Development of a theoretical model to understand pregnancy as a teachable moment for health behaviour change

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List of abbreviations

BAME   Black Asian and Minority Ethnic

BCTs   Behaviour Change Techniques

BCW   Behaviour Change Wheel

BMI   Body Mass Index

CASP   Critical Appraisal Skills Programme

COM-B   Capability-Opportunity-Motivation-Behaviour

COREQ   Consolidated Criteria for Reporting Qualitative Research

COVID-19   Coronavirus Disease

ENTRQ   Enhancing Transparency in Reporting the Synthesis of Qualitative Research

HBM   Health Belief Model

HRA   Health Research Authority

IMD   Index of Multiple Deprivation

IPA   Interpretative Phenomenological Analysis

JARS-Qual   Journal Article Reporting Standards for Qualitative Research

MBRRACE-UK   Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK

MECC   Making Every Contact Count

MRC   Medical Research Council

NHS   National Health Service

NICE   National Institute for Health and Care Excellence

NIHR	National Institute for Health Research
PANAS	Positive and Negative Affect Scale
PPI	Patient and Public Involvement
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PS	Pregnancy-Specific
PUQE	Pregnancy Unique-Quantification of Emesis
RCTs	Randomised Controlled Trials
REC	Research Ethics Committee
SDT	Self-Determination Theory
SFFFQ	Short Form Food Frequency Questionnaire
SGA	Small for Gestational Age
SRQR	Standards for Reporting Qualitative Research
TM	Teachable Moments
UK	United Kingdom
WHO	World Health Organisation

List of presentations

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Thesis abstract

Background: Pregnancy is often considered to be a 'teachable moment' for health behaviour change. However, existing behavioural models (TM and COM-B) were not developed specifically for, nor widely tested, in this population. The overall aim of this thesis was to understand pregnancy as a teachable moment by developing a pregnancy-specific model of health behaviour change.

Methods: Four studies were conducted. The first, a systematic review and meta-synthesis, investigated factors influencing health behaviour change during pregnancy. Subsequently, a theoretical mapping exercise was conducted to assess the extent to which the COM-B and TM models explain behaviour change during pregnancy (study two). The third study investigated longitudinally, which model best explained changes in eating behaviour during pregnancy. Finally, a qualitative interview study explored influences on women's eating behaviour throughout the antenatal period. The findings across the studies were synthesised to inform the development of a pregnancy-specific model of health behaviour change.

Findings: The findings from the first study revealed a myriad of internal and external factors that influence antenatal health behaviour. In the second study, the COM-B and TM models were found to be limited when applied to the context of pregnancy. Findings from the third study revealed that both models explained more variance in eating behaviour in early- and late-pregnancy, compared to mid-pregnancy and the postnatal period, however neither adequately accounted for behavioural changes. Qualitative findings revealed a range of influences on women's eating behaviour throughout the antenatal period. Whilst pregnancy is often conceptualised as one teachable moment in-and-of-itself, mid-pregnancy was highlighted as providing a more salient opportunity for change than other stages. Based on these findings, a pregnancy-specific behavioural model was developed that reflects six key domains understood to influence health behaviour during this time.

Conclusions: The COM-B and TM models fail to adequately explain pregnancy as a teachable moment for health behaviour change. Indeed, the conceptualisation of pregnancy as one teachable moment is flawed. The pregnancy-specific model provides an enhanced understanding of pregnancy as a teachable moment for behaviour change and highlights the nuanced factors influencing behaviour during this time. This understanding can be used to develop more appropriate interventions and to inform various aspects of clinical practice, to better support pregnant women and their infants.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Thesis format

This thesis is presented in journal format, owing to the candidate's ambition to publish all four studies during the PhD. Studies one, two, and three have been published in the peer-reviewed journals Health Psychology Review, Health Psychology and Behavioral Medicine, and the British Journal of Health Psychology, respectively. Study four is currently under peer-review by BMC Pregnancy and Childbirth. The supporting chapters in this thesis (chapters one, two, three, eight and nine) are presented in a traditional format.

Dedication

For my brother, Liam.

Acknowledgements

First and foremost, I'd like to express my gratitude to my brilliant supervisory team; Dr Sarah Peters, Dr Debbie Smith, and Dr Alexander Heazell. The support and guidance you have provided throughout this journey has been invaluable. Thank you for allowing me to develop my ideas and follow my own path.

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Completing this PhD during a global pandemic has been an immensely challenging experience, to say the least. I could not have got through it without the love and support of those around me. To my wonderful parents, your unconditional support and unwavering confidence in my ability has carried me through. Thank you for always supporting my ambitions. I love and appreciate you both so very much.

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CHAPTER ONE

1. Introduction

1.1. Chapter overview

This introductory chapter provides the background and rationale for the programme of research presented in this thesis. A general overview is provided relating to health behaviours, their relevance and importance during pregnancy, and the pregnancy-related behaviours focused on within this thesis. The teachable moment concept is then introduced, before two key behavioural models are presented and discussed in relation to the context of pregnancy. Utilisation of the teachable moment in clinical practice, to support antenatal health behaviour change, is then discussed. Finally, a pregnancy-specific model of behaviour change is proposed.

1.2. Health behaviours

Health behaviours have been defined as *"overt behaviour patterns, actions, and habits that relate to health maintenance, to health restoration, and to health improvement"* (Gochman, 1988, p.3). Health behaviours broadly fall into two categories; health-enhancing behaviours and health-impairing behaviours (Conner, 2015). Health-enhancing behaviours include actions taken by individuals to prevent illness and promote and maintain health. For example, consuming a healthy[1] diet, engaging in physical activity, regular tooth brushing, and getting adequate sleep. Conversely, health-impairing behaviours refer to those that increase the risk of negative health outcomes such as smoking, alcohol use, substance misuse, and risky sexual behaviours (Conner, 2015; Gochman, 1997).

Health behaviours play a key role in health outcomes across the life course. However, the salience of certain behaviours will increase at certain points in time, due to an increased risk of negative health outcomes. For example, some

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[1] Within this thesis, the term 'healthy' will be used to describe any health behaviours associated with positive health outcomes, or recommended by healthcare professionals.

health behaviours, such as receiving the flu vaccination or attending preventative cancer screenings (e.g., breast, bowel), become more important in older age due to an increased risk of disease (Public Health England, 2021; UK National Screening Committee, 2018, 2019). Other health behaviours might be linked to receiving a health diagnosis. For example, an individual diagnosed with Type 2 diabetes would be advised to make dietary changes and increase physical activity levels to help manage the condition (National Health Service [NHS], 2020a). When travelling abroad to countries where there is a high-risk of malaria, people are advised to take antimalarial medication (NHS, 2018), and throughout the COVID-19 pandemic the public were advised to wear face coverings to avoid virus transmission (Department of Health and Social Care, 2022).

As illustrated, there are many different types of health behaviours which might increase in importance throughout an individual's life, depending on various factors. It is therefore valuable to understand what influences these behaviours and how people can best be supported to engage with behaviours that will protect or enhance their health.

1.3. Health behaviours during pregnancy

Pregnancy is another example of a time when certain health behaviours may increase in salience. In other contexts, individuals might be encouraged to make one or two changes to their health behaviour at a time. For example, a dentist might encourage a patient to start flossing their teeth, or a doctor might recommend that a patient reduces their alcohol intake. However, during pregnancy women are advised to make a myriad of changes, often suddenly and simultaneously. Women are encouraged to attend a schedule of antenatal appointments, which, for an uncomplicated pregnancy, is typically 12 appointments for nulliparous women, and seven for multiparous women, over the antenatal period. Additional appointments are also provided for women beyond 40 weeks gestation or where there are complications or concerns (National Institute for Health and Care Excellence [NICE], 2021a). Figure 1.1 provides an overview of these key antenatal appointments.
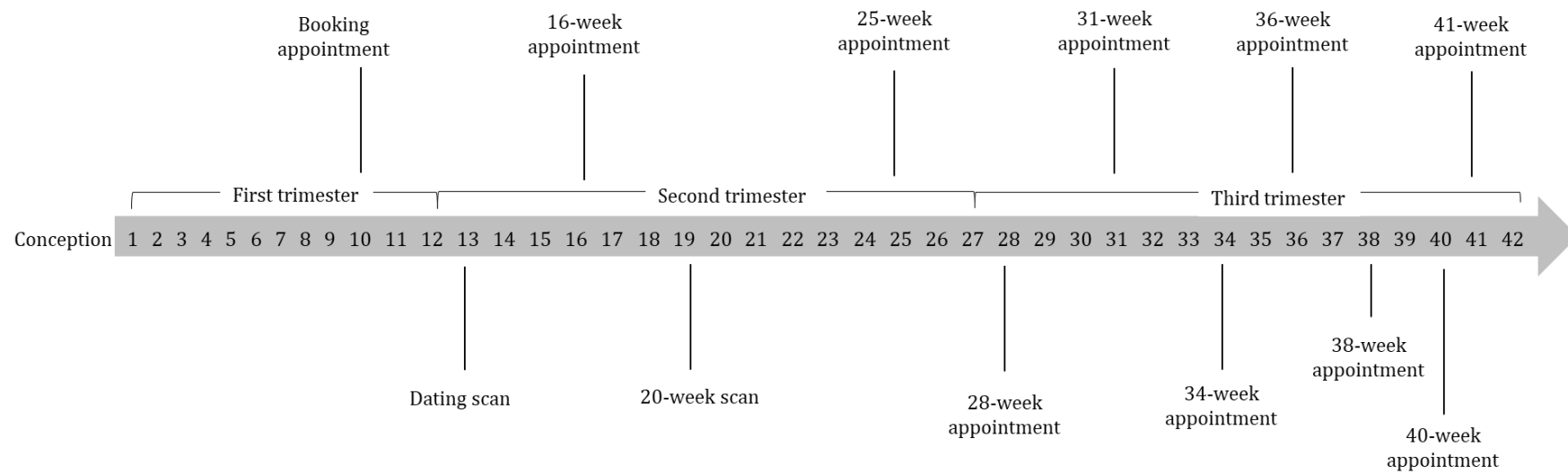
Figure 1.1. Overview of key antenatal appointments offered throughout an uncomplicated nulliparous pregnancy (NICE, 2021b)

In addition to attending clinical appointments, there are several other new pregnancy-specific behaviours that women are recommended to initiate during this period, including taking folic acid and vitamin D (NICE, 2008, 2014c). Women are also encouraged to maintain or modify various pregnancy-related behaviours. That is, behaviours that also occur outside of pregnancy, such as consuming a healthy diet or being physically active (NICE, 2010b, 2021a; Olander et al., 2018). Furthermore, several behaviours are recommended to be reduced or ceased during this time, including smoking, caffeine consumption, alcohol use, substance use, consumption of certain types of food, and vitamin A supplementation (NICE, 2008, 2010a, 2021a; NHS, 2020b). See Table 1.1 for a summary of these examples.

Table 1.1. Examples of recommended health behaviours during pregnancy

Initiate	Maintain or modify	Reduce or cease
Folic acid	Eating behaviour	Vitamin A
Vitamin D	Physical activity	Caffeine consumption
Antenatal appointments		Substance use
		Smoking
		Alcohol use
		Consumption of certain foods (e.g., raw shellfish, uncooked eggs)

1.4. Importance of healthy behaviours during pregnancy

Engaging in health compromising behaviours during pregnancy (e.g., poor dietary behaviour, sedentary behaviour, alcohol use, smoking) can increase the risk of pregnancy-related conditions such as preeclampsia and gestational diabetes (Yang et al., 2019), as well as the risk of obstetric complications such as preterm birth, caesarean birth, miscarriage, and stillbirth (Escañuela Sánchez et al., 2019; Liu et al., 2020; Sundermann et al., 2019; Yang et al., 2019). Delivering health messages and encouraging women to maintain or initiate healthy behaviours during pregnancy is therefore key in reducing the risks of poor health outcomes for both the mother and baby, and in supporting optimum maternal and fetal health.

Healthy behaviours established during pregnancy have the potential to persist into the postnatal period and beyond, which may further improve the mother's health (e.g., Avery, 2018), including her fertility and chance of future pregnancy success (e.g., Gaskins & Chavarro, 2018). Making healthy changes also has the potential to improve the health of the baby in-utero and in the long-term (Hsu & Tain, 2019; May et al., 2014; Wisborg et al., 2001). For example, smoking during pregnancy has been shown to increase the risk of preterm birth, stillbirth, small for gestational age (SGA) births, and reduced fetal brain development (Ekblad et al., 2015; Marufu et al., 2015; Philips et al., 2020). Furthermore, the implications of maternal smoking span beyond infancy, having been shown to be associated with negative health outcomes into adolescence (Rauschert et al., 2019; Thacher et al., 2018). Encouraging women to reduce or stop smoking behaviours therefore has wide reaching implications for the health of the baby.

From a behavioural perspective, maintaining healthy habits post-pregnancy may also have an indirect positive impact on the health of the child, as parental behaviours (e.g., eating behaviours) have been shown to be modelled by children as they get older (Patrick & Nicklas, 2005). Modelling healthy behaviour may also indirectly influence the behaviour of other adult members of the household, as both men and women are more likely to make healthy behavioural changes to their smoking, physical activity, and weight-related behaviours, if their spouse or partner also makes positive changes in these respective domains (Jackson et al., 2015).

Despite the risks, a substantial proportion of women enter pregnancy with established unhealthy behaviours and increased risk factors for poor health outcomes. For example, in 2017, 12.6% of pregnant women in England reported that they were current smokers at their booking appointment and 49% of pregnant women with a known Body Mass Index (BMI) were classed as overweight or obese (Public Health England, 2019). Rather than making healthy changes, research has shown that during pregnancy many women continue to smoke, consume alcohol, and significantly reduce their physical activity levels (Nascimento et al., 2015; NHS Digital, 2021; Popova et al., 2018). Given the

association between these behaviours and poor maternal and fetal health outcomes, this is a cause for concern and highlights the need to better support women to make healthy changes during this time.

1.5. Pregnancy-related health behaviours studied within the thesis

Of the health behaviours women are advised to adopt, those that are pregnancy-related, that may be sustained beyond pregnancy, may enhance long-term health outcomes to a greater degree than behaviours only initiated and maintained for the duration of pregnancy (i.e., vitamin supplementation). Dietary behaviour, physical activity, smoking, and alcohol use, are four pregnancy-related behaviours that are key modifiable behavioural risk factors for adverse pregnancy outcomes and lifelong non-communicable diseases, which also place the highest economic burden on the NHS (Hayes et al., 2021; Scarborough et al., 2011; World Health Organisation, 2020). As such, these four behaviours were the focus of the first two studies within this thesis.

As there are important differences between these four maternal behaviours, a single area was selected to study in depth, in studies three and four. Thus, the scope was narrowed to focus on eating behaviour[2] only. Eating behaviour was selected due to the high prevalence of obesity reported at booking appointments, as previously discussed (Public Health England, 2019), and the numerous poor maternal and fetal health outcomes associated with excess gestational weight gain. For example, increased risk of miscarriage, stillbirth, congenital abnormalities, fetal overgrowth, gestational diabetes, hypertension, and pre-eclampsia (Kominiarek et al., 2018; Poston et al., 2016; Yang et al., 2019). Rates of maternal obesity far exceeds the prevalence of other risk factors, such as smoking and alcohol use (Public Health England, 2019), making it a significant health priority. Whilst behavioural risk factors for obesity include both dietary behaviour and physical activity, research has shown that diet alone plays a greater role in weight loss and management than physical

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[2] For the purpose of this thesis, the terms dietary behaviour and eating behaviour are used interchangeably and reflect any behaviour relating to the consumption of food.

activity (Macfarlane & Thomas, 2010). Thus, eating behaviour is a key behaviour to target in order to improve maternal and fetal outcomes.

1.6. The teachable moment concept

Many women enter pregnancy engaging in unhealthy behaviours, as previously discussed. However, it has been argued that pregnancy presents an opportunity to make positive lifestyle changes (Lawson & Flocke, 2009), driven by an increase in motivation and receptivity to health messages (Ayyala et al., 2020; Edvardsson et al., 2011; Lindqvist et al., 2017). Significant events, or sets of circumstances, that motivate individuals to make positive changes to their behaviour, such as pregnancy, are often referred to as 'teachable moments' (Lawson & Flocke, 2009). This concept has been applied within various scholarly disciplines including health (Lawson & Flocke, 2009), education (Miller & Szymusiak, 2021), anthropology (Sobo et al., 2020), and environmentalism (Hart & Leiserowitz, 2009).

Within the health context, events considered to be teachable moments include receiving a chronic disease diagnosis, attending primary care consultations, hospital admissions, cancer screening or diagnosis, and pregnancy (Cohen et al., 2011; Cordovilla-Guardia et al., 2017; Dimova et al., 2020; Karvinen et al., 2015; Phelan, 2010; Taylor et al., 2007; Xiang, 2016). It has also been suggested that teachable moments can be created within the context of clinical interactions between patients and health professionals, by responding to cues to action, risk perceptions, and benefit or barriers to behaviour change (Lawson & Flocke, 2009). Researchers have proposed that health events such as these may prompt individuals to adopt risk-reducing behaviours such as reducing smoking and alcohol use, improving dietary behaviours, increasing physical activity, and utilising preventative healthcare (Humpel et al., 2007; Sriphanlop et al., 2018; Xiang, 2016).

Despite a shared understanding of the types of health events that might motivate behaviour change, the teachable moment concept has remained largely untested and poorly defined (Lawson & Flocke, 2009). A cross

disciplinary review of the literature found that the teachable moment is commonly understood in one of three ways; as an unpredictable opportunity that spontaneously facilitates teaching or learning, as a specific event or context resulting in increased capacity for change, or as a phenomenon involving a cueing event that prompts specific psychological responses (Lawson & Flocke, 2009). The latter of these three descriptions is exemplified by the work of McBride et al. (2003) whose teachable moments model (referred to hereon as the TM model) seeks to explain how teachable moments are created within the context of smoking cessation. Within Lawson and Flocke's (2009) review, McBride et al. (2003) were the only authors to discuss the mechanisms by which a teachable moment might influence behaviour, making their article one of the most compelling. However, similarly to the other included articles, a lack of prospective testing means the application of this model may be limited.

1.7. The Teachable Moments model

McBride et al. (2003) describe the teachable moment as a cognitive experience whereby an individual's judgement of an event and the perceived significance determines whether subsequent behaviour change will occur. The authors suggest that an effective teachable moment is cued by a health event that (1) increases personal perception of risk and outcome expectations, (2) provokes a strong affective or emotional response, and (3) prompts a redefinition of self-concept or social role (see Figure 1.2). Increased salience of these conceptual domains is suggested to increase motivation, self-efficacy, and skill acquisition, subsequently directing behaviour. The greater the degree to which all the domains are acted upon, the greater the likelihood the teachable moment will result in behaviour change (McBride et al., 2003). However, little discussion is provided as to way in which motivation, skills acquisition, and self-efficacy interact to direct behaviour, or the role of these respective constructs in the behavioural process.

