintiles ^e :									
Quintile 1	46	183	8.7 (0.2 – 17.2)	5.5 (2.1 – 8.8)	91.3 (82.8 – 99.8)	94.5 (91.2 – 97.9)	0.67	1	.41
Quintile 2	46	134	4.3 (0 – 10.5)	4.5 (0.9 – 8.0)	95.7 (89.5 – 100)	95.5 (92.0 – 99.1)	0.001	1	.97
Quintile 3	53	91	7.5 (0.2 – 14.9)	3.3 (0 – 7.0)	92.5 (85.1 – 99.8)	96.7 (93.0 – 100)	1.31	1	.25
Quintile 4	48	57	10.4 (1.5 – 19.4)	3.5 (0 – 8.4)	89.6 (80.6 – 98.5)	96.5 (91.6 – 100)	2.00	1	.16
Quintile 5	81	43	6.2 (0.8 – 11.5)	4.7 (0 – 11.2)	93.8 (88.5 – 99.2)	95.3 (88.8 – 100)	0.12	1	.73
NZiDep score ^f :									
1	84	298	9.5 (3.1 – 15.9)	3.7 (1.5 – 5.8)	90.5 (84.1 – 96.9)	96.3 (94.2 – 98.5)	4.72	1	.03
2	69	133	5.8 (0.1 – 11.5)	6.0 (1.9 – 10.1)	94.2 (88.5 – 99.9)	94.0 (89.9 – 98.1)	0.0004	1	.95
3	48	49	6.3 (0 – 13.4)	8.2 (0.2 – 16.1)	93.8 (86.6 – 100)	91.8 (83.9 – 99.8)	0.13	1	.72
4	49	40	4.1 (0 – 9.8)	7.5 (0 – 16.0)	95.9 (90.2 – 100)	92.5 (84.0 – 100)	0.49	1	.49
5	30	12	10.0 (0 – 21.4)	-	90.0 (78.7 – 100)	100 (100 – 100)	- ^g	-	-

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation; ^gOne empty cell so unable to calculate chi-square.

Table A16.

Prevalence of Children's Weekend Sleep Durations Across 24 Hours: Greater Than 13 versus 10 to 13 Hours, by Child Ethnicity

	n		Less than 10 hrs % (95% CI)		10 – 13 hrs % (95% CI)		χ^{2c}	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	137	267	6.6 (2.4 – 10.8)	4.9 (2.3 – 7.5)	93.4 (89.2 – 97.6)	95.1 (92.5 – 97.7)	0.51	1	.48
Male	138	256	5.8 (1.8 – 9.7)	3.9 (1.5 – 6.3)	94.2 (90.3 – 98.2)	96.1 (93.7 – 98.5)	0.74	1	.39
All	278	527	6.1 (3.3 – 8.9)	4.4 (2.6 – 6.1)	93.9 (91.1 – 96.7)	95.6 (93.9 – 97.4)	1.18	1	.28
NZDep2013 quintiles ^e :									
Quintile 1	43	180	2.3 (0 – 7.0)	5.6 (2.2 – 8.9)	97.7 (93.0 – 100)	94.4 (91.1 – 97.8)	0.77	1	.38
Quintile 2	47	132	6.4 (0 – 13.6)	3.8 (0.5 – 7.1)	93.6 (86.4 – 100)	96.2 (92.9 – 99.5)	0.55	1	.46
Quintile 3	51	91	9.8 (1.4 – 18.3)	3.3 (0 – 7.0)	90.2 (81.7 – 98.6)	96.7 (93.0 – 100)	2.60	1	.11
Quintile 4	50	56	6.0 (0 – 12.8)	7.1 (0.2 – 14.1)	94.0 (87.2 – 100)	92.9 (85.9 – 99.8)	0.06	1	.81
Quintile 5	80	42	6.3 (0.8 – 11.7)	-	93.8 (88.3 – 99.2)	100 (100 – 100)	^f	-	-
NZiDep score ^g :									
1	84	294	9.5 (3.1 – 15.9)	2.7 (0.9 – 4.6)	90.5 (84.1 – 96.9)	97.3 (95.4 – 99.1)	7.46	1	.006
2	70	131	1.4 (0 – 4.3)	5.3 (1.4 – 9.2)	98.6 (95.7 – 100)	94.7 (90.8 – 98.6)	1.83	1	.18
3	48	49	2.1 (0 – 6.3)	14.3 (4.1 – 24.4)	97.9 (93.7 – 100)	85.7 (75.6 – 95.9)	4.77	1	.03
4	48	39	6.3 (0 – 13.4)	-	93.8 (86.6 – 100)	100 (100 – 100)	^f	-	-
5	27	12	14.8 (0.5 – 29.1)	8.3 (0 – 26.7)	85.2 (70.9 – 99.5)	91.7 (73.3 – 100)	0.31	1	.58

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fOne empty cell so unable to calculate chi-square; ^gNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A17.

Prevalence of Weeknight/Weekend Sleep Duration Difference: More Than One Hour versus One Hour or Less, by Child Ethnicity