The TM model has foundations in several existing conceptual models of behaviour including the Health Belief Model (HBM), which emphasises the importance of cues to action as a precursor of behaviour change (Rosenstock,

1974). This conceptual element can be seen reflected as the 'cueing event' element of the TM model. Similarly to the TM model, the HBM was first developed in the context of a single behaviour (uptake of tuberculosis screening) and subsequently applied to other behavioural contexts. McBride et al. (2003) argue that focusing on an individual behaviour in this way facilitates comparison across studies and enables testing to assess whether teachable moments exist for other behavioural outcomes.

Although not presented in the heuristic, the authors also highlight the role of predisposing factors and characteristics (e.g., age, culture) that may influence an individual's cognitive response to the cueing event, similar to the modifying factors included in the HBM. However, no further consideration is given to these factors, which is a limitation of the model given what is known about the influence of socio-demographic factors on health behaviours. For example, different patterns of dietary behaviour have been found to be influenced by age, ethnicity, education, and levels of deprivation (Wall et al., 2016).
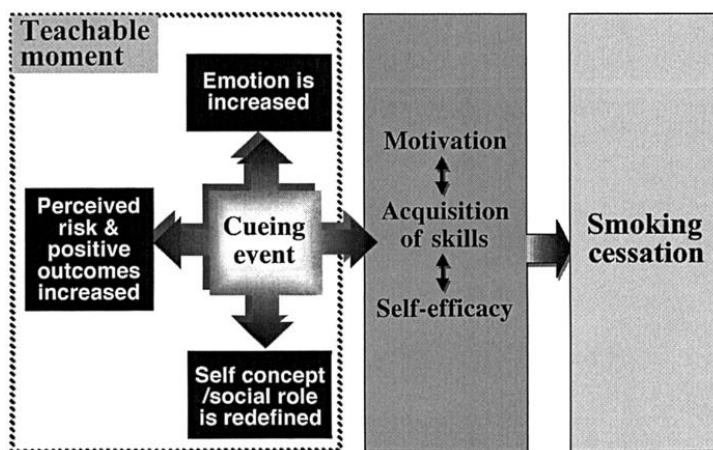
Figure 1.2. Heuristic model for teachable moments, within the context of smoking cessation (McBride et al., 2003)

1.8. Pregnancy as a teachable moment

Pregnancy is commonly understood to be a teachable moment for health behaviour change (Olander et al., 2018; Paterson et al., 2016; Phelan, 2010). In line with the TM model, the experience of pregnancy has the potential to act upon each of the three conceptual domains. Pregnancy, including the periconceptual period, may therefore be a particularly salient cueing event. For example, it is likely that planning for a pregnancy and/or the experience of being pregnant will prompt the mother to consider the associated risks of the pregnancy for both herself and her unborn child, and appraise outcomes related to her current behaviour (Petersen et al., 2015). Previous research suggests that women experience heightened risk perceptions due to fear of complications, frequent pregnancy surveillance, and the influence of unmonitored sources of information consumed online (Robinson et al., 2015). In some cases, perceptions of risk and hyper-vigilance can be further increased by difficulty conceiving or experiencing complications in prior pregnancies (Atkinson et al., 2016; Mills et al., 2014).

Pregnancy is an experience that is also likely to provoke a strong emotional response. Studies have reported heightened positive emotions such as joy and excitement in relation to pregnancy (Lou et al., 2017), as well as experiences of stress, anxiety, and depression (Rubertsson et al., 2014; Staneva et al., 2015). Moreover, pregnancy is an experience that encourages the adoption of a new social and emotional role as a mother, which may arguably be more salient for nulliparous women. Adoption of the maternal role, and the notion of 'good mothering', is well documented in the literature and suggests that for many women, pregnancy is a period of psychological, as well as physical, transformation (Hodgkinson et al., 2014; Ionio et al., 2021; Ladge et al., 2012).

Interestingly, within the context of pregnancy these three domains appear to interlink. For example, worry is an affective response that may be caused by heightened risk perceptions (Portnoy et al., 2014). Similarly, adoption of the maternal role, and specifically the 'good mother' role, relates to perceptions of

risk and a desire to protect the baby from harm (Robinson et al., 2015), as well as negative emotions and distress where women feel deviant or inadequate (Staneva et al., 2015).

1.9. The Capability-Opportunity-Motivation Behaviour model

Whilst the TM model is most commonly used, the Capability-Opportunity-Motivation Behaviour model (COM-B; Michie et al., 2011) (see Table 1.2) has been suggested to provide an alternative, and enhanced, understanding of pregnancy as a teachable moment (Olander et al., 2016). The COM-B model is a *"behaviour system"* that was developed based on an evaluation of existing frameworks of behaviour change (Michie et al., 2011, p.45). The model forms the core of the Behaviour Change Wheel (BCW), which is a broader framework reflecting intervention functions and policy categories used to classify and design interventions.

The COM-B model posits that three essential conditions are necessary to direct behavioural change: capability (physical and psychological), opportunity (physical and social), and motivation (reflective and automatic). All conditions, except for reflective motivation, are thought to be necessary to generate a behaviour (Michie et al., 2011). These determinants are suggested to more usefully, and insightfully, explain behaviour change during pregnancy, than those of the TM model, by moving beyond the traditional model of motivation, and considering that changes in capability and opportunity may also create opportune moments for intervention (Olander et al., 2016). For example, women's physical activity during pregnancy might be restricted by experiences of physical pregnancy symptoms, reflecting reduced physical capability. Having limited access to appropriate antenatal exercise classes may also act as a barrier, reflecting reduced physical opportunity, as might feelings of worry or anxiety about causing harm to the baby, reflecting automatic motivation (Flannery et al., 2018).

Table 1.2. COM-B model domains and definitions (Michie et al., 2011)

Domain		Definition
Capability	Physical	The individual's physical capacity to engage in the activity concerned
	Psychological	The individual's psychological capacity to engage in the necessary thought processes
Opportunity	Physical	All the factors that lie outside the individual afforded by the environment that make the behaviour possible or prompt it
	Social	All the factors that lie outside the individual afforded by the social environment and the cultural milieu that dictate the way that we think about things, that make the behaviour possible or prompt it
Motivation	Automatic	Automatic processes involving emotions and impulses that arise from associative learning and/or innate dispositions that energize and direct behaviour
	Reflective	Reflective processes involving evaluations and plans that energize and direct behaviour

1.10. Conceptual and theoretical issues

Despite their respective merits and application to pregnancy, neither the TM model nor the COM-B model were developed in the context of pregnancy or have been tested prospectively in a population of pregnant women. Furthermore, no pregnancy-specific model of behaviour change exists. Pregnancy is a unique physiological and psychological event (Slade et al., 2012; Soma-Pillay et al., 2016) that requires women to make decisions about the life of another individual (the fetus), to engage with an ordered healthcare plan, and to manage societal expectations about their own behaviour. Unlike other acute health events such as hospitalisation or clinical consultations, which are often brief, pregnancy typically lasts for between 37 to 42 weeks (NHS, 2021a). The physiological experience of pregnancy is continually evolving throughout that period, including observable bodily changes, changes in symptoms, and fluctuating hormone levels (Soma-Pillay et al., 2016). As such, it is crucial that

models used to understand behaviour change during pregnancy are developed in that context, to account for the unique aspects of the experience.

Pregnancy is often conceptualised as a teachable moment in-and-of-itself (e.g., Atkinson et al., 2016; Phelan, 2010). However, it has been suggested that multiple teachable moments may occur throughout pregnancy, triggered by individual antenatal events (e.g., receiving confirmation of the pregnancy, attending the initial booking appointment), or more broadly related to different gestational trimesters (Olander et al., 2016). Whilst McBride et al. (2003, p.166) consider that *"meaningful sub-events"* might provide targets for intervention, both the TM model and COM-B model provide a static understanding of behaviour change, assuming that a target behaviour will be influenced by simultaneous changes in the respective psychological constructs. These models are therefore limited when applied to pregnancy, which as discussed, is a dynamic health event that is constantly in flux.

1.11. Utilising the teachable moment in clinical practice

Pregnancy provides a unique opportunity for various health professionals to utilise the teachable moment and provide education and messages promoting healthy behaviours. Due to the schedule of antenatal appointments, there are multiple opportunities for contact between women and numerous health professionals, including midwives, family doctors, and obstetricians, over the course of their pregnancy (NICE, 2021a).

In the United Kingdom (UK), current guidelines for routine antenatal care recommend that women are provided with lifestyle advice during antenatal appointments, including information on cigarette smoking, alcohol consumption, exercise, and diet/nutrition (NICE, 2021a). NHS organisations are also required to provide staff with training to have opportunistic behaviour change conversations, as part of the 'Making Every Contact Count' initiative (MECC; Public Health England et al., 2016). However, research suggests that opportunities to deliver meaningful advice about health behaviour change are often not utilised to their full effect. Numerous studies have reported a lack of

conversations around making healthy lifestyle changes between women and midwives, and the provision of inconsistent advice from healthcare professionals (Cunningham et al., 2018; Lawrence et al., 2020; Weir et al., 2010). These findings are consistent with those of recent studies reporting that UK midwives feel they lack knowledge regarding guidelines and topics, and that they themselves receive inconsistent and conflicting recommendations about the information they should deliver (e.g., Royal College of Obstetricians and Gynaecologists, NICE) (Hopkinson et al., 2018; Lee et al., 2012; Schölin et al., 2021; Strömmer et al., 2021).

Current recommendations fail to provide sufficient information about conversations surrounding behaviour change. Whilst the guidance suggests that delivery of information is tailored to the time and stage of a woman's pregnancy, no further consideration is given to the different factors that may influence behaviour change efforts at different gestational stages (NICE, 2021a). Furthermore, the MECC initiative has been implemented inconsistently across the NHS, which has left many health professionals, including those in maternity care, feeling ill-equipped to have meaningful conversations about behaviour change (Chisholm et al., 2018; Keyworth et al., 2019).

In addition to the insufficiency of training pathways and existing guidelines regarding behaviour change, various other barriers to such conversations exist. For some health professionals these are practical barriers such as time constraints, having a lack of referral options (e.g., for weight or physical activity), lack of continuity of care, and needing to prioritise the management of clinical risks (Lee et al., 2012; McLellan et al., 2019). Other barriers relate to the clinical relationship. For example, some health professionals have concerns about broaching sensitive topics (e.g., weight or diet) and are keen to prioritise their relationship with the woman above delivering advice. Women's perceived receptivity or honesty about their current behaviour can also deter some health professionals from engaging in behaviour change conversations, as can feelings about their own health status (e.g., if they have a high BMI themselves) (Lee et al., 2012; McLellan et al., 2019).

In order to better support health professionals to capitalise on the opportunity pregnancy presents for behaviour change, behavioural interventions are regularly trialled in maternity care settings. However, they are frequently unsuccessful at changing target behaviour or affecting primary outcomes (Coleman et al., 2012; Dodd et al., 2008; Kennelly et al., 2018). This is often due to the absence of a theoretical framework or concepts (Brown et al., 2012; Currie et al., 2013; Flannery et al., 2019), which are necessary to target causal factors of behaviour, and to understand methods of change and the pathways through which they might occur (Bartholomew & Mullen, 2011; Michie et al., 2008). Where behavioural interventions do utilise theory, their effectiveness may be limited by the use of models that are not pregnancy-specific. For example, the MECC initiative uses a COM-B informed approach (Public Health England et al., 2016), which is a model that has not been developed nor tested in a pregnant population, as previously discussed.

It is evident that greater support is required in maternity settings to better utilise pregnancy as a teachable moment for health behaviour change. As such, the development of a pregnancy-specific model of behaviour change would be valuable. In order to deliver effective and appropriate behavioural interventions in antenatal care, they must be underpinned not only by theory, but by theory that has been developed in the context in which it is applied. More specifically, pregnancy is a unique health event which requires an understanding specific to the experience. Developing a behavioural model that is pregnancy-specific would not only enhance the level of support women receive, but would provide an appropriate framework for health professionals to refer to, to facilitate and guide behaviour change conversations in routine care. Whilst the development of a pregnancy-specific model will not address all of the barriers faced by health professionals to delivering behaviour change advice, it is an important first step in appreciating the unique needs of this population and attempting to provide an enhanced level of support and care for mothers and their infants.

1.12. Chapter summary

This chapter has provided the background and rationale for the research studies comprised within this thesis. A general overview of health behaviours and their importance during pregnancy was initially presented, followed by the rationale for the pregnancy-related behaviours focused on within the studies. The concept of the teachable moment was introduced, and the TM model and COM-B model were then presented and critically evaluated in relation to the context of pregnancy. The utilisation of the teachable moment within maternity care, to support women to make healthy changes, was then discussed. Chapter two presents the main aims of the thesis and individual research studies.

CHAPTER TWO

2. Aims and objectives

The overarching aim of this thesis was to understand pregnancy as a teachable moment by developing a pregnancy-specific model of health behaviour change. To do this, four studies were conducted, and the findings synthesised (see chapter eight). The aims of the individual studies are presented below. The overall structure of the thesis is illustrated in Figure 2.1.

2.1. Study one: Systematic review (Chapter four)

The aim of the first study was to identify factors influencing health behaviour change during pregnancy, specific to dietary behaviour, physical activity, smoking, and alcohol use.

2.2. Study two: Theoretical mapping exercise (Chapter five)

The aims of the second study were to:

1) Assess to what extent the factors identified as influencing behaviour change in the first study were accounted for in the COM-B and TM models.

2) Identify whether the COM-B model or the TM model is best used to understand behaviour change during pregnancy.

2.3. Study three: Longitudinal cohort study (Chapter six)

The aims of the third study were to:

1) Describe how the constructs of the COM-B model, the constructs of the TM model, and eating behaviour change over time.

2) Investigate whether the COM-B model or TM model better explains eating behaviour during pregnancy.

3) Examine whether certain time-points throughout pregnancy act as more salient teachable moments than others.

2.4. Study four: Interview study (Chapter seven)

The aim of the fourth study was to explore the influences on women's eating behaviour throughout pregnancy.
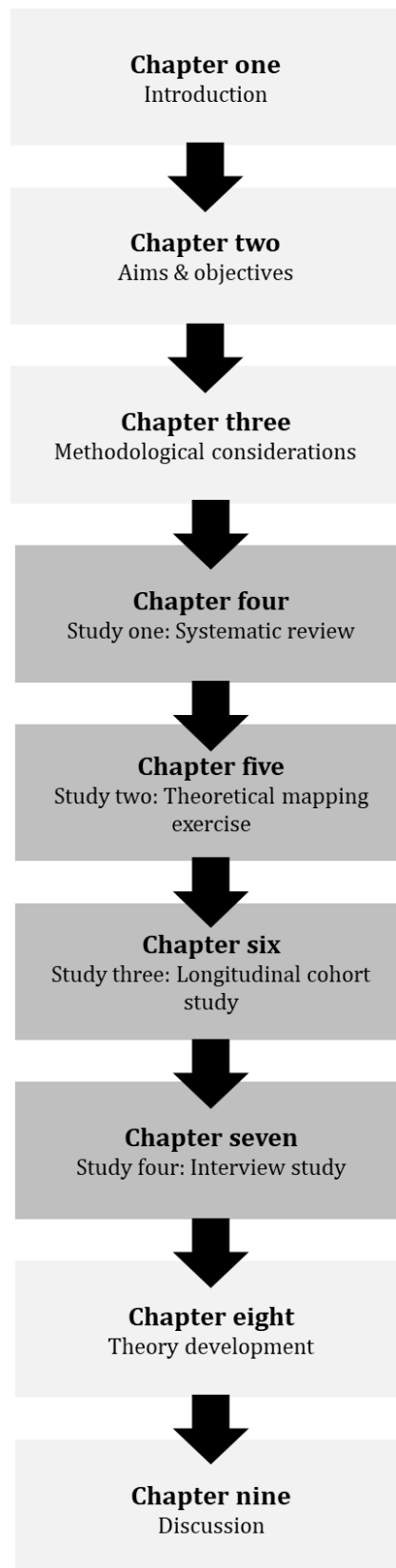
Figure 2.1. Thesis structure

CHAPTER THREE

3. Methodological considerations

3.1. Chapter overview

This chapter describes the rationale behind the key methodological decisions made throughout the thesis. In particular, the decision to involve lay members of the public in designing the research, the decision to incentivise participation, the use of a mixed methods approach, and key decisions relating to individual study design and analytical approaches.

3.2. Patient and Public Involvement

Patient and Public Involvement (PPI) in research has been defined as *"research being carried out 'with' or 'by' members of the public rather than 'to', 'about' or 'for' them"* (INVOLVE, 2021). PPI activities can involve members of the public at various stages of the research cycle (e.g., study design, set up, analysis, dissemination), which differs from other forms of participatory research, such as action research or co-design, which seeks to collaborate and work in partnership with members throughout the research process (Blomkamp, 2018; Bradbury-Huang, 2010; Koshy et al., 2011).

Involving lay members of the public in the design and development of health research is advocated on the grounds that those affected by a clinical condition or state (e.g., pregnancy) are entitled to input into research that may affect them (Bagley et al., 2016). Doing so helps to ensure that research is carried out in a way that is appropriate, acceptable, and relevant to those taking part, and improves the experience of those participating (INVOLVE, 2012; NIHR Centre for Engagement and Dissemination, 2021).

PPI activities were conducted with pregnant and recently postnatal women to inform the design of the empirical studies within this thesis (studies three and four). The desired outcomes of these activities were to ensure that the research studies were appropriate, that the language used was sensitive, and that the participant materials were clear and sufficiently detailed. To ensure a range of

perspectives were considered for each of the studies, the women involved had differing pregnancy experiences, including experiences of uncomplicated pregnancies, miscarriages, and stillbirth. Women's pregnancy backgrounds can shape their attitudes and influence their contribution to the research in meaningful ways (Moss et al., 2017). For example, some of the women who had previously suffered a pregnancy loss were particularly attuned to the use of sensitive language and terminology.

Women were involved at the design stage of both studies and were provided with information about the proposed recruitment and data collection approaches, and copies of key participant materials to review (e.g., participant information sheets, consent forms, surveys, debrief sheets). In line with guidance produced by the NIHR Centre for Engagement and Dissemination (2020), the PPI members were compensated £25 each for their involvement.

Input from PPI members was highly valuable as it highlighted weaknesses in the proposed research approaches, and details that had been overlooked. For example, the value of the recruitment incentive for the third study was originally intended to be one prize draw of £200 for completing all four surveys. However, it was highlighted that should a woman experience a pregnancy loss during the study, she would also lose the opportunity to win the prize. Based on this feedback, the incentive was changed to four smaller prize draws of £50 for each survey completed. This felt much more inclusive and addressed an otherwise overlooked issue. Other amendments included changes to the language used in the materials to make it more appropriate (e.g., not referring to a pregnancy as 'normal'), as well as edits to improve readability and comprehension. Incorporating these changes meant that overall, the participant materials were more considered and appropriate for the target demographic, ensuring the use of language that was sensitive to women who may experience complications during their pregnancy.

3.3. Incentivising participation

Recruitment and retention of participants in research is a key problem that is often overcome through the use of incentives. These can include monetary incentives and non-monetary incentives such as gifts, discounts, leisure vouchers, academic credit, or medical treatment (Dickert & Grady, 2008). The use of monetary incentives in particular has been shown to be an effective strategy to recruit and retain participants in various research contexts (Abshire et al., 2017; Jennings et al., 2015; Ngune et al., 2012), however, it is a highly debated issue. Some argue that the use of incentives may lead to undue inducement, exploitation, biased enrolment, or undermine autonomous decision-making, depending on the type of research (Resnik, 2015; Tishler & Bartholomae, 2002; Zutlevics, 2016). However, incentives are often viewed as a necessary tool to recruit sufficient participants. Provision of a monetary incentive compensates participants for their time and provides a token of appreciation for their involvement (Groth, 2010; Resnik, 2015; Zutlevics, 2016). Where risk of harm to the individual participants is assessed to be negligible, the use of incentives is often viewed as acceptable (Zutlevics, 2016).

In the context of this thesis, the decision was made to offer monetary incentives for participation in both empirical studies. Participants were offered the opportunity to be entered into a prize draw to win a £50 Love2Shop voucher for each of the four surveys they completed and to be entered into one-off prize draw to win a £100 Love2Shop voucher, for studies three and four, respectively. In the third study, the value of the incentive and timing of the prize draw (i.e., one draw per survey) was decided upon based on feedback received from PPI members, as previously discussed. The decision to offer financial incentives is in line with Health Research Authority (2014) guidance on payments and incentives in non-therapeutic research.

The decision to incentivise recruitment was based on an understanding of the potential benefits of doing so (i.e., enhanced recruitment) and assessment of the potential risk of harm to participants. Given the target population for both

studies were adults who had capacity to provide informed consent, and who were not deemed to be vulnerable, the offer of an incentive was considered appropriate.

There were several reasons for choosing to offer monetary incentives. Firstly, it was likely that due to the longitudinal nature of the third study, attrition rates would be high. It was therefore important to encourage participants to remain engaged with the study over the nine-month period, to enhance the potential for data collection. Another consideration related to the fact that recruitment took place during a pandemic. Whilst a decision to incentivise recruitment for the third study was made pre-pandemic, the protocol for study four was finalised after restrictions were first introduced in England (i.e., after 23/03/2020). It was anticipated that recruitment may prove more challenging at a time when changes in personal circumstances may reduce motivation for research participation, and that the offer of a financial incentive might improve engagement.

3.4. Use of a mixed methods approach

3.4.1. Methodological paradigms

Research can be conducted using either qualitative or quantitative methodologies. Quantitative research describes a range of methods used to investigate a measurable phenomenon using statistical or numerical data (Watson, 2014). Conversely, qualitative research describes a range of methods used to gather and analyse data in the form of human language and experience (Levitt et al., 2018). Whilst quantitative research seeks to objectively measure and report a given phenomenon, qualitative research provides rich insights and perspectives into individuals' worlds and experiences, often complementing knowledge gained using quantitative methods alone (Braun & Clarke, 2014).

The design, conduct, and analysis of research, whether qualitative or quantitative, is always underpinned, to some extent, by the researcher's own philosophical assumptions about the world and the nature of knowledge. Beliefs

about what is known and how knowledge is obtained are described as epistemological 'paradigms' or 'worldviews', and these influence how research questions are asked and answered (Morgan, 2007). Two main paradigms dominate methodological and epistemological debates in social sciences; positivism/post-positivism and constructionism/interpretivism (Dawadi et al., 2021; Feilzer, 2009). Whilst there is considerable nuance within these paradigms, simply put, those with a positivist worldview believe in a singular reality where objective inquiry can be used to discover the 'truth' and often favour quantitative research methods. Conversely, those with a constructionist worldview believe there is no single objective reality and tend to favour qualitative methods (Feilzer, 2009). These epistemological positions guide what can be said about research data and the inferences and meaning taken from it (Braun & Clarke, 2006).

3.4.2. Combining paradigms

Mixed methods research involves combining elements of both qualitative and quantitative research approaches for the purposes of breadth and depth of understanding and corroboration (Johnson et al., 2007). It has been argued that mixed methods research can involve mixing approaches within a single study, or within a program of research (Johnson et al., 2007), which is consistent with the approach taken in this thesis.

Whilst some qualitative and quantitative traditionalists believe that qualitative and quantitative paradigms are incompatible with one another (Johnson & Onwuegbuzie, 2004), others argue that the integration of the two methodological approaches is not only possible, but favourable (Johnson & Onwuegbuzie, 2004; Johnson et al., 2007). Mixed methods research can offer insights into phenomena that may not be achievable using qualitative or quantitative methods alone, and produces a more complete picture through differing research perspectives and lenses (Dawadi et al., 2021). Furthermore, the combination of qualitative and quantitative methods mean that the strengths and weaknesses of each method (e.g., the breadth of data produced

through quantitative inquiry and the depth of data generated through qualitative methods) are offset against one another, resulting in more robust conclusions (Dawadi et al., 2021).

Mixed methods research is underpinned by the paradigm of pragmatism. Pragmatism is not wedded to one particular epistemological paradigm and is concerned only with answering the research question using the most appropriate approaches (Feilzer, 2009). The pragmatic approach allows researchers to move away from the dichotomy of positivism/post-positivism and constructionism/interpretivism, valuing both objective and subjective knowledge (Dawadi et al., 2021; Feilzer, 2009).

The studies carried out as part of this thesis included a qualitative systematic review and theoretical mapping exercise, a quantitative longitudinal cohort study, and a qualitative interview study. Whilst each of the study methodologies are inherently linked to the dominant paradigms, the methodological decisions were guided by a principle of pragmatism, considering what approaches worked best to most effectively meet the overarching aim of the thesis.

3.4.3. Triangulation of findings

In addition to enhancing and broadening understanding of a given phenomenon, a key advantage of mixed methods research is that it facilitates triangulation of findings. Whilst a challenge of this approach is the potential for discrepancies within the respective data sets (Almalki, 2016), the successful assimilation of findings can lead to the synthesis or integration of theories, and initiation of new interpretations or ways of thinking (Jick, 1979; Rossman & Wilson, 1985). This approach was therefore highly appropriate given the overarching aim of the thesis, which was to develop a pregnancy-specific model of health behaviour change.

There are various ways in which triangulation of findings can occur. For example, a within-method approach can be used where multiple techniques are

used within a given method (e.g., multiple survey measurement scales measuring the same concept) or a between-method approach can be used to cross-validate findings generated from several distinct methods (Jick, 1979), such as that used within this thesis. The four studies within this thesis utilised various methods of inquiry including systematic review and meta-synthesis, theoretical mapping, longitudinal data collection, and timeline assisted interviews. Triangulation was achieved by identifying key insights from each of these studies that contributed meaningfully to the development of a pregnancy-specific model. Drawing upon the strengths of each of the methodologies, and utilising different approaches, facilitated the assimilation and integration of findings, to develop an enhanced theoretical and conceptual understanding of the phenomenon under investigation. This was achieved by meeting the aim of the thesis to develop a pregnancy-specific model of health behaviour change.

3.5. Study design and analytical approaches

As described above, this thesis is comprised of four studies that vary by study design and analytical approach. Full details pertaining to the methodological procedures can be found within the respective chapters, however justifications for the key methodological decisions made for each respective study are presented here within.

3.5.1. Study one: Systematic review and meta-synthesis

The first study in this thesis was a systematic review and meta-synthesis which aimed to identify factors influencing health behaviour change during pregnancy. Systematic reviews are a widely-used methodology that has been developed for searching, appraising, and synthesising the findings of individual research studies (Dixon-Woods et al., 2006). For researchers, health professionals, and policy-makers tasked with making decisions based on available evidence, systematic reviews integrate findings and highlight variations or consistencies across the literature, aiding decision-making (Mulrow, 1994). Compared to other types of reviews (e.g., narrative reviews) systematic reviews have long

been viewed as a superior methodology due to the increased rigor and transparency of the process (Dixon-Woods et al., 2006).

Historically, systematic reviews focused solely on the identification and synthesis of Randomised Controlled Trials (RCTs), and were concerned only with effectiveness outcomes, often referred to as a 'rationalist' model of systematic reviews (Dixon-Woods et al., 2006). However, a failure to include qualitative studies means that relevant evidence may be missed, limiting the conclusions that can be drawn from the data (Dixon-Woods & Fitzpatrick, 2001).

More recently, the value of qualitative research in systematic reviews has been recognised. This is owing to the critical perspective qualitative research can offer and contribution it can make to reviews of effectiveness, by providing insight into the *"what, how, and why"* (Centre for Reviews and Dissemination, 2009, p.221; Dixon-Woods & Fitzpatrick, 2001). In the context of this study, it was important to understand the lived experiences of women during their pregnancies, which cannot be captured using quantitative methods alone (Braun & Clarke, 2019). A scoping review of the literature revealed a plethora of qualitative research existed exploring women's experiences or perceptions of antenatal health behaviour change. As such, a systematic review and meta-synthesis was deemed necessary and appropriate, to capture and synthesise common findings from this disparate literature.

3.5.1.1. Quality appraisal

Quality appraisal in qualitative systematic reviews is an important activity that enables researchers to reflect upon and assess the rigor and trustworthiness of the studies, and to reduce the possibility of bias (Dixon-Woods et al., 2006). Quality appraisal can take the form of reflective dialogue between those assessing the studies, or alternatively, structured appraisal tools can be used (Majid & Vanstone, 2018). Various tools are available, all of which have their own merits and limitations. These include the Critical Appraisal Skills

Programme (CASP) quality appraisal checklist (CASP, 2018), the Consolidated Criteria for Reporting Qualitative Research (COREQ; Tong et al., 2007), and the Standards for Reporting Qualitative Research tool (SRQR; O'Brien et al., 2014). The use of structured tools such as these enables standardisation of methodological reporting of quality and can strengthen the understanding and applicability of findings from qualitative synthesis (Majid & Vanstone, 2018).

To appraise the quality of the studies included in the systematic review, the CASP quality appraisal checklist was used (CASP, 2018). The CASP tool is specific to the appraisal of qualitative research and is the most commonly used tool in Cochrane and the World Health Organisation (WHO) guideline processes (Noyes et al., 2018). Furthermore, the CASP tool is easy to understand, use, and administer (Majid & Vanstone, 2018). For these reasons it was deemed an appropriate and reliable tool to use. No studies were excluded from the review based on the quality appraisal, as there is limited evidence to suggest this is beneficial (Carroll et al., 2012; Dixon-Woods et al., 2007; Long et al., 2020). However, the assessment process allowed for transparency and provided an enhanced understanding of the contribution made by each study to the findings and conclusions of the review.

3.5.1.2. Reporting guidelines

Ensuring quality in reporting of systematic reviews is important, as systematic reviews are often viewed as the gold standard for evidence-based decision-making in healthcare (Pussegoda et al., 2017). Inadequately reported reviews can be difficult to interpret and may limit the extent to which the evidence can be used to inform best practice, resulting in wasted research resources (Pussegoda et al., 2017). To assess the quality of systematic review reporting, several criteria have been developed, including the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA; Moher et al., 2009), and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research statement (ENTRQ; Tong et al., 2012), both of which were used to guide the reporting of the systematic review conducted for this thesis.

These guidelines provide structured checklists for researchers to use in order to increase transparency and ensure reporting of the evidence is accurate and rigorous.

3.5.1.3. Analytical approach

Various methods can be used to synthesise qualitative data in systematic reviews, including thematic synthesis, meta-ethnography, textual narrative synthesis, framework synthesis, and grounded theory (Barnett-Page & Thomas, 2009). Thematic synthesis was selected as the most appropriate method to analyse and synthesis the data from the systematic review (Thomas & Harden, 2008). This approach combines and adapts elements from meta-ethnography and grounded theory approaches, to identify descriptive themes, which can be further interpreted to form analytical themes (Barnett-Page & Thomas, 2009). This approach is similar to analysis techniques used in primary research studies, and unlike other methods, such as textual narrative synthesis, seeks to identify and translate key concepts, enabling conclusions to be drawn based on commonalities across heterogeneous studies (Lockwood et al., 2020).

Thematic synthesis allows for the development of a richer interpretation and conceptual understanding that aims to go beyond the data, to allow for a new interpretation of the study findings that are greater than the sum of their parts (Barnett-Page & Thomas, 2009; Evans & Pearson, 2001; Flemming & Noyes, 2021). This was important given the aims of the review, which were not to purely summarise or describe current literature, but to synthesise it and consider the implications when the study findings were combined to create a 'whole'.

3.5.1.4. Inclusion of non-English language articles

Non-English language articles were included in the systematic review for several reasons. Firstly, both the Cochrane Handbook and the Campbell Collaboration recommend that authors should assess all relevant articles for

inclusion, irrespective of language (Kugley et al., 2017; Lefebvre et al., 2019). It was therefore important to adhere to current recommendations regarding best practice.

Whilst some have argued that the exclusion of non-English language articles has a limited impact on the findings and overall conclusions of reviews (Dechartres et al., 2018; Hartling et al., 2017; Nussbaumer-Streit, Klerings, Dobrescu, et al., 2020), excluding such articles may lead to an increased risk of bias (Pieper & Puljak, 2021; Song et al., 2010), or missing key evidence (Nussbaumer-Streit, Klerings & Gartlehner, 2020), and may limit the generalisability of findings (Aali & Shokraneh, 2021). Furthermore, excluding non-English language articles from qualitative reviews may mean that participants' experiences of culturally specific issues are not captured, and may serve to limit the transferability of the results (Butler et al., 2016). From a practical perspective, excluding non-English language articles during the search stage of a review also risks the exclusion of relevant English-language articles, where language values have been incorrectly defined or are missing (Aali & Shokraneh, 2021).

Inclusion of non-English language articles resulted in a more thorough review that was far more representative and inclusive of the current literature. However, the process of identifying suitable translators for these articles was extremely challenging and time consuming. As such, a discussion article was written, reflecting on the process of identifying low-cost sources of translation support, which has since been published in Research Synthesis Methods (see Appendix A).

3.5.2. Study two: Theoretical mapping exercise

In the second study, a theoretical mapping exercise was undertaken, to assess to what extent the factors identified as influencing health behaviour change in the systematic review, were accounted for in the COM-B and TM models. A hybrid approach was utilised, whereby the inductively generated sub-themes from the systematic review were deductively mapped to the constructs of the

COM-B and TM models. Inductive approaches involve deriving themes or interpretations directly from raw data, whereas deductive approaches test the congruence of data with existing assumptions, theories, or hypotheses (Thomas, 2006). Applying existing data-driven knowledge within theory-driven frameworks provided an enhanced conceptual understanding of how the influencing factors related to the model constructs and the applicability of these models to the context of pregnancy. Using a hybrid approach such as this has been argued to enhance rigor in the analytical process (Fereday & Muir-Cochrane, 2006; Xu & Zammit, 2020). Furthermore, this approach is in line with the pragmatic stance taken in this thesis, as pragmatism supports not only the use of different methods, but a continuous cycle of inductive and deductive reasoning (Mitchell, 2018).

3.5.3. Study three: Longitudinal cohort study

The third study was a longitudinal prospective cohort study, which aimed to investigate the utility of the COM-B and TM models to explain changes in eating behaviour during pregnancy. Longitudinal research is concerned with progress and change in status over a given time period and can show growth and patterns of change, which is important for causal studies on individual behaviour (Rajulton, 2001). Given the aims of the study, a longitudinal approach was deemed necessary to capture the data of interest over the specified time period.

3.5.3.1. Data collection

Data were collected from participants at four time-points over the study period: between 12-16 weeks of pregnancy, 20-24 weeks, 36-40 weeks, and between 6-12 weeks postpartum. These time-points were decided upon following discussion with clinicians with experience of providing care in pregnancy. The first three time-points were selected as they would capture data within each of the three pregnancy trimesters. Defining a short window for data collection within each trimester also aimed to avoid any ambiguity associated with using

standard trimester dates. For example, using a standard trimester timeline (0-12 weeks, 13-27 weeks, 28-42 weeks) would mean that a woman who is 13 weeks pregnant and a women who is 27 weeks + 6 days pregnant would both provide data relating to the same trimester/time-point, when there is likely to be substantial differences in experiences between women at these differing gestational stages.

One consideration when planning to recruit women during the earlier stages of pregnancy was that for some women their pregnancies may not continue to full term. Between 12-16 weeks of pregnancy was therefore deemed to be an appropriate time to commence recruitment and collect the first set of data, as by this stage most women have attended their first booking appointment and ultrasound scan (NICE, 2021b), which can detect some pregnancy complications at that early stage (Scibetta & Han, 2019). Furthermore, spontaneous miscarriages are more likely to occur before this point (Cohain et al., 2017). This decision was supported by PPI members and clinical staff involved in the study.

The final time-point for data collection was between 6-12 weeks postpartum. Whilst it was important to gather data during the early postpartum period, it was anticipated that women would be otherwise occupied shortly after the birth of their baby. In order to avoid overburdening participants during this time, six weeks postpartum was decided upon as an appropriate time-point to re-contact participants, with additional time added for participants to respond to the survey.

3.5.3.2. Analytical approach

Mixed effects regression models were used in the main analysis to compare changes in eating behaviour and model construct scores over time. Multiple linear regression models were used to identify whether the COM-B model or TM model better explained eating behaviour. Individual regression models were also used to assess the associations between model constructs and dietary

quality at each time-point, to identify if certain time-points act as more salient teachable moments than others during pregnancy. Given the aims of the study, the use of regression models was deemed to be the most appropriate approach, as this analytical method allows for the investigation of the relationship between explanatory variables (i.e., model constructs) and a response variable (i.e., eating behaviour) while considering the effects of confounding factors (Bender, 2009).

3.5.3.3. Online recruitment

Recruitment for the third study took place between February and June 2020, initially through NHS maternity units in the North-West of England. This was up until the point at which it was announced that pregnant women were a high-risk group for contracting COVID-19 (16/03/2020). After this point, recruitment was moved online, utilising paid adverts (e.g., Facebook, Instagram) and posts on social media and forums (e.g., Twitter, Reddit, MumsNet), university mailing lists, and recruitment websites.

A total of 42% of participants were recruited online. Whilst there are benefits to online recruitment, such an increasing reach, ease of participation, and time saving (Saberi, 2020), previous research has suggested that participants from cohorts recruited online have lower follow-up participation (Bajardi et al., 2014). This may therefore explain the relatively high levels of attrition found in the study (see page 138 for details). Recruiting online may also increase the risk of selection bias, which can consequently threaten internal validity (Young et al., 2020). For example, it is possible that the participants who self-selected to take part in the study were those who had an interest in healthy eating. This would mean that groups of women with less healthy diets may be underrepresented in the sample thus skewing the data to suggest women's eating behaviour is healthier than is actually reflected in the general population. Whilst this would have implications for the findings of the study, it has also been argued that recruitment of reproductive aged women online into

prospective cohort studies of reproduction are no more likely to be prone to selection bias than with 'traditional' recruitment methods (Hatch et al., 2016).