	n		More than 1 hr difference % (95% CI)		1 hr or less difference % (95% CI)		χ^2 ^c	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	159	281	15.7 (10.0 – 21.4)	7.5 (4.4 – 10.6)	84.3 (78.6 – 90.0)	92.5 (89.4 – 95.6)	7.38	1	.007
Male	162	270	21.0 (14.6 – 27.3)	6.3 (3.4 – 9.2)	79.0 (72.7 – 85.4)	93.7 (90.8 – 96.6)	20.99	1	<.001
All	324	556	18.8 (14.5 – 23.1)	7.0 (4.9 – 9.1)	81.2 (76.9 – 85.5)	93.0 (90.9 – 95.1)	28.36	1	<.001
NZDep2013 quintiles ^e :									
Quintile 1	48	184	12.5 (2.8 – 22.2)	4.3 (1.4 – 7.3)	87.5 (77.8 – 97.2)	95.7 (92.7 – 98.6)	4.46	1	.03
Quintile 2	50	143	20.0 (8.5 – 31.5)	5.6 (1.8 – 9.4)	80.0 (68.5 – 91.5)	94.4 (90.6 – 98.2)	9.09	1	.003
Quintile 3	60	96	21.7 (10.9 – 32.4)	6.3 (1.3 – 11.2)	78.3 (67.6 – 89.1)	93.8 (88.8 – 98.7)	8.20	1	.004
Quintile 4	57	60	22.8 (11.6 – 34.0)	16.7 (7.0 – 26.4)	77.2 (66.0 – 88.4)	83.3 (73.6 – 93.0)	0.70	1	.40
Quintile 5	100	47	17.0 (9.5 – 24.5)	6.4 (0 – 13.6)	83.0 (75.5 – 90.5)	93.6 (86.4 – 100)	3.07	1	.08
NZiDep score ^f :									
1	93	307	18.3 (10.3 – 26.3)	5.5 (3.0 – 8.1)	81.7 (73.7 – 89.7)	94.5 (91.9 – 97.0)	14.90	1	<.001
2	79	132	21.5 (12.3 – 30.8)	7.6 (3.0 – 12.1)	78.5 (69.2 – 87.7)	92.4 (87.9 – 97.0)	8.61	1	<.001
3	52	57	9.6 (1.3 – 17.9)	7.0 (0.2 – 13.9)	90.4 (82.1 – 98.7)	93.0 (86.1 – 99.8)	0.24	1	.62
4	61	42	23.0 (12.1 – 33.8)	9.5 (0.3 – 18.8)	77.0 (66.2 – 87.9)	90.5 (81.2 – 99.7)	3.11	1	.08
5	38	13	21.1 (7.5 – 34.6)	23.1 (0 – 49.6)	78.9 (65.4 – 92.5)	76.9 (50.4 – 100)	0.02	1	.88

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

APPENDIX 18: STATEMENT OF CONTRIBUTION

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: Diane Muller

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Title: How long do preschoolers in Aotearoa/New Zealand sleep? Associations with ethnicity and socioeconomic position.

Authors: Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L.

This manuscript is currently under review at the the journal Sleep Health.

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 assisted with data collection and cleaning, conducted all statistical analyses, wrote the original and subsequent drafts of the manuscript in response to feedback from co-authors and formatted the manuscript according to journal guidelines.

Diane Muller Digitally signed by Diane Muller
Date: 2019.03.24 14:27:31
+13'00'

Candidate's Signature

24/03/19

Date

Leigh Signal Digitally signed by Leigh Signal
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ou=Sleep/Wake Research Centre,
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Date: 2019.03.29 11:12:52 +13'00'

Principal Supervisor's signature

26/03/19

Date

**APPENDIX 19 – 28: PREVALENCE ESTIMATES OF
PRESCHOOLERS’ SLEEP TIMING AND SLEEP PROBLEMS**

Table A19.

Prevalence of Children's Weeknight Bedtimes: Later Than 8pm versus 8pm or Earlier, by Child Ethnicity

	n		Later than 8pm % (95% CI)		8pm or earlier % (95% CI)		χ^2 ^c	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	158	283	22.8 (16.2 – 29.4)	8.5 (5.2 – 11.7)	77.2 (70.6 – 83.8)	91.5 (88.3 – 94.8)	17.65	1	<.001
Male	165	275	27.3 (20.4 – 34.1)	6.9 (3.9 – 9.9)	72.7 (65.9 – 79.6)	93.1 (90.1 – 96.1)	34.40	1	<.001
All	326	564	25.5 (20.7 – 30.2)	7.6 (5.4 – 9.8)	74.5 (69.8 – 79.3)	92.4 (90.2 – 94.6)	54.08	1	<.001
NZDep2013 quintiles ^e :									
Quintile 1	48	188	16.7 (5.7 – 27.6)	3.2 (0.7 – 5.7)	83.3 (72.4 – 94.3)	96.8 (94.3 – 99.3)	12.44	1	<.001
Quintile 2	49	143	20.4 (8.7 – 32.1)	7.0 (2.8 – 11.2)	79.6 (67.9 – 91.3)	93.0 (88.8 – 97.2)	7.04	1	.008
Quintile 3	61	98	24.6 (13.5 – 35.7)	8.2 (2.6 – 13.7)	75.4 (64.3 – 86.5)	91.8 (86.3 – 97.4)	8.20	1	.004
Quintile 4	59	60	23.7 (12.5 – 34.9)	10.0 (2.2 – 17.8)	76.3 (65.1 – 87.5)	90.0 (82.2 – 97.8)	4.01	1	.05
Quintile 5	100	49	34.0 (24.6 – 43.4)	16.3 (5.6 – 27.1)	66.0 (56.6 – 75.4)	83.7 (72.9 – 94.4)	5.07	1	.02
NZiDep score ^f :									
1	94	309	17.0 (9.3 – 24.8)	7.8 (4.8 – 10.8)	83.0 (75.2 – 90.7)	92.2 (89.2 – 95.2)	6.90	1	.009
2	79	134	32.9 (22.3 – 43.5)	3.7 (0.5 – 7.0)	67.1 (56.5 – 77.7)	96.3 (93.0 – 99.5)	34.03	1	<.001
3	54	56	18.5 (7.8 – 29.2)	16.1 (6.1 – 26.0)	81.5 (70.8 – 92.2)	83.9 (74.0 – 93.9)	0.12	1	.73
4	62	45	27.4 (16.0 – 38.8)	8.9 (0.2 – 17.5)	72.6 (61.2 – 84.0)	91.1 (82.5 – 99.8)	5.68	1	.02
5	36	15	36.1 (19.6 – 52.6)	6.7 (0 – 21.0)	63.9 (47.4 – 80.4)	93.3 (79.0 – 100)	4.61	1	.03

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A20.