Many of those participants recruited online were those recruited after pregnant women were reported to be at high-risk of COVID-19. Specifically, 41.5% of participants were recruited after 16/03/2020 (for the purpose of this thesis, any time after this date will be referred to as 'lockdown' from hereon). Other studies conducted during 2020 have suggested that in some cases women experienced disruptions to their eating behaviour during this time (Whitaker et al., 2021; Zhang, Zhang, et al., 2020), as well as elevated anxiety related to concern about threat to their lives and those of their baby or loved ones (Corbett et al., 2020; Lebel et al., 2020; Qi et al., 2020). To address these issues, timing of recruitment (i.e., pre- or post-lockdown) was included as potential confounder in the main analysis.

3.5.4. Study four: Interview study

In study four, one-to-one interviews were used to explore influences on women's eating behaviour throughout pregnancy. Interviews are one of the most widely used qualitative methods in psychology research which can be used to explore participants' views, experiences, beliefs, and motivations about a given phenomenon (Gill et al., 2008; Willig, 2008). From a practical perspective, interviews provide a flexible and accessible approach to data collection that can reveal novel insight not otherwise considered (Gill et al., 2008; Qu & Dumay, 2011).

Given the aim of the study was to explore participants' experiences of eating behaviour during their pregnancies, interviews were considered to be the most appropriate method to utilise in this context. More specifically, semi-structured interviews were used, as this style of interviewing allows for broad topic areas to be defined, whilst providing flexibility for participants to diverge and to explore topics in greater depth (Gill et al., 2008).

3.5.4.1. Reporting guidelines

Similarly to the reporting guidelines developed for systematic reviews, a small number of tools also exist to assess the quality of reporting for primary qualitative studies. Three key sets of reporting standards include the Journal Article Reporting Standards for Qualitative Research (JARS-Qual Standards) (Levitt et al., 2018), and the SRQR (O'Brien et al., 2014), and COREQ (Tong et al., 2007), both of which can also be used to assess the quality of qualitative systematic reviews, as previously discussed. As with other types of reporting guidelines, these tools help to improve transparency of the research process and aid with critical appraisal by ensuring thorough reporting of key research elements (Dossett et al., 2021; O'Brien et al., 2014).

The interview study conducted as part of this thesis was reported in line with the COREQ criteria (Tong et al., 2007), which provides a comprehensive 32-item checklist. Whilst the COREQ has been criticised for taking a slightly more rigid approach to reporting than other reporting criteria (Dossett et al., 2021), it is specific to interview and focus group research. As such, this set of guidelines was considered to be the most appropriate to guide the write-up and reporting of this study.

3.5.4.2. Analytical approach

In order to understand women's experiences of eating throughout pregnancy, it was necessary to explore commonalities in their narratives, to identify factors influencing behaviour. As such, an inductive thematic analysis was conducted on the interview data, based on the five steps outlined by Braun and Clarke (2006). Thematic analysis is a commonly used analytical approach in qualitative research which seeks to identify, analyse, report, and interpret patterns within qualitative data (Braun & Clarke, 2006). Given the aims of the study, this approach was highly appropriate. Other analytical methods, such as content analysis and Interpretative Phenomenological Analysis (IPA), were discounted early on, as these methods are concerned more with individual narratives and

the use and meaning of language, respectively (Brocki & Wearden, 2006; Cheek, 2004).

Thematic analysis also offers a theoretically flexible approach, which differs to other qualitative methods such as IPA and grounded theory, which are theoretically bounded (Braun & Clarke, 2006). The flexible and non-prescriptive stance of thematic analysis is compatible with the pragmatic approach taken within this thesis, in which the methodological decisions were driven by the need to answer the research question, rather than by an underlying epistemology (Feilzer, 2009).

3.5.4.3. Use of a timeline

Within the research context, timelines have been defined as a *"visual depiction of a life history, where events are displayed in chronological order"* (Berends, 2011, p.2). Visual timelines can be used within qualitative interview studies to help participants focus on key elements of an experience and can result in the generation of richer, more in-depth data, as well as enhanced recall (Grant et al., 2019; Marshall, 2019; Sheridan et al., 2011).

Visual timelines were used during the interviews in the fourth study, to help aid participant recall, given their pregnancies may have taken place up to six months prior to the interview. Each timeline was created in advance of the interviews using the date the participants gave birth (information which was gathered via a demographic questionnaire). Key antenatal appointments (e.g., booking appointment, glucose test) and events (e.g., religious festivals, COVID-19 lockdowns) that occurred during the participant's pregnancy were calculated based on the date they gave birth and plotted on the timeline. The timelines were shared with participants using the 'share screen' function on Zoom, at three points throughout the interview, to support the interview schedule. The experience of using timelines in this way was wholly positive and provided participants with a point of focus throughout the interviews, which

meant that the structure of the interviews was often well maintained, and the participants' recall enhanced.

3.5.4.4. Online interviewing

The interview study was carried out between November 2020 and February 2021, during which time various lockdowns and restrictions were enforced in England. In order to adhere to social distancing guidelines, the interview study was conducted entirely online. Whilst the process of recruiting and collecting data online afforded similar benefits to those discussed in relation to the third study, it also highlighted several issues that could potentially have affected the quality of the data collected. These included difficulties assessing non-verbal cues, internet connectivity problems, and interruptions present in the home that may break the flow of the interview or inhibit disclosure (i.e., having family members in close proximity). However, conducting the interviews online was a convenient and cost-effective approach, and allowed for flexibility and comfort for both the PhD candidate and participants. This resulted in an enhanced interviewing style and generation of rich data. Since completing this study, a discussion article has been written, reflecting on the process of collecting data online. This has been submitted for publication (see Appendix B).

3.6. Chapter summary

This chapter has described the rationale behind the key methodological decisions made throughout the thesis. Firstly, the decision to seek PPI feedback on the design of the studies was justified. The rationale for incentivising participation in the empirical work was then provided. The reasoning for employing a mixed methods approach within this thesis was presented, and the key decisions relating to the individual study design and analytical processes were discussed. The next four chapters of this thesis present the four respective studies in publication format.

CHAPTER FOUR

4. Study one: Factors influencing health behaviour change during pregnancy: A systematic review and meta-synthesis

Journal

Health Psychology Review

Status

Published

Reference

Rockliffe, L., Peters, S., Heazell, A. E. P., & Smith, D. M. (2021). Factors influencing health behaviour change during pregnancy: A systematic review and meta-synthesis. *Health Psychology Review, 15*(4), 613-632. https://doi.org/10.1080/17437199.2021.1938632

4.1. Abstract

Pregnancy is an opportune time for women to make healthy changes to their lifestyle, however many women struggle to do so. Multiple reasons have been posited as to why this may be. This review aimed to synthesise this literature by identifying factors that influence women's health behaviour during pregnancy, specifically in relation to dietary behaviour, physical activity, smoking, and alcohol use. Bibliographic databases (MEDLINE, PsycINFO, CINAHL-P, MIDIRS) were systematically searched to retrieve studies reporting qualitative data regarding women's experiences or perceptions of pregnancy-related behaviour change relating to the four key behaviours. Based on the eligibility criteria, 30,852 records were identified and 92 studies were included. Study quality was assessed using the CASP tool and data were thematically synthesised. Three overarching themes were generated from the data. These were (1) A time to think about 'me', (2) Adopting the 'good mother' role, and (3) Beyond mother and baby. These findings provide an improved understanding of the various internal and external factors influencing women's health behaviour during the antenatal period. This knowledge provides the foundations from which future pregnancy-specific theories of behaviour change can be developed and highlights the importance of taking a holistic approach to maternal behaviour change in clinical practice.

4.2. Introduction

Pregnancy is a period of time when women may be more receptive to health promotion and experience increased motivation to make healthy changes to their lifestyle (Lindqvist et al., 2017; O'Brien et al., 2017). As such, it has been suggested that this period may be a 'teachable moment' (Phelan, 2010). McBride et al. (2003) define teachable moments as significant health events that may motivate an individual to adopt risk-reducing health behaviour(s). They argue that an effective teachable moment is cued by a health event that increases personal perception of risk and outcome expectations, provokes a strong emotional response, and causes a redefinition of self-concept or social role. Based on this model, pregnancy has the potential to act upon each of these psychological domains, creating a salient opportunity for change (Phelan, 2010).

Encouraging women to adopt healthy behaviours during pregnancy has the potential to reduce the risk of pregnancy-related conditions such as preeclampsia and gestational diabetes (Yang et al., 2019), as well as the risk of obstetric complications such as pre-term birth, caesarean birth, miscarriage, and stillbirth (Escañuela Sánchez et al., 2019; Liu et al., 2020; Sundermann et al., 2019; Yang et al., 2019). Furthermore, healthy behaviours developed during pregnancy have the potential to be maintained into the postnatal period and beyond, improving the health of women, as well as their children, who may otherwise emulate poor behaviours (Yelverton et al., 2020; Zarychta et al., 2019) or develop health conditions related to maternal risk factors (Edlow, 2017; Gutvirtz et al., 2019; Heslehurst et al., 2019; Stacy et al., 2019; Zhang, Wang, et al., 2020).

Current UK guidelines recommend that women are provided with lifestyle advice during antenatal appointments, including information on smoking cessation, alcohol consumption, exercise, and diet/nutrition (NICE, 2021a). These four behaviours are particularly important as they are key modifiable behavioural risk factors for adverse pregnancy outcomes and lifelong non-

communicable diseases, which also place the highest economic burden on the NHS (Hayes et al., 2021; Scarborough et al., 2011; World Health Organisation, 2020). Intervening early in pregnancy and supporting women to make changes to these behaviours may therefore improve the trajectory of health outcomes for both the mother and child, as well as reducing the associated burden on the health service.

The antenatal period provides a valuable opportunity for health professionals to intervene and address poor health behaviours, particularly because women are likely to have increased contact with health professionals during this time. Unlike other teachable moments in acute health settings, pregnancy typically provides a window of opportunity spanning up to forty weeks, involving multiple contacts between women and health professionals (NICE, 2021a). However, behavioural interventions that have been trialled in antenatal settings are frequently unsuccessful at changing the target behaviour or affecting primary outcomes (Coleman et al., 2012; Dodd et al., 2008; Kennelly et al., 2018). This is particularly true for groups of women who may receive greater benefit from such intervention, such as those with raised BMIs, for example (Dodd et al., 2014; Poston et al., 2015).

A commonality of ineffective behavioural interventions is that they are often not underpinned by theoretical concepts (Brown et al., 2012; Currie et al., 2013; Flannery et al., 2019). Using theory in intervention development is necessary in order to target causal factors of behaviour, and to understand methods of change and the pathways through which change may occur (Bartholomew & Mullen, 2011; Michie et al., 2008). However, there is currently no theoretical model of behaviour change specific to pregnancy. Whilst more general models may be applied to the antenatal context, pregnancy is a unique health event that requires an understanding that is specific to the experience. This is not least because pregnancy is a physiological event, as opposed to a pathological process, that is associated with psychological changes. It is also unique in that it requires decision-making about the life of another individual. From the mother's perspective, pregnancy involves engaging with an ordered health care

plan, and invokes societal expectations about behaviour, meaning pregnancy is a health event unlike any other.

In order to work towards a goal of developing a relevant pregnancy-specific theory of behaviour change, it is necessary to first understand the mechanisms underlying women's decisions about their health behaviour. Whilst many studies have sought to do this, a qualitative review of these studies, focusing on multiple health behaviours, does not exist.

Qualitative research can provide an understanding of women's perspectives and lived experiences that cannot be captured using quantitative methods alone (Braun & Clarke, 2019). Reviewing and thematically synthesising this literature allows for the development of a richer interpretation and conceptual understanding that goes beyond the findings of individual studies, producing novel findings that are greater than the sum of its parts (Barnett-Page & Thomas, 2009; Evans & Pearson, 2001; Flemming & Noyes, 2021). A scoping review of the literature revealed a plethora of qualitative research, confirming our supposition that a qualitative review would be the most appropriate method to address the research question.

This review aims to systematically search and synthesise the existing qualitative literature to identify factors influencing health behaviour change during pregnancy, specific to dietary behaviour, physical activity, smoking, and alcohol use.

4.3. Methods

This review has been conducted and reported in line with the PRISMA guidelines (Moher et al., 2009) and ENTREQ guidance for reporting qualitative syntheses (Tong et al., 2012) (see Supplementary Material, S1 & S2 / Appendix C). The review protocol was registered in PROSPERO on 10/01/2019 (CRD42019119302) (see Appendix D).

4.3.1. Eligibility

Studies were included if they reported any qualitative data about women's experiences or perceptions of pregnancy-related[iii] behaviour change, specifically; dietary behaviour, physical activity, smoking, and alcohol use. Studies were eligible for inclusion if they included participants who were over 18 years old and pregnant, or less than 2 years postnatal (providing retrospective data). Journal articles, university dissertations and theses, and unpublished reports were included.

Studies from low- or middle-income countries were excluded (based on the list provided by The World Bank, 2019), as were those including women on specialist care pathways for a medical diagnosis (e.g., gestational diabetes), or women who had previously experienced pregnancy complications (as reported by study authors), unless these women were differentiable from the participants of interest. Studies including women deemed to be of high-risk status who were advised not to engage in a behaviour of interest (as reported by study authors) were also excluded (e.g., women advised bed rest for threatened preterm labour or recurrent vaginal bleeding), unless these women could also be differentiated from the population of interest. These exclusion criteria were applied to reduce the variance in advice provided in relation to the

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[iii] Pregnancy-related health behaviours are those that occur outside of pregnancy, that evidence suggests are beneficial to health if *maintained* or *modified* during the antenatal period. Pregnancy-specific behaviours are those that occur during pregnancy only, that evidence suggests are beneficial to health if *initiated* during this period (e.g., recommended dietary changes, recommended supplementation etc.) (Olander et al., 2018).

health behaviours of interest (see Supplementary Material, S3, / Appendix C for full eligibility criteria).

4.3.2. Search strategy

MEDLINE, PsycINFO, CINAHL-P, and MIDIRS were searched on the 11/12/18 (and updated on 02/09/20). The search strategy used was tailored according to the indexing rules of each database. Terms were combined using Boolean operators. Truncation and Wild Cards were used to find variations of original search terms. Where possible, MeSH Headings were also used. No restrictions were placed on language or publication date (see Supplementary Material, S4, / Appendix C for the search strategy used).

4.3.3. Study selection

Records retrieved by the searches were imported into Endnote reference management software version X8.0.1 (Clarivate, 2016) and duplicates were removed. To ensure internal consistency in the application of the eligibility criteria LR and DS both independently screened 10% of all titles, then discussed and refined the eligibility criteria. This process was repeated four times. An agreement level of 99.7% was reached for the final 10% of titles screened. The refined eligibility criteria were then used by LR to screen the remaining titles and abstracts of all records. Full-text screening was conducted by LR, with 10% of the records also screened by SP. An agreement level of 100% was reached. Reference lists of included studies were searched for other relevant studies, and Google Scholar was used to search all citing articles for additional relevant studies. Grey literature was searched using Open Grey and Jisc Library Hub Discover, as well as searching for publications of key authors.

4.3.4. Data extraction and quality assessment

Data from included studies were extracted using a data extraction tool specifically designed for this study. All text within the 'results' or 'findings'

section was treated as data (see Supplementary Material, S5, / Appendix C for further details of extracted data items). Authors were contacted for further information where necessary. Study quality was assessed using a modified[iv] version of the Critical Appraisal Skills Programme qualitative appraisal checklist (CASP; Critical Appraisal Skills Programme, 2018). Assessment of all included studies was conducted by LR, with 10% assessed by DS over two rounds to clarify assessment criteria. 100% agreement on the quality assessment of those studies was reached. No papers were excluded based on quality, as there is limited evidence to suggest this is beneficial (Carroll et al., 2012; Dixon-Woods et al., 2007; Long et al., 2020). However, the assessment process allows for transparency and enhances our understanding of the contribution made by each study to the findings and conclusions of the review.

4.3.5. Data synthesis

Data extracted from the results/findings sections of the included studies were analysed using thematic synthesis (Thomas & Harden, 2008). An inductive approach was taken and initially LR and DS conducted line-by-line coding of papers containing references to dietary behaviour. Both author interpretations and participant quotes were coded. Papers addressing dietary behaviour were coded first. Descriptive and higher-order themes were then developed following discussion and joint interpretation of the data.

This thematic framework was then used to guide the analysis of the papers containing references to physical activity, smoking and alcohol use. The data were coded inductively, and these initial codes mapped onto the existing thematic framework. Additional codes were developed where necessary. Coding was conducted separately for each behaviour by the lead author. Analysis was conducted using NVivo 12 Plus (QSR International Pty Ltd, 2018). A breakdown of the of the studies containing data pertaining to each health behaviour is reported in the Supplementary Material (Appendix C) (see S6).

[iv] The CASP criteria were modified by omitting question ten and defining criterion hints according to discussions between LR and DS.

4.4. Results

After removing duplicates, 30,852 records were screened for eligibility, based first on title and abstract, and then on full-text. A total of 89 records were eligible for inclusion. Three theses contained two studies each, giving a total of 92 studies included in this review (see Figure 4.1, Supplementary Material, S7 / Appendix C). Forty-six studies contained data on physical activity, 41 on dietary behaviour, 40 on smoking, and 19 on alcohol use.

Included studies were journal articles (n=62, 67%), dissertations/theses (n=29, 32%), and a research report (n=1, 1%), published between 1990 and 2020. Studies comprised 1,889 participants[v], although data from some of these participants has been excluded, as per the eligibility criteria. Most studies were conducted in the United Kingdom (n=39, 42%). 59% (n=54) of studies included participants in the antenatal period only, 28% (n=26) included both antenatal and postnatal participants, and 13% (n=12) included only those in the postnatal period. Where reported, most studies included both nulliparous and multiparous women (n=52, 57%). Interviews were the most common method of data collection (n=79, 86%), and where described, thematic analysis was the most frequently used analysis method (n=26, 28%) (see Supplementary Material, S8, S9 / Appendix C).

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[v] On two occasions, two studies analysed data collected from the same participant sample. The total number of participants included therefore reflects 90 studies. All other reported characteristics reflect the total 92 studies.