Prevalence of Children's Weeknight Bedtimes: Later Than 9pm versus 9pm or Earlier, by Child Ethnicity

	n		Later than 9pm % (95% CI)		9pm or earlier % (95% CI)		χ^2 ^c	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	158	283	5.1 (1.6 – 8.5)	3.2 (1.1 – 5.2)	94.9 (91.5 – 98.4)	96.8 (94.8 – 98.9)	0.97	1	.32
Male	165	275	7.9 (3.7 – 12.0)	1.1 (0 – 2.3)	92.1 (88.0 – 96.3)	98.9 (97.7 – 100)	13.56	1	<.001
All	326	564	6.7 (4.0 – 9.5)	2.1 (0.9 – 3.3)	93.3 (90.5 – 96.0)	97.9 (96.7 – 99.1)	12.01	1	.001
NZDep2013 quintiles ^e :									
Quintile 1	48	188	4.2 (0 – 10.0)	1.1 (0 – 2.5)	95.8 (90.0 – 100)	98.9 (97.5 – 100)	2.21	1	.14
Quintile 2	49	143	2.0 (0 – 6.1)	0.7 (0 – 2.1)	98.0 (93.9 – 100)	99.3 (97.9 – 100)	0.64	1	.42
Quintile 3	61	98	6.6 (0.2 – 12.9)	3.1 (0 – 6.5)	93.4 (87.1 – 99.8)	96.9 (93.5 – 100)	1.09	1	.30
Quintile 4	59	60	5.1 (0 – 10.9)	1.7 (0 – 5.0)	94.9 (89.1 – 100)	98.3 (95.0 – 100)	1.07	1	.30
Quintile 5	100	49	12.0 (5.5 – 18.5)	6.1 (0 – 13.1)	88.0 (81.5 – 94.5)	93.9 (86.9 – 100)	1.25	1	.26
NZiDep score ^f :									
1	94	309	3.2 (0 – 6.8)	2.3 (0.6 – 3.9)	96.8 (93.2 – 100)	97.7 (96.1 – 99.4)	0.26	1	.61
2	79	134	5.1 (0.1 – 10.0)	1.5 (0 – 3.6)	94.9 (90.0 – 99.9)	98.5 (96.4 – 100)	2.31	1	.13
3	54	56	7.4 (0.2 – 14.6)	1.8 (0 – 5.4)	92.6 (85.4 – 99.8)	98.2 (94.6 – 100)	2.00	1	.16
4	62	45	9.7 (2.1 – 17.2)	2.2 (0 – 6.7)	90.3 (82.8 – 97.9)	97.8 (93.3 – 100)	2.37	1	.12
5	36	15	13.9 (2.0 – 25.8)	6.7 (0 – 21.0)	86.1 (74.2 – 98.0)	93.3 (79.0 – 100)	0.53	1	.47

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A21.

Prevalence of Children's Weekend Bedtimes: Later Than 8pm versus 8pm or Earlier, by Child Ethnicity

	n	n	Later than 8pm % (95% CI)		8pm or earlier % (95% CI)		χ^{2c}	df^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	158	279	39.2 (31.5 – 46.9)	16.1 (11.8 – 20.5)	60.8 (53.1 – 68.5)	83.9 (79.5 – 88.2)	29.14	1	<.001
Male	162	275	45.7 (37.9 – 53.4)	14.9 (10.7 – 19.1)	54.3 (46.6 – 62.1)	85.1 (80.9 – 89.3)	49.78	1	<.001
All	323	560	42.7 (37.3 – 48.1)	15.4 (12.4 – 18.4)	57.3 (51.9 – 62.7)	84.6 (81.6 – 87.6)	81.04	1	<.001
NZDep2013 quintiles ^e :									
Quintile 1	48	187	31.3 (17.6 – 44.9)	12.3 (7.5 – 17.1)	68.8 (55.1 – 82.4)	87.7 (82.9 – 92.5)	10.12	1	.002
Quintile 2	49	143	32.7 (19.0 – 46.3)	11.2 (6.0 – 16.4)	67.3 (53.7 – 81.0)	88.8 (83.6 – 94.0)	12.11	1	<.001
Quintile 3	59	97	42.4 (29.4 – 55.4)	22.7 (14.2 – 31.2)	57.6 (44.6 – 70.6)	77.0 (68.8 – 85.8)	6.76	1	.009
Quintile 4	58	59	37.9 (25.1 – 50.8)	15.3 (5.8 – 24.7)	62.1 (49.2 – 74.9)	84.7 (75.3 – 94.2)	7.72	1	.006
Quintile 5	100	49	54.0 (44.1 – 63.9)	22.4 (10.3 – 34.6)	46.0 (36.1 – 55.9)	77.6 (65.4 – 89.7)	13.31	1	<.001
NZiDep score ^f :									
1	92	307	34.8 (24.9 – 44.7)	14.0 (10.1 – 17.9)	65.2 (55.3 – 75.1)	86.0 (82.1 – 89.9)	20.02	1	<.001
2	78	132	47.4 (36.1 – 58.8)	12.9 (7.1 – 18.7)	52.6 (41.2 – 63.9)	87.1 (81.3 – 92.9)	30.65	1	<.001
3	52	55	38.5 (24.8 – 52.1)	23.6 (12.0 – 35.2)	61.5 (47.9 – 75.2)	76.4 (64.8 – 88.0)	2.75	1	.10
4	63	46	44.4 (31.8 – 57.1)	19.6 (7.7 – 31.5)	55.6 (42.9 – 68.2)	80.4 (68.5 – 92.3)	7.34	1	.007
5	38	15	55.3 (38.7 – 71.8)	20.0 (0 – 42.9)	44.7 (28.2 – 61.3)	80.0 (57.1 – 100)	5.40	1	.02

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A22.
Prevalence of Children's Weekend Bedtimes: Later Than 9pm versus 9pm or Earlier, by Child Ethnicity

	n		Later than 9pm % (95% CI)		9pm or earlier % (95% CI)		χ^{2c}	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	158	279	12.7 (7.4 – 17.9)	5.0 (2.4 – 7.6)	87.3 (82.1 – 92.6)	95.0 (92.4 – 97.6)	8.21	1	.004
Male	162	275	17.9 (11.9 – 23.9)	4.7 (2.2 – 7.3)	82.1 (76.1 – 88.1)	95.3 (92.7 – 97.8)	20.37	1	<.001
All	323	560	15.5 (11.5 – 19.4)	4.8 (3.0 – 6.6)	84.5 (80.6 – 88.5)	95.2 (93.4 – 97.0)	29.24	1	<.001
NZDep2013 quintiles ^e :									
Quintile 1	48	187	8.3 (0.2 – 16.4)	1.6 (0 – 3.4)	91.7 (83.6 – 99.8)	98.4 (96.6 – 100)	5.98	1	.01
Quintile 2	49	143	4.1 (0 – 9.8)	2.8 (0.1 – 5.5)	95.9 (90.2 – 100)	97.2 (94.5 – 99.9)	0.20	1	.66
Quintile 3	59	97	13.6 (4.6 – 22.6)	7.2 (2.0 – 12.5)	86.4 (77.4 – 95.4)	92.8 (87.5 – 98.0)	1.70	1	.19
Quintile 4	58	59	13.8 (4.6 – 22.9)	10.2 (2.2 – 18.1)	86.2 (77.1 – 95.4)	89.8 (81.9 – 97.8)	0.36	1	.55
Quintile 5	100	49	26.0 (17.3 – 34.7)	10.2 (1.4 – 19.0)	74.0 (65.3 – 82.7)	89.8 (81.0 – 98.6)	4.98	1	.03
NZiDep score ^f :									
1	92	307	14.1 (6.9 – 21.4)	4.6 (2.2 – 6.9)	85.9 (78.6 – 93.1)	95.4 (93.1 – 97.8)	10.28	1	.001
2	78	132	15.4 (7.2 – 23.6)	2.3 (0 – 4.8)	84.6 (76.4 – 92.8)	97.7 (95.2 – 100)	12.71	1	<.001
3	52	55	11.5 (2.6 – 20.5)	9.1 (1.2 – 16.9)	88.5 (79.5 – 97.4)	90.9 (83.1 – 98.8)	0.17	1	.68
4	63	46	15.9 (6.6 – 25.2)	8.7 (0.2 – 17.2)	84.1 (74.9 – 93.4)	91.3 (82.8 – 99.8)	1.22	1	.27
5	38	15	23.7 (9.5 – 37.8)	6.7 (0 – 21.0)	76.3 (62.2 – 90.5)	93.3 (79.0 – 100)	2.03	1	.15

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A23.
Prevalence of Social Jetlag: One Hour or More versus Less Than One Hour, by Child Ethnicity

	n		1 hr or more difference (95% CI)		Less than 1 hr difference % (95% CI)		χ^{2d}	dfe	p
	Māori ^b	Non-Māori ^c	Māori ^b	Non-Māori ^c	Māori ^b	Non-Māori ^c			
Child gender:									
Female	150	271	11.3 (6.27 – 16.5)	5.2 (2.5 – 7.8)	88.7 (83.5 – 93.8)	94.8 (92.2 – 97.5)	5.38	1	.02
Male	156	272	12.2 (7.0 – 17.4)	2.6 (0.7 – 4.5)	87.8 (82.6 – 93.1)	97.4 (95.5 – 99.3)	16.03	1	<.001
All	309	548	11.7 (8.1 – 15.2)	3.8 (2.2 – 5.4)	88.3 (84.8 – 91.9)	96.2 (94.6 – 97.8)	19.45	1	<.01
NZDep2013 quintiles ^f :									
Quintile 1	47	186	10.6 (1.5 – 19.8)	3.2 (0.7 – 5.8)	89.4 (80.2 – 98.5)	96.8 (94.2 – 99.3)	4.58	1	.03
Quintile 2	49	140	4.1 (0 – 9.8)	2.1 (0 – 4.6)	95.9 (90.2 – 100)	97.9 (95.4 – 100)	0.53	1	.47
Quintile 3	55	93	16.4 (6.3 – 26.5)	2.2 (0 – 5.2)	83.6 (73.5 – 93.7)	97.8 (94.8 – 100)	10.15	1	.001
Quintile 4	54	56	13.0 (3.7 – 22.2)	8.9 (1.2 – 16.6)	87.0 (77.8 – 96.3)	91.1 (83.4 – 98.8)	0.46	1	.49
Quintile 5	95	48	10.5 (4.2 – 16.8)	8.3 (0.2 – 16.4)	89.5 (83.2 – 95.8)	91.7 (83.6 – 99.8)	0.17	1	.68
NZiDep scores ^g :									
1	90	302	13.3 (6.2 – 20.5)	2.6 (0.8 – 4.5)	86.7 (79.5 – 93.8)	97.4 (95.5 – 99.2)	16.35	1	<.001
2	76	128	7.9 (1.7 – 14.1)	1.6 (0 – 3.7)	92.1 (85.9 – 98.3)	98.4 (96.3 – 100)	5.07	1	.02
3	50	55	14.0 (4.0 – 24.0)	9.1 (1.2 – 16.9)	86.0 (76.0 – 96.0)	90.9 (83.1 – 98.8)	0.62	1	.43
4	59	44	10.2 (2.2 – 18.1)	2.3 (0 – 6.9)	89.8 (81.9 – 97.8)	97.7 (93.1 – 100)	2.48	1	.12
5	34	14	14.7 (2.2 – 27.2)	28.6 (1.5 – 55.6)	85.3 (72.6 – 97.8)	71.4 (44.4 – 98.5)	1.25	1	.26

^aSocial jetlag = absolute difference between weeknight and weekend midsleep time, with midsleep = sleep start + (wake time – sleep start)/2; ^bChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^cChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^dPearson chi-square; ^eDegrees of freedom; ^fNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^gNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A24.