Identification

Records identified through database searching
(n=46,940)

Medline n=17,702
PsycINFO n=6,852
CINAHL-P n=15,519
MIDIRS n=6,867

Records identified through other sources
(n=36)

Dissertation/thesis (n=19)
Not identified by original search (n=8)
Non-English dissertation/thesis (n=6)
Non-English study (n=2)
Preprint (n=1)

Records after
duplicates removed
(n=30,852)

Screening

Titles & abstracts screened
(n=30,852)

Records excluded
(n=30,693)

Eligibility

Full-text articles assessed
for eligibility
(n=159)

Records excluded
(n=106)

Reasons for exclusion
Participant/s on specialist care pathway* (n=37)
Participant/s <18 years old* (n=28)
Key demographic information not available (n=16)
Participant/s >2years postnatal* (n=12)
Participant/s experienced pregnancy complications* (n=9)
Irrelevant findings (n=9)
No qualitative results presented (n=8)
Low- or middle-income country (n=5)
Participant/s of high-risk status* (n=4)
Participant/s not pregnant/postnatal* (n=2)

NB: Total n ≠ 106 as multiple reasons for exclusion are reported
*Includes studies where data from eligible/ineligible participants cannot be distinguished and extracted from the dataset

Included

Total
(n=89 records)*

*92 studies

Studies providing data on physical activity
(n=46)

Studies providing data on dietary behaviour
(n=41)

Studies providing data on smoking
(n=40)

Studies providing data on alcohol use
(n=19)

NB: Some studies provided data relating to multiple health behaviours, therefore total n ≠ 92

Figure 4.1. PRISMA flow diagram of included studies, adapted from Moher et al. (2009)

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There was notable variation in quality between studies. In particular, many studies failed to discuss the role of the researcher and any consideration of the impact that may have on data generation or interpretation (n=64, 70%). Over a quarter of studies did not provide an appropriate rationale for the methods/design used (n=28, 30%), or provide sufficient detail about the data collection process (n=24, 26%). Just under a quarter of studies also failed to clearly report the data analysis process (n=21, 23%) (for full details of quality assessment for each study see Supplementary Material, S10 / Appendix C).

Three overarching themes, and nine sub-themes were generated (see Figure 4.2). The main themes are entitled 'A time to think about 'me'', 'Adopting the 'good mother' role', and 'Beyond mother and baby'. All four health behaviours are discussed concurrently. Author comments and participant quotes are presented within the text to illustrate the themes (see Table 4.1 for additional author comments and illustrative quotes). Both author interpretations and participant quotes reflect women's perspectives and experiences, and as such, the findings have been reported according to this perspective. Additional detail pertaining to the barriers and facilitators identified within the analysis is provided in the Supplementary Material (Appendix C) (see S11).

Theme 1. A time to think about 'me'

The first theme relates to women's desire to think about their own mental and physical needs during pregnancy. During this period women held a desire to self-indulge (1.1), to retain ownership over their body and behaviour (1.2), and for good health (1.3), all of which affected their motivation to make health behaviour changes in both positive and negative ways.

1.1. A desire to self-indulge

Women reported a desire to indulge themselves throughout their pregnancy, in relation to all four behaviours. For some women, this desire encouraged the maintenance or uptake of healthy behaviours such as physical activity. Engaging in physical activity was viewed by some as an opportunity to do something for

1.1. A desire to self-indulge

1.2. A desire to retain ownership over body & behaviour

1. A time to think about 'me'

1.3. A desire for good health

3.1. Practical & environmental influences

3. Beyond mother and baby

3.2. Social influences

3.3. Knowledge, understanding, & advice

2. Adopting the 'good mother' role

2.1. Driven by the health of the baby

2.2. Driven by roles & expectations

2.3. Driven by pre-pregnancy attitudes & behaviours

Figure 4.2. Thematic structure

themselves and as a behaviour that provided some *"me time"* [41]. Some women also viewed physical activity as a physical *"need"* [63].

> *"…exercise is a time for you to be completely selfish in yourself and just think about you […] you can focus on your own body, you're alone with your own thoughts"* (Participant quote [41])

However, the desire to self-indulge sometimes encouraged poorer health behaviours such as continuing to smoke or consume alcohol[vi]. These behaviours were reported to be pleasurable activities or a *"treat"* [29, 33, 73], although this desire was sometimes driven by physical addition. Similarly, women also reported a desire to *"reward"* [3, 62] themselves and relax their approach towards their eating during this time. Pregnancy was perceived by some women to be a period when normal rules and expectations around food consumption eased, allowing them to indulge without the consequence or judgement normally afforded to them. Some women also talked about being *"exempt"* [74a] from dieting and from seeking the slim body ideal that many women aspire to achieve. For some, excess weight gain was viewed as inevitable, which also encouraged poorer dietary behaviours.

> *Pregnancy appears to prescribe increased food intake, relaxing women's behaviours from 'guilt-eating' to self-indulgence, in keeping with the 'eating for two adage'* (Author comment [83])

1.2. A desire to retain ownership over body and behaviour

Women wanted to retain control and ownership over the decisions they made about all four health behaviours. Some were resistant to being told what to do and dismissive of advice from professionals (e.g., midwifes and GPs), and family and friends. Women were particularly quick to question guidelines surrounding

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[vi] Where women chose to continue drinking alcohol, it was often reported to be consumed in greater moderation than in pre-pregnancy, or limited to settings deemed socially acceptable, such as special occasions (e.g., birthdays, weddings), or as an accompaniment to a meal.

Table 4.1. Illustrative author comments and/or participant quotes for each health behaviour

	Theme 1. A time to think about 'me'		
	1.1. A desire to self-indulge	**1.2. A desire to retain ownership over body and behaviour**	**1.3. A desire for good health**
Dietary behaviour	*Eating chocolate was a sensual, embodied experience for the 'I', the individual woman, who chose not to sacrifice the pleasure in eating for the 'we' that consumed her 'self'* (Author comment [62])	*"Everybody is going to have their own opinions, but I don't try to listen to nobody else." Women were very definite about whose advice they would follow when deciding what to eat. They would listen to others primarily out of respect, but in the end, decided what was foolish and what was worth listening to (Author comment/participant quote [38])*	*Difficulty managing pregnancy symptoms (cravings, tiredness and morning sickness) resulted in some women choosing foods they typically would not have eaten pre-pregnancy, like crisps and chocolate. Monica described how a combination of cravings and morning sickness resulted in her eating "crisps basically all the way through [pregnancy]"* (Author comment/participant quote [74a])
Physical activity	*"I think to be honest it was probably for me rather than for the baby" (Participant quote [58])*	*Maintaining control over their pregnancy weight gain and body image emerged as a significant motivator to exercise by all the women interviewed (Author comment [41])*	*"I'm afraid of having complications like preeclampsia or diabetes given a few of my risk factors. That's my motivation to continue with sport"* (Participant quote [30])
Smoking	*For Mya, smoking during her pregnancy, whilst on holiday was also perceived to be a 'treat'. This notion of a treat was important, as she reported abstaining from smoking at all other times during her pregnancy. "I think just one cigarette a night was my, my sort of wee treat"* (Author comment/ participant quote [29])	*They expressed annoyance at others who criticized their smoking, with several defiantly commenting, "It's my body", "it's my baby...they can kiss my butt!" (Author comment/participant quote [65])*	*Lurking just below the surface of their words was the idea that smoking was paradoxically providing the women with immediate health-related benefits as it threatened to rob them of their long-term health* (Author comment [61])
Alcohol use	*"I began to think bugger the kid, what about me?" (Participant quote [86])*	*The mothers in this study showed a keen desire to form their own opinions, and not just willingly accept health guidance and recommendations without understanding the reasons behind it and the health benefits or gains that they will receive from it (Author comment [29])*	*"I think it would drive me mad if I was doing everything for the baby. I think it would drive me absolutely beserk (mad) and that has an effect that can't be any good for the baby. If I'm happy in me then the baby's going to be happy and I think that's, that's what I'm more concerned about" (Participant quote [51])*

	Theme 2. Adopting the 'good mother' role		
	2.1. Driven by the health of the baby	**2.2. Driven by roles and expectations**	**2.3. Driven by pre-pregnancy attitudes and behaviours**
Dietary behaviour	*At the beginning of their pregnancy the participants were more aware of their eating habits and strictly followed their attitude to eat more of that which was considered beneficial, for the sake of the fetus (Author comment [3])*	*"…I want to eat healthy, because I want the baby to be brought up healthy, I don't want it to be brought up on junk food. I want to be a good role model" (Participant quote [85])*	*For a few women, staying healthy seemed to come naturally. "I know how to eat healthily – I've always done it" (Author comment/participant comment [58])*
Physical activity	*For Jessica (34), a previous miscarriage led her to associate running with dangerous outcomes. She noted that since becoming pregnant "I stopped, like I really stopped doing any leisure activities …except watching tv and movies," and obtained a disability placard for her car so that she could avoid walking from her car to her office (Author comment/participant quote [26])*	*"If I would see pregnant women jogging, I don't know what I would think. I would think oh my gosh what is she doing! …It's a bit of community or social conditioning" (Participant quote [84])*	*Moreover, intrinsic motivation facilitators were cited only by exercisers and were characterized by physical activity being enjoyable, a part of their routine, and a part of who they were (Author comment [55])*
Smoking	*Her doctor also told her that if trying to quit was very stressful for her, then she should stop trying to quit because stress could be more harmful to the fetus than nicotine (Author comment [65])*	*All those who smoked throughout pregnancy experienced a strong social pressure not to. Consequently, they did not want to be seen smoking in public, describing an anxious tension from the weight of other people's opinion towards them (Author comment [46])*	*"I cut down 'cause I was pregnant, cause my son had had asthma real bad. And I didn't want this one turnin' out like that and I know its from the cigarettes" (Participant comment [11])*
Alcohol use	*"Thinking that in continuing to drink or to smoke you can inflict a birth defect [on your baby], it's just terrible. How can you live with that?" (Participant quote [33])*	*"…in the end if my partner said anything I kind of just did the opposite just to you know prove a point, not, I wouldn't go to the length that I would think that my baby is being harmed but just to make that point of you know that it's nothing to do with you, this is my baby and my pregnancy" (Participant quote [35])*	*…drinking was so integrated into their daily life, a major reduction would have involved a cultural redefinition. Not surprisingly, they resisted such pressures by drawing on their sense of personal autonomy and attacking the basis for such advice (Author comment [86])*

Theme 3. Beyond mother and baby

	3.1. Practical and environmental factors	3.2. Social influences	3.3. Knowledge, understanding, and advice
Dietary behaviour	*To most women, maintaining a healthy diet was difficult for several reasons, including their feelings that eating healthy was challenging due to their busy lives and that eating at a fast-food restaurant was easier (Author comment [81])*	*Women discussed that if her partner had also been committed to making healthier food changes, it would have been easier for her to change (Author comment [74a])*	*"I've gained weight because of my pregnancies. I didn't know that I had to have nutritional care to learn to how to balance my meals, as I didn't know how to balance my meals either" (Participant quote [22])*
Physical activity	*"Because of the pressures of work...I didn't have time during the working week to do it" (Participant quote [87])*	*"I always knew, that when I did get pregnant I would still like to carry on with keeping active like that lady I said I saw in the gym, who I thought well good for you I would like to be like that one day" (Participant quote [41])*	*Some women described uncertainty or lack of knowledge about appropriate type of exercise, and one woman even questioned the suitability of exercise in any shape or form during pregnancy (Author comment [68])*
Smoking	*The burden of childcare exacerbated any barriers that location and format of smoking cessation services created. Women's mobility was restricted due to lack of transport and alternative childcare (Author comment [79])*	*Because smoking was pervasive in their social networks, many women reported struggling with frequent temptations to smoke when they stopped during the pregnancy (Author comment [64])*	*''They [health professionals] say it is bad for the baby. I honestly, in my opinion, feel that smoking isn't going to hurt it at all; that is what I think'' (Participant quote [14])*
Alcohol use	*"I thought to myself that I'd got the rest of my life and I could live for a year without it. It'd save money anyway" (Participant quote [86])*	*"I'm an outsider at parties because the others were drinking. So I avoid the others so I don't feel left out and I avoid situations where people are drinking" (Participant quote [13])*	*The advice on drinking during pregnancy was described as being confusing, unclear or lacking sufficient detail (Author comment [71])*

alcohol use, due to the conflicting nature of the advice provided. Some dismissed guidelines as open to interpretation and/or irrelevant to them as they did not consume what they perceived to be harmful levels of alcohol. Likewise, some women believed their current activity levels were appropriate and therefore did not need to increase, or in some cases reduce, their activity to recommended levels. All behaviours were viewed as a matter of personal choice, but this was most pronounced for smoking and alcohol use. Decision-making was also sometimes based on a compensatory rationale; for example, choosing to continue drinking because they had sacrificed other pleasurable behaviours, such as smoking tobacco or marijuana.

> *"Oh, well, at the end of the day I could eat healthy, I just choose not to. It's really up to you on what you eat"* (Participant quote [59])

Instead of following guidance, some women preferred to respond intuitively to what they perceived to be their body's, or baby's, needs. Whilst this sometimes resulted in healthy behaviours, such as maintaining existing exercise routines, it sometimes meant making poorer food choices, continuing to consume alcohol, and/or reducing physical activity.

> *… although they considered the antenatal physical activity guidelines to be helpful […] they did not let these messages take preference over the signals their own body was giving them. They trusted their own body more than the guidelines and showed resistance toward being told what to do* (Author comment [84])

Some women were motivated to increase, or maintain, healthy eating or exercise behaviour in an attempt to navigate their changing bodies and assert control over their weight gain. In some cases, smoking was also used as a tool to control appetite and aid weight loss/control. For some women this was driven by a fear of how they might look or feel if they were to gain an excessive amount of weight. The challenge of losing weight postnatally was also a concern, especially for those who had previously experienced postnatal weight retention.

1.3. A desire for good health

Pregnancy symptoms were reported to impact upon all four health behaviours to some extent. Nausea and increased sensitivity to smell and taste sometimes restricted smoking and alcohol use. Many modified their dietary behaviour, often, but not always, in an unhealthy way, in an attempt to mange feelings of nausea or sickness, due to food cravings, or due to changes in appetite or food preferences. Backache, lower body pain, and fatigue also restricted some women's ability and willingness to engage in physical activity. However, these symptoms were sometimes alleviated by adopting a healthier diet or becoming more active.

> *"Pregnancy changes are not always good changes are they. People get tired, you get headaches, leg pains and backache and I think those sorts of things make people think you shouldn't exercise but for me the opposite is true"* (Participant quote [41])

Beyond their immediate pregnancy symptoms, women considered the positive impact of making behavioural changes on their overall health, in relation to all four behaviours. However, the perceived benefits of continuing to smoke or drink alcohol sometimes outweighed the perceived benefits of reducing these behaviours. Some women were hopeful that making healthy changes to their diet and activity levels might increase the likelihood of experiencing an uncomplicated pregnancy and/or birth, and giving birth to a smaller baby.

However, some women's concerns about their health meant they were deterred from physical activity, as they reported being keen to protect themselves and avoid injury. Considering the benefits to their future health also acted as a driver to change. For example, some women reported a desire to improve their dietary behaviour in order to protect their future health and future pregnancies. Maintaining or increasing physical activity was perceived by some to aid with recovery after childbirth and enable them to be physically active again, sooner, postnatally. Some women also discussed their future intentions to quit smoking.

Women's mental health and emotional state also impacted on their motivation to make changes to all four behaviours, to various extents. Smoking and alcohol use in particular were sometimes used as coping mechanisms and as such, reducing these behaviours could be viewed as potentially anxiety-inducing or stressful. Negative emotions such as boredom, stress, and frustration also drove unhealthy eating, as for some, this behaviour was a source of comfort to sate emotional needs. For some smokers, their perception of whether the changes were permanent or temporary also impacted upon their motivation.

> *Women expressed a wish to escape from reality and problems in their lives and cigarettes and alcohol appeared to offer them this escape* (Author comment [1])

Conversely, having a positive attitude and high levels of confidence and self-efficacy improved some women's ability to reduce their alcohol consumption, smoking, and/or increase their physical activity levels. Women reported experiencing a positive impact on their mental health and wellbeing as a result of making changes to their smoking and physical activity, which in turn acted as motivation to continue making healthy changes. Physical activity was also perceived by some to help prepare them psychologically for childbirth.

Theme 2. Adopting the 'good mother' role

Women were keen to fulfil the 'good mother' role. This was driven by the health of the baby (2.1), by roles and expectations (2.2), and by women's pre-pregnancy attitudes and behaviours (2.3). The focus on them as a mother was distinct to the focus on them as an individual and as such, some women experienced feelings of guilt when their desires and behaviours misaligned. Counterintuitively, these feelings of guilt sometimes increased the desire to smoke. Whilst some women adopted behavioural changes automatically, or with relative ease, for others, these changes were more deliberate or sacrificial, sometimes only occurring once the pregnancy felt more 'real' or became physically noticeable, giving a sense of connection to the baby. Conversely,

feeling disconnected from the pregnancy acted as a barrier to changing smoking behaviour in some instances.

2.1. Driven by the health of the baby

Motivation to make healthy changes was often driven by the desire to ensure the health of the baby and to minimise any risks. Women talked about creating *"the best conditions"* [3] for carrying a baby by eating healthily and ensuring they consumed nutritious food for the baby's benefit. However, concern about risk to the baby sometimes acted as a barrier to changing behaviour, particularly in relation to physical activity. This was especially true for women who had previously experienced a miscarriage or other difficulties. Similarly, some women chose to maintain smoking or alcohol use, and reported believing that cessation may harm the baby in some way, either through nicotine withdrawal, or harm associated with negative maternal mental health.

> *Participants described how their unborn child's interests were first and foremost in their minds. These women revealed feeling an obligation to protect their child's health and safety. "I've got to think of my child, I've got to put them first"* (Author comment/participant quote [71])

Women described a sense of responsibility, not only towards their baby, but to themselves, their partner, and family, which provided motivation for change. For some women who attempted to reduce smoking or increase levels of physical activity, receiving positive feedback on their baby's health whilst attending antenatal scans and tests provided reassurance and further motivation to continue making healthy changes. However, confirmation of a healthy scan or test result also supported some women's decisions to continue to smoke, drink alcohol, and eat unhealthily.

> *…as her pregnancy progressed and they were assured from scans and the*
> *midwife their baby was healthy, they felt able to have crisps each day or*
> *chocolate. "…I'm getting closer to the end, and it sounds a bit awful in some*
> *ways, but what difference does it make now because the baby is healthy"*
> (Author comment/participant quote [74a])

2.2. Driven by roles and expectations

For some women, it was important to adhere to what they perceived to be the role of a 'good mother', by eating healthily, stopping drinking, ceasing smoking, and/or staying physically active. However, some women continued to drink alcohol based on the idea that retaining their identity, and thus alcohol consumption, enabled them to become good mothers. For some women, changes they made to their smoking and drinking behaviour, were due, in part, to societal pressures and expectations. Women reported feeling under surveillance throughout their pregnancy and the stigma and feeling of judgement associated with making unhealthy choices motivated some women to adjust their behaviour. Societal expectations to eat more healthily during pregnancy were also reported.