Prevalence of Children's Sleep Habits Questionnaire Total Scores: 41 or Greater versus Less Than 41, by Child Ethnicity

	n		CSHQ total score ≥41 % (95% CI)		CSHQ total score <41 % (95% CI)		χ^2 ^c	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	154	267	69.5 (62.1 – 76.8)	57.3 (51.3 – 63.3)	30.5 (23.2 – 37.9)	42.7 (36.7 – 48.7)	6.13	1	.01
Male	154	260	67.5 (60.1 – 75.0)	60.4 (54.4 – 66.4)	32.5 (25.0 – 39.9)	39.6 (33.6 – 45.6)	2.12	1	.15
All	311	532	68.8 (63.6 – 74.0)	59.0 (54.8 – 63.2)	31.2 (26.0 – 36.4)	41.0 (36.8 – 45.2)	8.03	1	.005
NZDep2013 quintiles ^e :									
Quintile 1	45	177	71.1 (57.3 – 84.9)	54.8 (47.4 – 62.2)	28.9 (15.1 – 42.7)	45.2 (37.8 – 52.6)	3.92	1	.05
Quintile 2	47	136	59.6 (45.0 – 74.1)	61.8 (53.5 – 70.0)	40.4 (25.9 – 55.0)	38.2 (30.0 – 46.5)	0.07	1	.79
Quintile 3	54	88	72.2 (59.9 – 84.6)	60.2 (49.8 – 70.7)	27.8 (15.4 – 40.1)	39.8 (29.3 – 50.2)	2.11	1	.15
Quintile 4	57	59	66.7 (54.0 – 79.3)	57.6 (44.6 – 70.6)	33.3 (20.7 – 46.0)	42.4 (29.4 – 55.4)	1.01	1	.32
Quintile 5	100	46	72.0 (63.0 – 81.0)	67.4 (53.3 – 81.5)	28.0 (19.0 – 37.0)	32.6 (18.5 – 46.7)	0.32	1	.57
NZiDep score ^f :									
1	91	296	67.0 (57.2 – 76.9)	53.7 (48.0 – 59.4)	33.0 (23.1 – 42.8)	46.3 (40.6 – 52.0)	5.03	1	.02
2	79	121	64.6 (53.8 – 75.3)	61.2 (52.3 – 70.0)	35.4 (24.7 – 46.2)	38.8 (30.0 – 47.7)	0.24	1	.63
3	49	54	71.4 (58.3 – 84.5)	77.8 (66.3 – 89.2)	28.6 (15.5 – 41.7)	22.2 (10.8 – 33.7)	0.55	1	.46
4	57	43	71.9 (59.9 – 84.0)	65.1 (50.3 – 80.0)	28.1 (16.0 – 40.1)	34.9 (20.0 – 49.7)	0.53	1	.47
5	35	14	74.3 (59.1 – 89.5)	64.3 (35.6 – 93.0)	25.7 (10.5 – 40.9)	35.7 (7.0 – 64.4)	0.49	1	.48

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A25.
Prevalence of How Problematic Child Sleep Patterns Are: Moderate or Large versus No Problem, by Child Ethnicity

	n		Moderate or large problem % (95% CI)		No problem % (95% CI)		χ^{2c}	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	114	188	23.7 (15.8 – 31.6)	22.3 (16.3 – 28.3)	76.3 (68.4 – 84.2)	77.7 (71.7 – 83.7)	0.07	1	.79
Male	114	196	22.8 (15.0 – 30.6)	26.0 (19.8 – 32.2)	77.2 (69.4 – 85.0)	74.0 (67.8 – 80.2)	0.39	1	.53
All	230	390	23.5 (18.0 – 29.0)	24.6 (20.3 – 28.9)	76.5 (71.0 – 82.0)	75.4 (71.1 – 79.7)	0.10	1	.75
NZDep2013 quintiles ^e :									
Quintile 1	24	131	33.3 (13.0 – 53.7)	24.4 (17.0 – 31.9)	66.7 (46.3 – 87.0)	75.6 (68.1 – 83.0)	0.84	1	.36
Quintile 2	36	101	25.0 (10.1 – 39.9)	26.7 (18.0 – 35.5)	75.0 (60.1 – 89.9)	73.3 (64.5 – 82.0)	0.04	1	.84
Quintile 3	47	65	23.4 (10.8 – 36.0)	26.2 (15.2 – 37.1)	76.6 (64.0 – 89.2)	73.8 (62.9 – 84.8)	0.11	1	.74
Quintile 4	41	45	22.0 (8.7 – 35.2)	20.0 (7.8 – 32.2)	78.0 (64.8 – 91.3)	80.0 (67.8 – 92.2)	0.05	1	.82
Quintile 5	75	35	21.3 (11.8 – 30.8)	22.9 (8.2 – 37.5)	78.7 (69.2 – 88.2)	77.1 (62.5 – 91.8)	0.03	1	.86
NZiDep score ^f :									
1	70	209	24.3 (14.0 – 34.6)	23.4 (17.7 – 29.2)	75.7 (65.4 – 86.0)	76.6 (70.8 – 82.3)	0.02	1	.89
2	48	93	25.0 (12.3 – 37.7)	19.4 (11.2 – 27.5)	75.0 (62.3 – 87.7)	80.6 (72.5 – 88.8)	0.60	1	.44
3	37	38	27.0 (12.0 – 42.0)	34.2 (18.4 – 50.0)	73.0 (58.0 – 88.0)	65.8 (50.0 – 81.6)	0.46	1	.50
4	51	33	21.6 (9.9 – 33.3)	33.3 (16.4 – 50.3)	78.4 (66.7 – 90.1)	66.7 (49.7 – 83.6)	1.43	1	.23
5	24	12	16.7 (0.6 – 32.7)	33.3 (2.0 – 64.6)	83.3 (67.3 – 99.4)	66.7 (35.4 – 98.0)	1.29	1	.26

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A26.
Prevalence of How Often Children's Sleep Patterns Are a Problem: At Least Once a Week versus Never, by Child Ethnicity

	n	n	At least once a week % (95% CI)		Never % (95% CI)		χ^2 ^c	df ^d	p
			Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	116	180	44.8 (35.6 – 54.0)	37.2 (30.1 – 44.4)	55.2 (46.0 – 64.4)	62.8 (55.6 – 69.9)	1.70	1	.19
Male	120	180	37.5 (28.7 – 46.3)	41.7 (34.4 – 48.9)	62.5 (53.7 – 71.3)	58.3 (51.1 – 65.6)	0.52	1	.47
All	239	364	41.4 (35.1 – 47.7)	39.8 (34.8 – 44.9)	58.6 (52.3 – 64.9)	60.2 (55.1 – 65.2)	0.15	1	.70
NZDep2013 quintiles ^e :									
Quintile 1	31	115	67.7 (50.3 – 85.2)	37.4 (28.4 – 46.4)	32.3 (14.8 – 49.7)	62.6 (53.6 – 71.6)	9.14	1	.003
Quintile 2	36	96	38.9 (22.2 – 55.6)	42.7 (32.6 – 52.8)	61.1 (44.4 – 77.8)	57.3 (47.2 – 67.4)	0.16	1	.69
Quintile 3	47	66	40.4 (25.9 – 55.0)	42.4 (30.2 – 54.7)	59.6 (45.0 – 74.1)	57.6 (45.3 – 69.8)	0.05	1	.83
Quintile 4	39	38	38.5 (22.5 – 54.4)	34.2 (18.4 – 50.0)	61.5 (45.6 – 77.5)	65.8 (50.0 – 81.6)	0.15	1	.70
Quintile 5	79	34	35.4 (24.7 – 46.2)	41.2 (23.7 – 58.6)	64.6 (53.8 – 75.3)	58.8 (41.4 – 76.3)	0.33	1	.56
NZiDep score ^f :									
1	67	195	49.3 (37.0 – 61.5)	38.5 (31.6 – 45.4)	50.7 (38.5 – 63.0)	61.5 (54.6 – 68.4)	2.40	1	.12
2	56	82	42.9 (29.5 – 56.2)	32.9 (22.5 – 43.3)	57.1 (43.8 – 70.5)	67.1 (56.7 – 77.5)	1.41	1	.24
3	39	42	43.6 (27.3 – 59.9)	52.4 (36.6 – 68.1)	56.4 (40.1 – 72.7)	47.6 (31.9 – 63.4)	0.63	1	.43
4	52	27	28.8 (16.1 – 41.6)	48.1 (28.0 – 68.3)	71.2 (58.4 – 83.9)	51.9 (31.7 – 72.0)	2.89	1	.09
5	25	14	40.0 (19.4 – 60.6)	50.0 (20.0 – 80.0)	60.0 (39.4 – 80.6)	50.0 (20.0 – 80.0)	0.37	1	.55

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A27.

Prevalence of How Problematic the Time Children Take to Fall Asleep Is: Moderate or Large versus No Problem, by Child Ethnicity

	n		Moderate or large problem % (95% CI)		No problem % (95% CI)		χ^{2c}	df ^d	p
	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	109	200	23.9 (15.7 – 32.0)	18.0 (12.6 – 23.4)	76.1 (68.0 – 84.3)	82.0 (76.6 – 87.4)	1.51	1	.22
Male	129	190	25.6 (18.0 – 33.2)	17.4 (11.9 – 22.8)	74.4 (66.8 – 82.0)	82.6 (77.2 – 88.1)	3.16	1	.08
All	240	393	25.0 (19.5 – 30.5)	17.8 (14.0 – 21.6)	75.0 (69.5 – 80.5)	82.2 (78.4 – 86.0)	4.72	1	.03
NZDep2013 quintiles ^e :									
Quintile 1	30	137	40.0 (21.4 – 58.6)	16.8 (10.5 – 23.1)	60.0 (41.4 – 78.6)	83.2 (76.9 – 89.5)	8.00	1	.005
Quintile 2	37	88	16.2 (3.8 – 28.7)	17.0 (9.0 – 25.1)	83.8 (71.3 – 96.2)	83.0 (74.9 – 91.0)	0.01	1	.91
Quintile 3	48	68	33.3 (19.5 – 47.2)	14.7 (6.1 – 23.3)	66.7 (52.8 – 80.5)	85.3 (76.7 – 93.9)	5.61	1	.02
Quintile 4	42	44	19.0 (6.7 – 31.4)	11.4 (1.6 – 21.1)	81.0 (68.6 – 93.3)	88.6 (78.9 – 98.4)	0.99	1	.32
Quintile 5	77	35	22.1 (12.6 – 31.6)	34.3 (17.7 – 50.8)	77.9 (68.4 – 87.4)	65.7 (49.2 – 82.3)	1.87	1	.17
NZiDep score ^f :									
1	59	226	27.1 (15.4 – 38.8)	15.9 (11.1 – 20.7)	72.9 (61.2 – 84.6)	84.1 (79.3 – 88.9)	3.93	1	.05
2	62	11	29.0 (17.4 – 40.7)	12.0 (5.2 – 18.7)	71.0 (59.3 – 82.6)	88.0 (81.3 – 94.8)	7.07	1	.008
3	42	34	31.0 (16.4 – 45.5)	41.2 (23.7 – 58.6)	69.0 (54.5 – 83.6)	58.8 (41.4 – 76.3)	0.86	1	.35
4	49	27	20.4 (8.7 – 32.1)	18.5 (2.9 – 34.2)	79.6 (67.9 – 91.3)	81.5 (65.8 – 97.1)	0.04	1	.84
5	28	11	10.7 (0 – 22.9)	27.3 (0 – 58.7)	89.3 (77.1 – 100)	72.7 (41.3 – 100)	1.66	1	.20

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

Table A28.