> *Yvette highlighted a sense of surveillance, saying that she felt like people*
> *were 'watching me' to ensure that she acted like a 'good' responsible*
> *mother* (Author comment [29])

However, feelings of stigma and judgment also encouraged some women to conceal their behaviour, and in some cases women's smoking habits increased as a response to external pressure. Interestingly, some women also reported feeling judged for exercising, despite it being an objectively healthy behaviour, as pregnancy was often perceived by others to be a time when women should reduce their activity levels. This is in contrast to the idea that maintaining physical activity adheres to the 'good mother ideal', as discussed above, suggesting there is a lack of clarity as to what is considered a safe or appropriate level of activity during pregnancy. Whilst this acted as a barrier for

some, others rejected this notion and were determined to disprove existing stereotypes. This attitude was shared by some of the women who continued to drink alcohol in moderation, refusing to adhere to the idea that this made them any less responsible as mothers.

> *"No, I generally didn't do it in public […] I would wait till I got home and I would smoke out the back at home so no one could see me. I wouldn't do it in public because I didn't want to [sighs], um I had people – I had a lady look at me funny and I felt really bad"* (Participant comment [89])

2.3. Driven by pre-pregnancy attitudes and behaviours

The extent to which women changed their behaviour and adopted the 'good mother' role was partly influenced by women's pre-pregnancy lifestyles, their attitudes, and the relationships they had with the respective health behaviours prior to pregnancy. For some women, changing their behaviours meant losing part of their pre-pregnancy identity. Women who had pre-established healthy habits and routines were more likely to maintain these throughout the pregnancy, which was true for all behaviours. The converse also applied. Established beliefs and intentions that women held about making behavioural changes once pregnant also affected their decision-making. Women reported pre-pregnancy intentions to reduce smoking and alcohol use, as well as physical activity.

> *"…by the time I got pregnant I had quite strong opinions on what I thought was appropriate and what I didn't… we made our decisions quite quickly and easily just on previous or prior knowledge"* (Participant quote [51])

Parity also affected attitudes towards behavioural change. Nulliparous women were sometimes more cautious than their multiparous counterparts in relation to alcohol use and physical activity. However, multiparous women sometimes made healthy changes in subsequent pregnancies where their behaviour had previously resulted in negative health outcomes for either themselves or an

existing child. Conversely, women who had previously experienced a healthy pregnancy despite unhealthy behaviours were often less motivated to make behavioural changes in subsequent pregnancies. For both nulliparous and multiparous women, difficulty conceiving, or experience of a prior miscarriage, could sometimes act to encourage a reduction of physical activity, smoking and alcohol use.

> *All the smokers in the interview survey cut down except for 20-year-old Ruth, [...] "It's a load of poppy-cock, she (her child) was nine and a quarter pounds and I smoked 30 a day when I was carrying her"* (Author comment/participant quote [86])

Theme 3. Beyond mother and baby

Beyond the immediate experience of the mother and baby, various external influences affected women's decision-making about their health behaviour. These included practical and environmental influences (3.1), social influences (3.2), and knowledge, understanding, and advice (3.3).

3.1. Practical and environmental influences

Environment played a role in influencing women's decision-making in relation to all four health behaviours. Being in settings that promoted unhealthy behaviours, or that provided easy access to unhealthy foods or cigarettes, acted as a barrier to behaviour change for some women. Conversely, availability of healthy food options facilitated healthy choices. Being unfamiliar with the local area and having to rely on transportation rather than walking sometimes restricted potential for physical activity, as did the weather, which was also reported to affect dietary behaviour.

Inaccessibility of pregnancy-appropriate exercise classes and places to be active was another barrier to physical activity for some women. Accessibility of smoking cessation services was similarly important; lack of access, in terms of

inconvenient times and locale of appointments, impacted on some women's ability to attend. The cost of healthy food and gym memberships was an additional barrier for some women to change their behaviour, whilst the cost of cigarettes and alcohol (and potential for saving money) sometimes motivated a reduction in these activities. Interestingly, smoking was used by some women as a way to save money on food, due to it acting as an appetite suppressant.

> *"One thing that discourages me is it [physical activity] is expensive. So I think a lot of maybe if there were options out there that didn't cost money because the recreation centre is expensive and day care is expensive"* (Participant quote [55])

Time constraints and competing priorities, such as work or existing childcare responsibilities, were cited as barriers to physical activity, healthy eating, and smoking cessation. Some women perceived healthy meals as time-consuming to prepare and therefore embraced the convenience of pre-prepared food, takeaways, or eating out at restaurants. Being from a socially disadvantaged background, poor living conditions, and frequent relocations were also cited as factors affecting sustained smoking habits and alcohol use. Similarly, for economically-deprived women relying on donations, availability of food also affected some women's dietary behaviour.

> *"I really don't decide right now because, um, I'm staying at a family shelter, and so they kind of feed us"* (Participant quote [59])

3.2. Social influences

Social support and the influence of others acted as both a barrier and facilitator, across all four behaviours. Supportive partners were reported to play an instrumental role in women's behaviour change efforts; however, partners' dietary behaviour, physical activity levels, smoking habits, and alcohol use all had the potential to act as significant barriers where they were unhealthy. The support of friends, family, and work colleagues was also reported to facilitate

behaviour change, however some women reported experiencing pressure from others to smoke, consume alcohol, or to 'eat for two'. This is in contrast to women's experiences of societal pressure and expectations to maintain healthy behaviours, as discussed previously.

> *"She [mom] gave me the portion. I was like, 'Whoa, this is a lot.' She was like, 'Oh, you're eating for two! It's not that much'"* (Participant quote [72])

The social nature of eating, smoking, and alcohol use, and being a part of social networks where smoking and drinking were social norms, could make behaviour change more difficult. Avoidance of such social situations facilitated healthy changes. However, women described feeling isolated when they chose to abstain from smoking or drinking, which could impact negatively on relationships where this had once been a shared activity. Conversely, the social nature of physical activity facilitated this behaviour for some women. Pregnancy specific classes were highly valued and provided women with a chance to see other pregnant women modelling positive behaviour.

> *Their social network has contributed to the continuation of the use of cigarettes and alcohol. One participant stated that a friend has influenced her to continue with her habits and avoiding them has been so difficult* (Author comment [1])

Other women's health behaviour during pregnancy was often used as a 'yard-stick' for one's own choices. Across all behaviours, women used others' experiences to justify their own behaviours, based on either positive or negative health outcomes that they attributed to a women's behaviour during pregnancy.

3.3. Knowledge, understanding, and advice

Across all behaviours, knowledge and understanding was an important factor affecting decision-making. Whilst some women were aware of the importance of making healthy changes, and had the skills and knowledge necessary to do so,

some women lacked an understanding about potential harm to the baby, held misconceptions that justified their behaviour, and lacked appropriate knowledge. Some women appeared to perceive there to be a hierarchy of health behaviours, whereby it was more important to modify certain behaviours over others.

> *"I think that the not eating too much junk was a higher priority than going swimming or whatever, or you know just doing some type of physical activity, even though I know they go hand in hand"* (Participant quote [67])

Women reported receiving informational support from health professionals about all four health behaviours, however women's level of engagement with advice about smoking and dietary behaviour appeared to be affected by the quality of the patient-provider relationship. Having advice about dietary behaviour delivered by a midwife, as well as continuity of care, was also reported to be of value. However, some women reported feeling rushed during appointments with health professionals and reported a lack of informational support and discussion about behaviour change. Information provided by health care professionals and official guidance (e.g., from healthcare providers) about diet, physical activity, and alcohol use, was perceived to be restrictive, and a *"one-size-fits-all"* [29] approach, with little appreciation for individual differences, or differing cultures and demographic backgrounds. Information about smoking and alcohol use in particular, was perceived to be conflicting and inconsistent. Some health professionals exacerbated this issue by providing advice that was contradictory to 'official' guidance.

> *"...I tried to cut down to quit, no good. I spoke to my ob [obstetrician] and he said that the baby would already be used to it and he really didn't believe that it caused all that much damage"* (Participant quote [89])

Faced with conflicting or inconsistent information from professionals, women often sought information from other sources (e.g., books, the internet) and relied upon lay advice to inform their decision-making. Some women also

adhered to cultural beliefs about which foods should be included in their diet and about appropriate levels of physical activity during pregnancy.

4.5. Discussion

This review identified three overarching themes which encompass factors that can influence behaviour change during pregnancy. Whilst there is variability in the extent to which each of the individual factors relate to dietary behaviour, physical activity, smoking, and alcohol use, there are clear commonalities, and the overall themes and sub-themes provide a level of explanation that is relevant across these behaviours.

Findings reveal that pregnancy is a time when women think about themselves and their own needs, rather than exclusively focusing on those of their unborn child. Women reported feeling exempt from societal beauty standards, in relation to their body size and shape, and for some this led to indulgence in high-calorie, low-nutrient dense food. This is consistent with findings reported elsewhere in the literature (Hodgkinson et al., 2014; Stockton & Nield, 2020). Accordingly, women were keen to retain control and ownership over their decision-making, rather than passively accepting advice and guidelines that might suggest pleasurable behaviours should be limited. Previous research has highlighted the role of control in relation to the changing maternal body (Hodgkinson et al., 2014), which was also evident in this review, however fewer studies have discussed the role of control as related to behaviour and decision-making.

Distinctively, pregnancy was also viewed as a time to adopt the role of the 'good mother', often by making healthy lifestyle changes. This shift in identity is consistent with McBride et al.'s (2003) model, which suggests that redefinition of self-concept or social role is a key construct underlying teachable moments. The 'good mother' concept has been discussed at length in the literature, although more frequently in relation to the postnatal period (Goodwin & Huppatz, 2010; Johnston & Swanson, 2003; Marshall et al., 2007; Pedersen, 2016). Our findings extend this concept to the antenatal period, suggesting that identity transition may have implications for maternal health behaviours.

Our findings also reveal that beyond the insularity of the mother and baby, various external factors influenced women's behaviour. In particular, social support was shown to be an important influence, especially from a partner. Previous research has shown that women whose partners continue to smoke or drink throughout pregnancy are significantly less likely to change their own behaviour (McLeod et al., 2003; Ortega-García et al., 2020). This is important as partners are not likely to make behavioural changes during this time (Everett et al., 2007), and therefore highlights the importance of engaging partners in discussions surrounding lifestyle changes during the antenatal period.

Women's knowledge and understanding about the target health behaviour was also shown to be an influential factor. In particular, lack of understanding about health outcomes and low risk perceptions were identified as barriers to change. This is consistent with several behavioural theories which suggest that risk perceptions and outcome expectancies are a key element underpinning motivation to change (Becker, 1974; McBride et al., 2003). Women's understanding was further hindered by confusing and conflicting messages received from health professionals and government advice, which is also evident in the findings of other studies (Stockton & Nield, 2020; Weeks et al., 2018). This is important to reflect upon, as delivering a consistent message has been shown to increase adherence to antenatal advice (Shanmugalingam et al., 2020), highlighting the need for dissemination of clear messages, through health professionals to service users.

The review findings highlighted factors such as social disadvantage and economic deprivation as influencing health behaviours. These findings are consistent with the results of previous quantitative studies that have shown a relationship between socio-economic status and deprivation, and rates of smoking, alcohol use, and dietary behaviour (Bodnar et al., 2017; de Wolff et al., 2019; Onah et al., 2016). Going forward, it will be important to consider the influence of these factors on health behaviour to ensure that any theory of change developed is appropriate and accounts for the impact of non-modifiable factors such as these.

Our findings suggest that women's decision-making is influenced by an interplay of intrinsic and extrinsic motivations, concepts defined in Self-Determination Theory (SDT; Ryan & Deci, 2000). For example, theme one clearly identifies intrinsic motivations related to individual needs and autonomy. Conversely, the remaining themes provide examples of extrinsic motivations related to societal expectations, social influence, and external environments. Individuals who are intrinsically motivated often display improved performance of the target behaviour (Ryan & Deci, 2000). This may have implications for theory and intervention development, as addressing intrinsic motivations may therefore result in improved behavioural outcomes.

It is also of note that a number of influencing factors identified in this review acted as either barriers or facilitators to the same behaviour, for different women. For example, judgement and societal pressure was experienced by some women as a facilitator to smoking cessation, whilst for others it acted to encourage the behaviour. Similarly, some factors encouraged both healthy and unhealthy behaviours. For example, concern about risk motivated some women to improve their dietary behaviour but drove others to reduce their physical activity levels. This highlights the importance of individual differences in human behaviour and decision-making and the value of tailoring the delivery of health promotion advice to individuals.

Importantly, the review findings suggest that factors identified as influencing behaviour change apply to all four health behaviours, to varying extents. While differences were found during the initial coding stage of the analysis, the inductive process of grouping and synthesising the data revealed similarities across the four health behaviours, at the sub-theme, and overarching theme level. This is important and may have implications for future theory development as it suggests that theoretical models may not need to be behaviour-specific if the model components address relevant influencing factors. Likewise, behaviour-specific theory may be utilised effectively in alternate contexts if the model similarly incorporates components that address the factors identified in this review.

However, it is important to consider the limitations of the included studies. In particular, response bias may have had an impact on the way in which participants responded to researchers, especially given the qualitative nature of the research. As such, our findings may have been skewed by this. Furthermore, dissertations and theses were included in this review; studies conducted as part of university courses may be of a lower standard than peer-reviewed articles. This may not be reflected accurately in the quality assessment, as dissertations/theses in particular often allow for greater discussion of methodological detail, satisfying many of the CASP criteria, but may lack trustworthiness and rigor not otherwise captured by the reported information. However, including these sources provides a more complete view of the available evidence (Mahood et al., 2014).

4.5.1. Strengths and limitations

This was an extensive review that synthesises common findings from a disparate literature, highlighting the diversity of factors that may influence women's decision-making. The review protocol was pre-registered, and the review was conducted rigorously, including grey literature and non-English language studies (Rockliffe, 2021). However, there are a number of potential limitations to be considered.

The inclusion/exclusion criteria for the systematic review were designed to reduce variability in the advice women may have received about the behaviours of interest (i.e., excluding women on specialist care pathways, or those advised to modify certain behaviours). However, it is likely that individual variability affected the results to some extent. For example, multiparous women sometimes altered their behaviour in subsequent pregnancies based on their previous experience. Therefore, future research should consider whether the experiences of nulliparous and multiparous women are distinct. Furthermore, it is likely that cultural differences, or differences in healthcare advice, will have varied between countries despite limiting included studies to high-income countries (Abalos et al., 2016; Evenson et al., 2013). It is important to take this

into account when interpreting the findings, as these differences are likely to be an implicit factor affecting women's behaviour.

4.5.2. Implications for theory and clinical practice

The factors identified in this review provide a foundation from which a pregnancy-specific theory of behaviour change, and in turn interventions, can be developed. Our findings lend support for the model constructs posited by McBride et al. (2003). However, it would be beneficial to explore this in greater detail in future research, to assess the extent to which influencing factors can be mapped to the model. It may also be valuable to explore the use of alternative behaviour change theories in this context, such as the Capability-Opportunity-Motivation Behaviour model (COM-B; Michie et al., 2011), which has been suggested to provide a superior understanding of pregnancy as a teachable moment (Olander et al., 2016). Developing a clearer understanding of the efficacy of existing models to explain pregnancy as a teachable moment is an important step in the development of a pregnancy-specific theory. Further to this, it may also be advantageous to consider the role of theories such as SDT and the influence of differing types of motivation on desired behavioural outcomes (Ryan & Deci, 2000).

Future research may wish to further define and investigate the barriers and facilitators to behaviour change identified in this study, from which practical and clinical recommendations can be developed. However, independent of future work, the findings of this review have valuable clinical implications. In particular, highlighting the importance of taking a holistic approach to behaviour change, by considering multiple internal and external factors that may influence women's decision-making and motivation. Furthermore, the findings emphasise the importance of delivering behavioural advice that is appropriate and consistent.

4.5.3. Conclusions

Women's desire to think about their own needs, their adoption of the 'good mother' role, and external factors beyond the mother and baby, all appear to influence women's decision-making about their health behaviour during pregnancy. In clinical practice it is important to consider the myriad of internal and external factors that may affect women's motivation to change their behaviour, and to take a holistic view of maternal health when delivering behaviour change advice. These findings provide us with an improved understanding of the underlying mechanisms influencing maternal decision-making, which future research can build upon to develop appropriate, meaningful theory specific to this context.

CHAPTER FIVE

5. Study two: Understanding pregnancy as a teachable moment for behaviour change: A comparison of the COM-B and Teachable Moments models

5.1. Abstract

Objectives: Theoretical models have informed the understanding of pregnancy as a 'teachable moment' for health behaviour change. However, these models have not been developed specifically for, nor widely tested, in this population. Currently, no pregnancy-specific model of behaviour change exists, which is important given it is a unique yet common health event. This study aimed to assess the extent to which factors influencing antenatal behaviour change are accounted for by the COM-B model and Teachable Moments (TM) model, and to identify which model is best used to understand behaviour change during pregnancy.

Design: Theoretical mapping exercise.

Methods: A deductive approach was adopted; nine sub-themes identified in a previous thematic synthesis of 92 studies were mapped to the constructs of the TM and COM-B models. The sub-themes reflected factors influencing antenatal health behaviour.

Findings: All sub-themes mapped to the COM-B model constructs, whereas the TM model failed to incorporate three sub-themes. Missed factors were non-psychological, including practical and environmental factors, social influences, and physical pregnancy symptoms. In contrast to the COM-B model, the TM model provided an enhanced conceptual understanding of pregnancy as a teachable moment for behaviour change, however neither model accounted for the changeable salience of influencing factors throughout the pregnancy experience.

Conclusions: The TM and COM-B models are both limited when applied within the context of pregnancy. Nevertheless, both models offer valuable insight that should be drawn upon when developing a pregnancy-specific model of behaviour change.

5.2. Introduction

During pregnancy, women often have increased motivation to improve their lifestyle and health behaviours (Lindqvist et al., 2017; O'Brien et al., 2017). For this reason, pregnancy is commonly referred to as a 'teachable moment', which has been defined as a "*naturally occurring life transition [...] or health event [...] thought to motivate individuals to spontaneously adopt risk-reducing health behaviours*" (McBride et al., 2003, p.156).

Teachable moments can present valuable opportunities for professionals to promote healthy behaviours, as patients may be more receptive to health messages at this time (e.g., cessation of cigarette smoking). In particular, pregnancy provides a unique opportunity for health professionals to deliver health promotion, as women have increased frequency of contact with health professionals over the course of their pregnancy (NICE, 2021a).

Eating behaviour, smoking, alcohol use, and physical activity are four key modifiable behavioural risk factors for adverse pregnancy outcomes and lifelong non-communicable diseases (Hayes et al., 2021; World Health Organisation, 2020). Supporting and encouraging pregnant women to make healthy changes to these behaviours is therefore particularly important, as this can reduce the risk of pregnancy-related conditions such as preeclampsia and gestational diabetes, and obstetric complications such as caesarean birth, miscarriage, and stillbirth (Escañuela Sánchez et al., 2019; Liu et al., 2020; Sundermann et al., 2019; Yang et al., 2019). Furthermore, improving pregnancy-related behaviours (i.e., those that also occur outside of pregnancy) may mean healthy changes are maintained into the postnatal period and beyond, potentially improving long-term health outcomes for both the mother and child, and for future pregnancies.