Prevalence of How Often the Time Children Take to Fall Asleep is Problematic: At Least Once a Week versus Never, by Child Ethnicity

	n	n	At least once a week % (95% CI)		Never % (95% CI)		χ^{2c}	df ^d	p
			Māori ^a	Non-Māori ^b	Māori ^a	Non-Māori ^b			
Child gender:									
Female	99	166	44.4 (34.5 – 54.4)	38.0 (30.5 – 45.4)	55.6 (45.6 – 65.5)	62.0 (54.6 – 69.5)	1.09	1	.30
Male	115	155	40.9 (31.7 – 50.0)	39.4 (31.6 – 47.1)	59.1 (50.0 – 68.3)	60.6 (52.9 – 68.4)	0.06	1	.80
All	216	325	42.6 (35.9 – 49.2)	39.1 (33.7 – 44.4)	57.4 (50.8 – 64.1)	60.9 (55.6 – 66.3)	0.67	1	.41
NZDep2013 quintiles ^e :									
Quintile 1	30	104	66.7 (48.8 – 84.6)	38.5 (29.0 – 48.0)	33.3 (15.4 – 51.2)	61.5 (52.0 – 71.0)	7.49	1	.006
Quintile 2	31	78	29.0 (12.1 – 46.0)	41.0 (29.9 – 52.2)	71.0 (54.0 – 87.9)	59.0 (47.8 – 70.1)	1.36	1	.24
Quintile 3	34	55	47.1 (29.4 – 64.7)	38.2 (24.9 – 51.4)	52.9 (35.3 – 70.6)	61.8 (48.6 – 75.1)	0.68	1	.41
Quintile 4	39	39	38.5 (22.5 – 54.4)	30.8 (15.6 – 45.9)	61.5 (45.6 – 77.5)	69.2 (54.1 – 84.4)	0.51	1	.48
Quintile 5	76	29	40.8 (29.5 – 52.1)	48.3 (28.9 – 67.6)	59.2 (47.9 – 70.5)	51.7 (32.4 – 71.1)	0.48	1	.49
NZiDep score ^f :									
1	59	175	47.5 (34.3 – 60.6)	35.4 (28.3 – 42.6)	52.5 (39.4 – 65.7)	64.6 (57.4 – 71.7)	2.70	1	.10
2	53	79	45.3 (31.4 – 59.1)	34.2 (23.5 – 44.9)	54.7 (40.9 – 68.6)	65.8 (55.1 – 76.5)	1.65	1	.20
3	35	33	51.4 (34.0 – 68.8)	60.6 (43.0 – 78.2)	48.6 (31.2 – 66.0)	39.4 (21.8 – 57.0)	0.58	1	.45
4	45	23	28.9 (15.1 – 42.7)	52.2 (30.1 – 74.3)	71.1 (57.3 – 84.9)	47.8 (25.7 – 69.9)	3.55	1	.06
5	24	12	37.5 (16.6 – 58.4)	41.7 (8.9 – 74.4)	62.5 (41.6 – 83.4)	58.3 (25.6 – 91.1)	0.06	1	.81

^aChildren identified by mothers as belonging to the Māori ethnic group either as a single ethnicity or in conjunction with belonging to other ethnic groups; ^bChildren identified by mothers as belonging to one or more ethnic groups not including Māori; ^cPearson chi-square; ^dDegrees of freedom; ^eNZDep2013 measure of neighbourhood deprivation based on maternal address where child lives for at least 4 nights per week; ^fNZiDep measure of individual deprivation used as a proxy for child material deprivation.

APPENDIX 29: STATEMENT OF CONTRIBUTION

DRC 16



MASSEY UNIVERSITY
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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: Diane Muller

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Title: Sleep timing and sleep problems of preschoolers in Aotearoa/New Zealand: Relationships with ethnicity and socioeconomic position
Authors: Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L.
This manuscript has been prepared for submission to the journal 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: **70%**
and / or
- Describe the contribution that the candidate has made to the Published Work:
The candidate assisted with data collection and cleaning, conducted all statistical analyses and wrote the original and subsequent drafts of the manuscript in response to feedback from all co-authors.

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APPENDIX 30: STATEMENT OF CONTRIBUTION

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STATEMENT OF CONTRIBUTION TO DOCTORAL THESIS CONTAINING PUBLICATIONS

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Name of Candidate: Diane Muller

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). "Their sleep means more harmony": Maternal perspectives and experiences of preschoolers' sleep in ethnically and socioeconomically diverse families in Aotearoa/New Zealand. *Qualitative Health Research*.

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 designed the study in consultation with Associate Professor Signal and Dr Paine, recruited participants, collected all data, analysed the data in consultation with all co-authors and wrote the original and subsequent manuscript drafts in response to feedback from co-authors. She formatted the manuscript according to journal guidelines, amended the manuscript in response to reviewers' comments and responded to reviewers, in consultation with co-authors.

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**APPENDIX 31: QUALITATIVE STUDY SUMMARY
BROCHURE**

To summarise

- ❖ Mothers value their preschooler's sleep health, which influences the functioning and wellbeing of children, mothers and families.
- ❖ Mothers use a variety of strategies to support their children to sleep well e.g. activity, diet, routines, creating sleep enhancing bedrooms.
- ❖ Not all mothers have the same amount of choice, control or resources available to them to be able to support their children to sleep well.
- ❖ Factors outside of the home e.g. child health services, early childhood education policy, can have a flow on effect on mothers' experiences of preschooler sleep.

The take home message

It is important that government policies relating to housing, health and early childhood education, for example, consider the sleep health of children/tamariki. By doing so mothers can be empowered to support their young children to sleep well in ways that work for them and their family.

Ethical approval was granted by the Central Health and Disability Ethics Committee: (CEN/09/09/070/AM05)

¹SEP based on NZIDep which is a measure of individual socioeconomic deprivation. Reference: Salmond, C., Crampton, P., King, P., & Waldegrave, C. (2006). NZIDep: A New Zealand index of socioeconomic deprivation for individuals. *Social Science & Medicine*, 62(6), 1474-1485.

²Braun, V., & Clarke, V. (2013). *Successful Qualitative Research: A Practical Guide for Beginners*. London: Sage.

*We sincerely thank all of the mothers,
and their children, who took part in this study.*



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Mothers' Experiences of Preschoolers' Sleep in Aotearoa/New Zealand: A Qualitative Study



*He taonga te tamaiti
Every child is a treasure*



Sleep/Wake Research
Centre



Why we did this study

Sleep is important for health, development and wellbeing. Understanding how families experience sleep, and what makes it easier or more difficult for preschoolers to sleep well, can help to identify changes needed in areas such as healthcare services and social policy to support sleep.

To understand how families experience preschoolers' sleep in Aotearoa/New Zealand (NZ) we interviewed Māori and non-Māori mothers living in different socioeconomic circumstances (low and high socioeconomic position [SEP]¹).

Mothers and children in the study

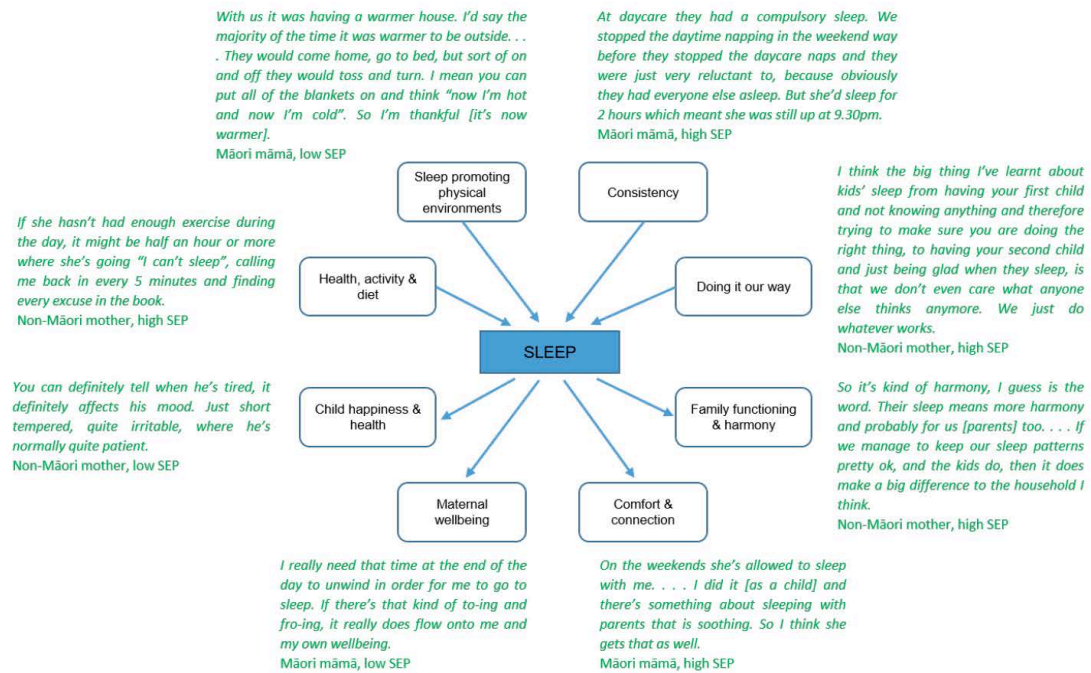
A group of women, who had completed *Moe Kura: Mother and Child, Sleep and Wellbeing in Aotearoa/New Zealand (Moe Kura)* study questionnaires, who lived in the Wellington region and whose *Moe Kura* child was 4 years old, were invited to take part.

- ❖ Fifteen Māori mothers (low SEP = 7, high SEP = 8) and 16 non-Māori mothers (low SEP = 7, high SEP = 9) were interviewed.
- ❖ On average, Māori women were 33 years old and non-Māori women were 38 years old.
- ❖ Children were 4 years old except for four (2 Māori and 2 non-Māori children) who had just had their 5th birthday.
- ❖ Children belonged to the same ethnic group as their mothers, except for one Māori child whose mother identified as non-Māori.

What we found

Interview data were analysed using thematic analysis². This involves looking carefully at what mothers have said in the interviews and identifying common themes. Eight themes were identified in relation to mothers' views and experiences of their preschooler's sleep and the things that helped, or made it more difficult for, children to sleep well.

Map of themes and illustrative quotes of mothers' experiences of their preschooler's sleep and the factors that influence how well children sleep.



APPENDIX 32: STATEMENT OF CONTRIBUTION

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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: Diane Muller

Name/Title of Principal Supervisor: Associate Professor T. Leigh Signal

Name of Published Research Output and full reference:

Muller, D., Paine, S-J., Wu, L. J., & Signal, T. L. (in press). "We're doing the best job we can": Maternal experiences of facilitators and barriers to preschoolers sleeping well in Aotearoa/New Zealand. *Sleep Health*. DOI: <https://doi.org/10.1016/j.sleh.2019.01.005>

In which Chapter is the Published Work: Chapter 7

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 designed the study in consultation with Associate Professor Signal and Dr Paine, recruited participants, collected all data, analysed the data in consultation with all co-authors and wrote the original and subsequent manuscript drafts in response to feedback from co-authors. She formatted the manuscript according to journal guidelines, amended the manuscript in response to reviewers' comments and responded to reviewers, in consultation with co-authors.

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APPENDIX 33: APPROVAL TO INCLUDE MANUSCRIPT IN THESIS

SLEEP HEALTH

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Terry Young, PhD

Ombudsman

Thomas Roth, PhD

Dear Ms. Muller,

Per your request, and upon approval from the publisher at Elsevier, I am providing this letter in writing to approve the publication of your article, SleepHealth-D-18-00152R1 (“We’re doing the best job we can”: Maternal experiences of facilitators and barriers to preschools sleeping well in Aotearoa/New Zealand), as part of your thesis. We realize that a print copy will be deposited in the Massey University library and a digital copy will be available online. Please let us know if this article from your dissertation receives any media attention and please be sure to reference that it is published in Sleep Health. We appreciate your contribution to Sleep Health and hope you continue to support the Journal.

Congratulations on your near completion of your doctoral studies! Wishing you continued research successes.

Sincerely,



Editor-in-Chief, Sleep Health

Professor of Family, Population, and Preventive Medicine, Stony Brook Medicine