However, the concept of the 'teachable moment' has remained largely untested and poorly theorised (Lawson & Flocke, 2009), particularly in relation to pregnancy. McBride et al. (2003) first posited the psychological characteristics

underlying teachable moments within the context of smoking cessation. The authors argue that an effective teachable moment is cued by a health event that (1) increases personal perception of risk and outcome expectations, (2) provokes a strong emotional response, and (3) causes a redefinition of self-concept or social role. The greater the degree to which all the domains are acted upon, the greater the likelihood the teachable moment will result in behaviour change (McBride et al., 2003). It is clear that pregnancy has the potential to act upon each of these psychological domains. For example, it is likely that the experience of being pregnant will prompt the mother to consider the associated risks of the pregnancy for both herself and her unborn child, and outcomes related to her current behaviour (Coll et al., 2017). Pregnancy is also an experience that is likely to provoke a strong emotional response (McLeish & Redshaw, 2017; Nakamura et al., 2018), and that encourages the adoption of a new social role as a mother, especially for nulliparous women (Hennekam, 2016).

While McBride et al.'s (2003) model (hereafter referred to as the TM model) appears to explain pregnancy as a teachable moment, Olander et al. (2016) have suggested that the Capability-Opportunity-Motivation Behaviour model (COM-B; Michie et al., 2011) provides a broader explanation of health behaviour change during pregnancy. The COM-B model has been posited as a 'behaviour system', that involves three essential conditions to generate behavioural change: capability (physical and psychological), opportunity (physical and social), and motivation (reflective and automatic). All conditions, except for reflective motivation, are thought to be necessary to generate a behaviour (Michie et al., 2011). Olander et al. (2016) argue that existing definitions of teachable moments rely mainly on motivation to explain behaviour change and that the COM-B model offers a greater understanding by moving beyond motivation and incorporating both an individual's capability and opportunity (also described as the 'context') to change their behaviour.

Whilst both the TM and COM-B models appear to offer relevant insight into the process of antenatal behaviour change, neither has been widely tested in a

pregnant population, and a model of behaviour change specific to pregnancy does not exist. Pregnancy is a unique physiological event (Soma-Pillay et al., 2016) that requires women to make decisions about the life of another individual (her fetus), to engage with an ordered healthcare plan, and to manage societal expectations about their own behaviour. Unlike other teachable moments in acute health settings (e.g., hospitalisation, clinical appointments) (Meltzer et al., 2019; Son, 2015), pregnancy typically lasts up to forty weeks and is an evolving physiological process that requires women to to make changes across multiple health behaviours. As such, it has been argued that throughout pregnancy individual events may create multiple individual teachable moments (e.g., feeling the baby move for the first time, attending key antenatal appointments) (Olander et al., 2016). It is therefore necessary to develop an understanding of behaviour change that is specific to the pregnancy experience, and for a behavioural model to be developed in the context in which it is intended to be applied.

In order to better understand pregnancy as a teachable moment for behaviour change, existing models applied to this context need to be examined to identify which psychological constructs are meaningful to the pregnancy experience, to establish which model might be best utilised in this context, and to identify where adaptations may be needed. Gaining this understanding will highlight elements of the models that are relevant, or irrelevant, within the context of pregnancy and provide insight that will contribute to the development of an enhanced pregnancy-specific model.

A previous systematic review and meta-synthesis identified factors influencing health behaviour change during pregnancy, specific to dietary behaviour, physical activity, smoking, and alcohol use (Rockliffe et al., 2021a). This was an important first step in understanding pregnancy as a teachable moment. The current study aims to build upon this understanding by (1) assessing to what extent these factors are accounted for in the TM and COM-B models and (2) identifying which model is best used to understand behaviour change during pregnancy.

5.3. Methods

Details of the systematic review and meta-synthesis have been reported in full elsewhere (Rockliffe et al., 2021a). In brief, four bibliographic databases were searched (MEDLINE, PsycINFO, CINAHL-P, and MIDIRS) on the 11/12/18 (and updated on 02/09/20) for studies providing qualitative data about women's experiences or perceptions of behaviour change specific to dietary behaviour, physical activity, smoking, and alcohol use, during an uncomplicated pregnancy. Hand searching and grey literature searches were also performed.

The search strategy retrieved 46,940 records. After removal of duplicates (n=16,088) the titles and abstracts (n=30,852) were screened by LR and DS, and full texts screened (n=159) by LR and SP. Additional records were identified using alternative search methods (n=36). Ninety-two studies were included in the review (see Rockliffe et al., 2021a for list of included studies). Study data were extracted using a data extraction tool, and study quality assessed using a modified version of the Critical Appraisal Skills Programme qualitative appraisal checklist (CASP; Critical Appraisal Skills Programme, 2018).

Included studies were journal articles (n=62, 67%), dissertations/theses (n=29, 32%), and a research report (n=1, 1%). These studies comprised 1,889 participants and were published between 1990 and 2020, most of which were conducted in the United Kingdom (n=39, 42%). The majority of studies included women in the antenatal period only (n=54, 59%), 28% (n=26) included those in both the antenatal and postnatal period, and 13% (n=12) included only postnatal participants. Where reported, 57% of studies (n=52) included both nulliparous and multiparous women. Study characteristics are provided in the supplementary material of the original article (see Appendix C).

Extracted data from the results sections of included studies were thematically synthesised (Thomas & Harden, 2008). Both author interpretations and participant quotes were coded line-by-line, using an inductive approach, before

developing descriptive and higher-order themes. Papers containing references to dietary behaviour were analysed first, before using the thematic framework to guide the analysis of the papers containing references to physical activity, smoking, and alcohol use. Where additional codes were identified, these were incorporated into the thematic framework. Three overarching themes and nine sub-themes were generated from the data, which reflected factors present in the literature that influence women's antenatal health behaviour. These were entitled (1) A time to think about 'me', (2) Adopting the 'good mother' role, and (3) Beyond mother and baby. See Table 5.1 for details of the thematic framework. The themes and sub-themes apply to varying degrees across all four behaviours.

Table 5.1. Themes identified in thematic synthesis (Rockliffe et al., 2021a)

Themes	Sub-themes
1. A time to think about 'me'	1.1. A desire to self-indulge 1.2. A desire to retain ownership over body & behaviour 1.3. A desire for good health [mental & physical]
2. Adopting the 'good mother' role	2.1. Driven by the health of the baby 2.2. Driven by roles & expectations 2.3. Driven by pre-pregnancy attitudes & behaviours
3. Beyond mother & baby	3.1. Practical & environmental influences 3.2. Social influences 3.3. Knowledge, understanding, & advice

5.3.1. Analytical approach

In the current study, a deductive approach was used to assess the extent to which the sub-themes identified in the thematic synthesis were accounted for by the TM model and COM-B model. The identified sub-themes were mapped to each of the models in turn. Sub-themes were mapped to the models, rather than the raw data from the systematic review, as the sub-themes summarise and reflect those data comprised within them. This mapping approach was unique to this study, although similar approaches have been reported elsewhere in the literature (e.g., Flannery et al., 2018; Gould, 2014; Rahman et al., 2021).

The mapping task was undertaken independently by LR and DS, then compared and contrasted to identify differences in the way the sub-themes had been mapped to the model constructs. Where differences existed, LR and DS discussed their interpretation and understanding of each of the sub-themes and/or constructs, before coming to a joint agreement as to the appropriate placement. In some instances, sub-themes were mapped to more than one construct. The agreed criteria for mapping the sub-themes to the models are presented in Tables 5.2 and 5.3. Mapping of the sub-themes was finalised following discussions with the wider research team.

Table 5.2. Criteria used to map sub-themes to the TM model constructs

Model construct	Criteria
Risk perceptions and outcome expectations	The sub-theme should describe perceived risk or outcome expectancies related to the women's health or that of the pregnancy or baby. It can also describe any factors influencing a woman's perception of risk
Increased affective or emotional response	The sub-theme should describe an emotional state or response in relation to the pregnancy directly, or external pregnancy-related factors (e.g., social, environmental, practical)
Redefinition of self-concept or social role	The sub-theme should describe any factors impacting on a woman's sense of identity during her pregnancy

Table 5.3. Criteria used to map sub-themes to the COM-B model constructs

Model construct	Criteria
Capability	*Physical* The sub-theme should describe factors influencing a woman's ability to physically participate in a health behaviour
	Psychological The sub-theme should describe factors influencing a woman's understanding, or ability to make decisions about her health behaviour
Opportunity	*Social* The sub-theme should describe any social or societal factors influencing health behaviour
	Physical The sub-theme should describe any external environmental factors influencing health behaviour
Motivation	*Automatic* The sub-theme should describe any reference to passive decision-making and behaviours driven by emotions or desires
	Reflective The sub-theme should describe behaviour driven by active decision-making, based on prior experience or reflection on past experience

5.4. Results

In this section, each model and mapped sub-themes is presented in turn, describing how the sub-themes align with the particular model constructs. Illustrative quotes from the original analysis are presented within the text.

5.4.1. Mapping sub-themes to the TM model constructs

Seven of the nine sub-themes from the thematic synthesis mapped to constructs of the TM model. 'A desire for good health' (1.3.), 'Driven by the health of the baby' (2.1.), and 'Knowledge, understanding, and advice' (3.3.) mapped to 'risk perceptions and outcome expectancies'.

'A desire to self-indulge' (1.1.), 'A desire to retain ownership over body and behaviour' (1.2.), 'A desire for good health' (1.3.), 'Driven by the health of the baby' (2.1.), and 'Driven by roles and expectations' (2.2.) mapped to the 'increased affective or emotional response' construct.

'Driven by roles and expectations' (2.2.) and 'Driven by pre-pregnancy attitudes and behaviours' (2.3.) both mapped to the 'redefinition of self-concept or social role' construct.

The sub-themes 'Practical and environmental influences' (3.1.), and' Social influences' (3.2.), did not map to any of the model constructs. 'A desire for good health' (1.3.) mapped to several constructs, however the model did not account for women's experiences of physical symptoms captured within this sub-theme. This reflects a gap in the model where influences external to the woman and her pregnancy, or influences beyond her immediate control, such as physical symptoms, are not fully accounted for.

Figure 5.1 provides a visual representation of the way the sub-themes mapped to the constructs of the TM model.

1.1. A desire to self-indulge

1.2. A desire to retain ownership over body & behaviour

1.3. A desire for good health

2.1. Driven by the health of the baby

2.2. Driven by roles & expectations

Increased affective or emotional response

1.3. A desire for good health

2.1. Driven by the health of the baby

3.3. Knowledge, understanding, & advice

Risk perceptions and outcome expectancies

Cueing event

Redefinition of self-concept or social role

– – – – represents a sub-theme that has been mapped to multiple constructs

2.2. Driven by roles & expectations

2.3. Driven by pre-pregnancy attitudes & behaviours

Sub-themes not mapped to the model

3.1. Practical & environmental influences

3.2. Social influences

Aspects of sub-themes not mapped to the model

1.3. A desire for good health

Figure 5.1. Mapping of sub-themes to the TM model constructs

5.4.1.1. Risk perceptions and outcome expectancies

Women's desire to ensure the health of their unborn baby **(2.1. 'Driven by the health of the baby'),** as well as their own health **(1.3. 'A desire for good health'),** acted to influence their health behaviour. Underlying this desire for good health were concerns about risks and negative outcomes associated with carrying out certain health behaviours. Women were keen to support the healthy development of their pregnancy, although the way in which they did this was often dependent on their understanding of the associated risks and the advice they received **(3.3. 'Knowledge, understanding, and advice').**

> *One of the women who had not sought any advice and did not receive any was worried about the health of the baby when exercising [...] Lack of the right advice meant that the fears of exercising took over and she stopped all exercise as a result.* (Trevorrow, 2016)

Women were sometimes driven to make healthy changes as they believed doing so would result in positive outcomes, such as increasing the chances of experiencing an uncomplicated pregnancy or birth. Some women also believed that eating healthily and maintaining physical activity would aid with their post-birth recovery, and positively impact their future health, which often motivated change.

> *"For some reason I just had it in my head that if I stayed active during my pregnancy I would have an easier labour, and then I'd recover quicker afterwards."* (Smith, 2017)

5.4.1.2. Increased affective or emotional response

Perceived risks to mother and baby **(2.1. 'Driven by the health of the baby'; 1.3. 'A desire for good health')** elicited feelings of worry and concern, which in many cases encouraged healthy changes. However, modifying existing

behaviours such as smoking or consuming alcohol, or engaging in physical activity, was also perceived to be risky by some, which could discourage change.

> *"During this pregnancy, I have tried to reduced [sic] my smoking, I am trying if I can quit once and for all… just for the sake of my baby… I willn't [sic] want anything bad to happen."* (Agberotimi, 2013)

More generally, women's mental state or emotional functioning influenced their motivation and decision-making in both positive and negative ways **(1.3. 'A desire for good health').** Whilst positive emotions and feeling mentally healthy could facilitate positive choices, negative emotions and unhelpful coping strategies could also act as barriers to change. In particular, feelings of judgment and shame had a bidirectional influence **(2.2. 'Driven by roles and expectations')**.

> *"[My friend] stopped smoking at work because she was like, "People are hating me down there! …I feel like I'm going to be lynched…. Smokers are staring at me like I'm the devil!"* (Murray et al., 2014)

Some women experienced feelings of desire in relation to behaviours they experienced as being pleasurable or beneficial to their sense of well-being **(1.1. 'A desire to self-indulge')**. This desire often acted to facilitate unhealthy behaviours such as eating increased quantities of food or continuing to smoke or consume alcohol. Conversely, it also encouraged some women to maintain physical activity. For some, the desire to self-indulge was at odds with their desire to do the best for the baby. This sometimes generated feelings of guilt, which could act as a barrier to smoking cessation **(2.1. 'Driven by the health of the baby')**.

> *This suggests that for her total abstinence [from alcohol] is not necessary, and when desires are sufficiently strong, she can pay attention to them*. (Atkinson et al., 2016)

Women's desire to retain control over their health behaviours **(1.2. 'A desire to retain ownership over body and behaviour')** acted as a barrier to change for some women, who were reported to resist advice and involvement from others and listen primarily to their own intuition, although this could also facilitate healthy choices. Additionally, some women were motivated to improve their behaviours in an attempt to assert control over gestational weight gain and their changing maternal body.

5.4.1.3. Redefinition of self-concept or social role

During pregnancy, women were keen to adopt what they perceived to be the role of a 'good mother'. This sometimes involved modifying their health behaviour in an attempt to demonstrate they were putting their baby first and to comply with societal pressures and expectations **(2.2. 'Driven by roles and expectations').** However, some women were determined to disprove perceived stereotypes surrounding how pregnant women should behave, by continuing to exercise or consume some alcohol. Where women felt disconnected from their pregnancy and new identity as a mother, this could act as a barrier to smoking cessation.

> *"…it was just a transition between who I was then, a young smoker and free, to being someone who was responsible for a child. So, once I stopped [smoking] I felt that that was my first responsibility for that child."*
> (Ashwin et al., 2012)

Women's motivation to adopt the 'good mother' role was sometimes influenced (in both positive and negative ways) by their pre-pregnancy 'self', which was based on established attitudes and beliefs, behaviours, and skills **(2.3. 'Driven by pre-pregnancy attitudes and behaviours').** Fear of losing their pre-pregnancy identity acted as a barrier to change for some women. Prior experience of pregnancy or motherhood, or a lack thereof, also influenced women's decision-making.

I would argue that drinking alcohol, especially wine is seen as a significant social act, and a firm part of a woman's pre-pregnancy identity. Continuing to drink alcohol [during] pregnancy may therefore be a continuation of this expression of identity. (Ford, 2013)

5.4.2. Mapping sub-themes to the COM-B model constructs

All nine sub-themes from the thematic synthesis mapped to the six constructs of the COM-B model. 'A desire for good health' (1.3.) and 'Knowledge, understanding, and advice' (3.3.) mapped to the 'physical capability' and 'psychological capability' constructs of the model, respectively.

'A desire to self-indulge' (1.1.), 'A desire for good health' (1.3.),' Driven by roles and expectations' (2.2.), and 'Driven by pre-pregnancy attitudes and behaviours' (2.3.) mapped to 'automatic motivation', whilst 'A desire to self-indulge' (1.1.), 'A desire to retain ownership over body and behaviour' (1.2.), 'A desire for good health' (1.3.), and 'Driven by the health of the baby' (2.1.) mapped to 'reflective motivation'.

'Driven by roles and expectations' (2.2.) and 'Social influences' (3.2.) mapped to 'social opportunity', and 'Practical and environmental influences' (3.1.) mapped to 'physical opportunity'.

Figure 5.2 provides a visual representation of the way the sub-themes mapped to the constructs of the COM-B model.
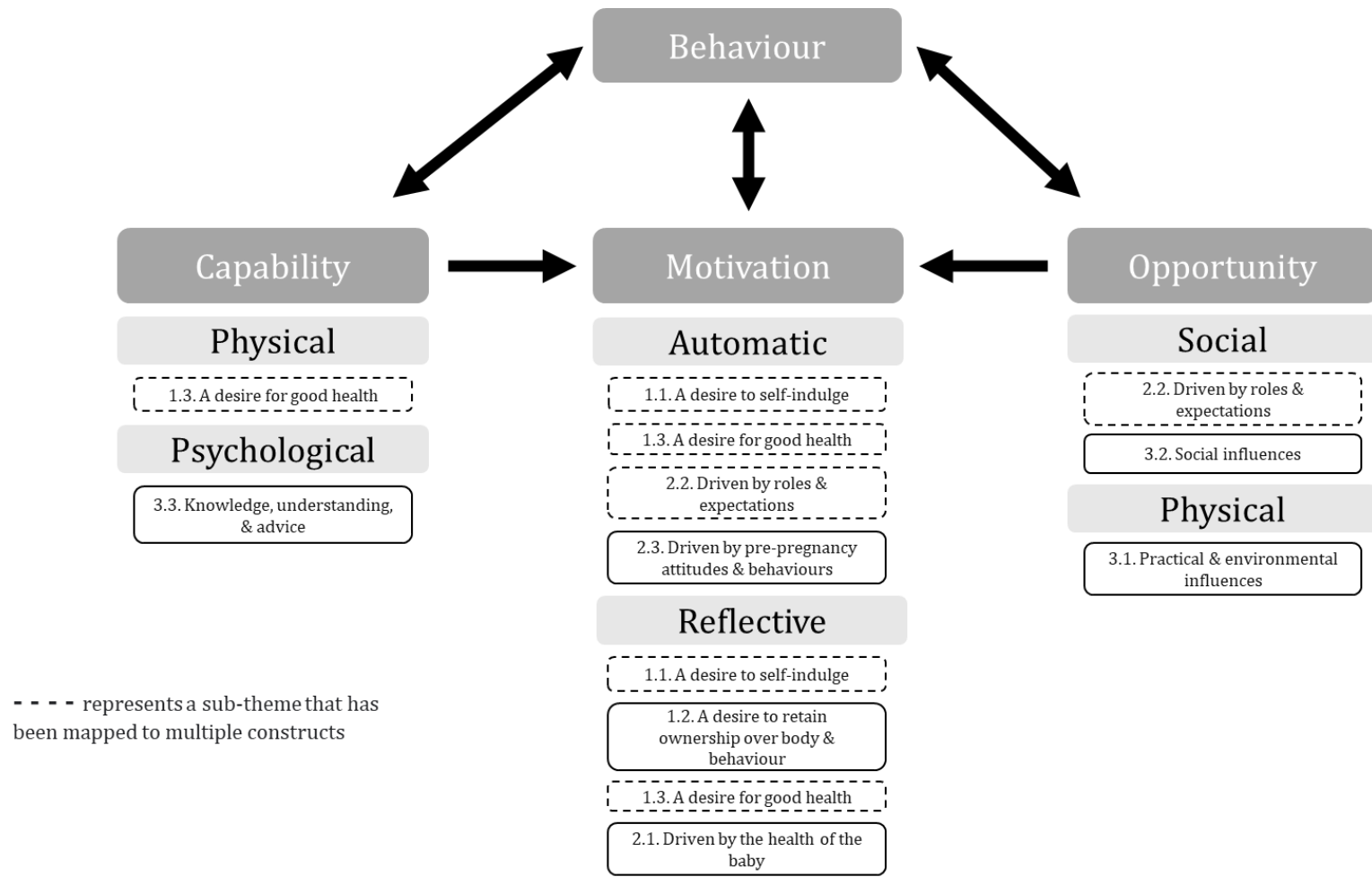
Figure 5.2. Mapping of sub-themes to the COM-B model constructs

5.4.2.1. Capability

5.4.2.1.1. Physical

Women's physical capability to undertake healthy behaviours was sometimes compromised by pregnancy symptoms **(1.3. 'A desire for good health').** For example, some women were unable to eat a healthy, balanced diet due to symptoms of sickness and nausea, changes in food preferences and/or cravings. Other symptoms such as bodily pain, fatigue, and/or nausea also restricted some women's ability to engage in physical activity.

> *"I underestimated how tired I would be and how sick I'd feel… because of the nausea the last thing you want to do is exercise."* (Cioffi et al., 2010)

5.4.2.1.2. Psychological

Women's psychological capability to make decisions about their health behaviour was affected by their levels of knowledge and understanding, and the advice they received **(3.3. 'Knowledge, understanding, and advice').** Those who had high levels of knowledge about the impact of their health behaviours on their pregnancy were better positioned to make healthy choices. Conversely, women who were less informed, who held misconceptions about the impact of their behaviours, or who did not have the skills necessary to make healthy changes, were less likely to do so. Support and advice received from health professionals also fed into decision-making, which could act as either a barrier or facilitator to change.

> *For those participants who gained excessive weight during their pregnancy, they voiced that if their midwife had informed them of this, they would have been more likely to make changes to their diet and levels of* activity. (Smith, 2017)

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5.4.2.2. Motivation

5.4.2.2.1. Automatic

Women were often keen to indulge themselves during pregnancy and engage in behaviours that they perceived to be pleasurable, such as eating, drinking alcohol, or smoking **(1.1. 'A desire to self-indulge')**. This was driven by a sense that rules around food intake were relaxed during pregnancy, or because the behaviours were already established pre-pregnancy. In such cases, women appeared to be motivated by automatic impulses and desires, rather than conscious decision-making.

> *…relaxed social pressures of the slender ideal, accepting of increased food intake in pregnancy, when coupled with previous learned behaviours and habits gave rise to intemperance…* (Tweheyo, 2016)

Furthermore, some women's mental and emotional states influenced their decision-making about their health **(1.3. 'A desire for good health').** Negative emotions (e.g., boredom, stress, frustration) sometimes drove unhealthy eating behaviour and behaviours such as smoking and alcohol use were used as coping mechanisms by some women. These behaviours sometimes prompted feelings of shame and judgement, although this was also experienced in relation to physical activity. This could have a bidirectional influence on behaviour, in the sense that some women were motivated to make healthy changes, whilst others reported concealing their behaviour or increasing their smoking habits in response **(2.2. 'Driven by roles and expectations').** Conversely, positive emotions and attributes (e.g., having a positive attitude, increased levels of confidence and self-efficacy) sometimes facilitated change **(1.3. 'A desire for good health')**.

> *One pregnant female who was in the process of quitting was motivated by guilt and stigma: "[...] It makes me ashamed and looks bad as no one likes smokers these days."* (Bull et al., 2007)

Automatic processes relating to established pre-pregnancy habits and routines also influenced health behaviour **(2.3. 'Driven by pre-pregnancy attitudes and behaviours').** Women with existing un/healthy behaviours often maintained these during pregnancy. Similarly, established beliefs and attitudes towards the idea of making behavioural changes during pregnancy also influenced decision-making. Prior experience of pregnancy, or previous pregnancy difficulties, fed into behavioural decisions for some women.

> *"...growing up you always get these kind of, you know, like 'this is the way you should do it, this is the way you shouldn't do it' and it all just kicks in at the same time [...] I felt like it was just all my instincts just pushing us"* (Laing, 2015)

5.4.2.2.2. Reflective

Some women engaged in a reflective decision-making process based on a desire to retain control and ownership over their health behaviours **(1.2. 'A desire to retain ownership over body and behaviour')**. This meant responding intuitively to what they believed their body or baby needed, which for some women meant avoiding making healthy changes. Women also reported a reflective motivation to make healthy changes to their eating behaviour and physical activity levels, based on a desire to exert control over their changing maternal bodies.

> *Physical activity was a strategy utilised by each woman in this study to control the way they felt about their bodies, and to manage their feelings about the changes their bodies were subject to.* (Dormer, 2019)

In making decisions about their health behaviour, it was evident that reflecting on anticipated outcomes in relation to the health of the baby **(2.1. 'Driven by the health of the baby')** and on their own health **(1.3. 'A desire for good health')** were important influences. Women reported concerns about experiencing pregnancy or birth complications, and were keen to avoid causing

harm to their unborn baby as a consequence of engaging in poor health behaviours. However, some women reported concerns that ceasing behaviours such as smoking and drinking, might also have negative repercussions. Feelings of guilt were reported by some women when their behaviours did not align with their good intentions, which sometimes exacerbated poor health behaviours.

> *"…I don't want my baby, you know, affected by it, it's just I want it to, you know, have a proper start, if it came out with any defects or anything through alcohol and that was my fault, I'd never forgive myself."* (Laing, 2015)

As a result of maintaining or initiating healthy behaviours, some women experienced improvements in their mental health and well-being. Reflecting on this further motivated these women to maintain their healthy behaviours, and some viewed prioritising these activities (i.e., physical activity) as an indulgence **(1.1. 'A desire to self-indulge')**. Reflecting on the potential benefits to postnatal health also influenced some women's decision-making.

5.4.2.3. Opportunity

5.4.2.3.1. Social

Social opportunity impacted on women's motivation to make changes to their behaviour, to varying degrees **(3.2. 'Social influences').** Levels of support from those around them influenced women's behaviour, as did social norms (e.g., where smoking and drinking were considered the norm) and the behaviour of others. Health behaviours that are by nature social activities, such as drinking alcohol or smoking, were difficult to modify, especially where they were important features of social relationships. However, the social nature of physical activity could act as a facilitator.

> *If friends or acquaintances who were currently or recently pregnant ate more unhealthy food during pregnancy it was easy to be influenced to also eat this.* (Andersson & Ernstsson, 2017)

Societal roles and expectations **(2.2. 'Driven by roles and expectations'),** which is another form of social opportunity, also influenced decision-making. Some women were motivated to change their behaviours due to a desire to adhere to the 'good mother' role, and/or in response to societal pressure and expectations. Feelings of judgement and stigma surrounding certain behaviours (as previously discussed) could act as a barrier or a facilitator to behavioural change.

> *Social norms, dictating that expectant mothers should avoid alcohol, were cited as the main reasons why women stopped drinking.* (Schölin et al., 2017)

5.4.2.3.2. Physical

The physical environment and related external influences impacted on women's opportunity to make changes to their behaviour **(3.1. 'Practical and environmental influences').** Environments that promoted un/healthy behaviours or increased availability of un/healthy choices influenced some women's decision-making. Practical factors such as lack of familiarity with the physical environment, the weather, and accessibility of appropriate exercise classes/spaces also influenced motivation to be physically active. Time constraints, competing priorities, financial considerations, and availability and/or accessibility of support services influenced some women's decision-making and motivation, as did socio-economic disadvantage.

> *"I have spent sometimes £15 on one meal that is going to be really healthy and I could just go buy a pizza for £2."* (Chana & Haith-Cooper, 2019)

5.5. Discussion

The purpose of this study was to understand to what extent factors identified as influencing antenatal health behaviour were accounted for by the TM model and COM-B models of behaviour change, and to establish which model is best used to understand behaviour change during pregnancy.

Results of the theoretical mapping exercise revealed that all sub-themes identified in the previous review mapped to the COM-B model, indicating that all influencing factors play a role in directing behaviour during pregnancy. However, the TM model failed to account for several sub-themes (1.3. 'A desire for good health'; 3.1. 'Practical and environmental influences'; 3.2. 'Social influences') which mapped to the 'physical capability', 'physical opportunity', and 'social opportunity' constructs of the COM-B model, respectively.

The three sub-themes not accounted for by the TM model reflect non-psychological factors that influence behaviour, such as those in the physical or social environment, or the experience of pregnancy symptoms. The existing TM model constructs capture women's internal cognitive processes relating to risk, emotions, and identity, but fail to account for any factors beyond these internal psychological processes or those presented in the external environment. Accordingly, the unmapped sub-themes that mapped to the 'opportunity' construct of the COM-B model (also described as the 'context') are defined as factors that *"lie outside the individual"* (Michie et al., 2011, p.4). Numerous studies have highlighted the important role that social, and practical or environmental factors play in women's decision-making around their health during pregnancy (Harrison et al., 2018; O'Brien et al., 2017; Omidvar et al., 2018). Furthermore, physical pregnancy symptoms are commonly cited as a barrier to behaviour change, particularly in relation to dietary behaviour and physical activity (Foxcroft et al., 2011; Harrison et al., 2018; Swift et al., 2017). As such, and as these factors were also captured in the COM-B model, the addition of a construct reflecting non-psychological factors may enhance the overall utility of the TM model within the context of pregnancy.

Physical pregnancy symptoms are often transient for women, frequently occurring most severely during the first trimester (Smith et al., 2000). The study findings highlight the need to consider factors such as these, that are changeable, as it has implications for the timing of interventions if certain stages of pregnancy present more barriers to change, than others. It is therefore important to reflect upon whether other factors mapped to the models, or the model constructs themselves, change or whether they remain stable throughout pregnancy. For example, a women's psychological capability may increase over time as she acquires new knowledge, or risk perceptions may reduce. Whilst this wasn't explored explicitly in the original review, it has previously been suggested that pregnancy may provide several individual teachable moments for behaviour change, prompted by significant events (e.g., receiving confirmation of the pregnancy, feeling the baby kick for the first time) (Olander et al., 2016). Neither the TM model nor COM-B model offer a heuristic that accounts for potential changes in the salience of factors influencing health behaviour, strengthening the argument for the development of a pregnancy-specific model. Further qualitative inquiry is necessary to explore the different factors influencing health behaviour throughout pregnancy, to identify whether certain stages afford more powerful teachable moments than others.

Our findings identified some similarities and overlap between the constructs of the two models. For example, two of the sub-themes mapped to the 'automatic motivation' construct of the COM-B model also mapped to the 'increased affective or emotional response' construct of the TM model. This makes sense as the 'automatic motivation' construct is defined as involving emotions and impulses (Michie et al., 2011). Similarly, the sub-theme mapped to the 'psychological capability' construct of the COM-B model also mapped to the 'risk perceptions and outcome expectancies' construct of the TM model. This also makes sense, as risk perception relies on psychological processes to assess the probability of negative outcomes, based on knowledge acquisition (Johnson, 1993). However, this highlights the different ways in which the model constructs have been conceptualised, which is the key difference between the two models.

The COM-B model is a general behaviour system designed to incorporate various contexts (Michie et al., 2011), which may explain why all sub-themes mapped to the respective constructs. The model constructs are intentionally broad and encompassing, owing to the nature of its design (Michie et al., 2011), however this has previously been highlighted as a limitation, as it restricts the ability to test and falsify the model in any given context (Ogden, 2016). Whilst Olander et al. (2016) suggest that the COM-B model may provide an enhanced analysis of behaviour in pregnancy, by considering factors beyond motivation alone, the model's lack of specificity limits its ability to be fully applied to this context. Conversely, the TM model has been designed to specifically understand the way in which health events may act as teachable moments for behaviour change (McBride et al., 2003). Pregnancy is often conceptualised as a teachable moment, or series of teachable moments (Olander et al., 2016; Phelan, 2010), as it is a health event that prompts women to consider associated health risks, that may provoke a strong emotional response, and that may cause women to reflect upon their own identity as a mother (Phelan, 2010). As such, the TM model provides a level of conceptual understanding than goes beyond what the COM-B model can offer. This is evident from the way in which the sub-themes mapped to the constructs; For example, sub-themes from each of the three overarching themes mapped to the 'risk perceptions and outcome expectancies' construct of the model, highlighting the way in which risk is interwoven throughout women's experience of pregnancy. Similarly, all sub-themes within the higher order theme 'A time to think about 'me'' mapped to the 'increased affective or emotional response' construct, emphasising the emotional impact of pregnancy in relation to women's own needs and desires.

It is interesting to note that some of the the TM model constructs did not explain various pregnancy behaviours in the way in which the model originally posits. McBride et al. (2003) state that events eliciting a strong emotional or affective response, whether positive or negative, may increase the likelihood of a teachable moment. However, for some women elicitation of strong emotions, such as shame or judgment, led them to reduce their physical activity levels or increase their smoking behaviour. It may be that this is pregnancy-specific and

an additional limitation of applying this model to this health context. Conversely, the COM-B model does not suggest a directional relationship between model constructs and behaviour. It may be beneficial to explore this further in future work, to better understand how the same factors can influence behaviour in opposing ways.

An additional observation is that for both models more sub-themes mapped to certain constructs than others. For example, within the TM model more sub-themes mapped to 'increased affective or emotional response' than any other constructs. Similarly, within the COM-B model the most sub-themes mapped to the 'motivation' constructs. It is possible that this indicates these constructs play a bigger role in directing behaviour than the others. However, further research would be required to assess how much variance each of the model constructs explain of a target behaviour, using a quantitative approach.

5.5.1. Strengths and limitations

This study has generated novel findings that have highlighted the relative merits and limitations of existing models of teachable moments when applied within the context of pregnancy. However, there are some limitations of this study that should be acknowledged. Firstly, the sub-themes used in the mapping exercise were generated from an analysis focused on pregnancy-related behaviours only (i.e., behaviours that also occur outside of pregnancy, such as dietary behaviour, smoking etc.) rather than pregnancy-specific behaviours (i.e., those that occur during pregnancy only, that are initiated during this period, such as recommended supplementation) (Olander et al., 2018). It is therefore possible that the models might be better suited to understanding certain behaviours over others. Furthermore, it is important to consider that within the behaviours included in the analysis, the models, or certain model constructs, might be more relevant to particular behaviours. For example, the TM model was developed in the context of smoking cessation and is therefore frequently used to understand this behaviour, above others (Baron et al., 2017; McBride et al., 2003, 2017). Furthermore, the ability of the COM-B

model to explain behaviour has been suggested to vary across behavioural contexts; in particular it has been found to better explain physical activity than it has eating behaviour (Willmott et al., 2021). With this in mind, it may be beneficial to further explore differences between behaviours by conducting individual mapping exercises. Whilst the sub-themes used in the analysis reflected factors that influenced all four behaviours, there was some degree of variability in the extent to which they applied to each. To capture any such nuance, it may therefore be advantageous to map the raw data from the original analysis to the model constructs, rather than the sub-themes.

Secondly, the mapping exercise relied on judgments as to which constructs the sub-themes were mapped to. Whilst two of the authors completed the mapping task independently to enhance reliability, there is still an element of subjectivity that will have guided the task. Furthermore, it is important to highlight that the limitations of the original review also have implications for interpreting the findings of this study. In particular, it is likely that individual variability (i.e., parity), cultural differences, and differences in healthcare advice provided in different countries will have influenced women's health behaviour, both implicitly and explicitly.

Whilst the findings of the mapping exercise provide us with an improved understanding about the utility of existing models, we are unable to draw firm conclusions without empirical data to support our suppositions. It will therefore be beneficial to further explore these findings and test the models using a more structured quantitative approach.

5.5.2. Implications for theory development

The findings from this study provide valuable insight that will contribute towards the development of an enhanced pregnancy-specific model. Whilst the COM-B model provides an overall 'good-fit' in terms of influencing factors mapped to the model, it lacks a conceptual understanding relevant to the pregnancy experience. Conversely, the TM model provides a level of

conceptualisation that appears relevant to the pregnancy experience but fails to account for non-psychological factors. Furthermore, the TM model does not appear to explain the bidirectionality of some pregnancy behaviours (i.e., the way in which the same influencing factor may encourage both healthy and unhealthy behaviours), and neither model accounts for changes in the salience of influencing factors over time. Longitudinal research is therefore necessary to better understand how the models operate at different stages throughout pregnancy; measuring women's health behaviour (e.g., eating behaviour) and the model constructs at multiple gestational stages would provide an enhanced understanding of how the model constructs change throughout pregnancy and to what extent they explain behaviour.

It will be important to consider all of these elements during theory development and to build upon the knowledge we have generated. By combining the existing TM model constructs with a construct that reflects non-psychological factors, including physical symptoms, social influences, and practical and environmental influences, we may be able to develop an enhanced model that is more relevant and meaningful to the pregnancy context. It will also be valuable to consider the evolving nature of pregnancy and the relevance of model constructs at different points throughout pregnancy.

5.5.3. Conclusions

Both the COM-B model and TM model have limitations when applied within the context of pregnancy. However, each model contains elements which will be crucial in the development of a pregnancy-specific model of behaviour change. Going forward, it is necessary to develop a model that adequately conceptualises women's pregnancy experiences and accounts for non-psychological influencing factors, in additional to internal cognitive processes. Combining aspects of each model will be key to developing an enhanced model that is appropriate and effective in supporting women to improve their health behaviour during pregnancy.

CHAPTER SIX

6. Study three: Investigating the utility of the COM-B and TM model to explain changes in eating behaviour during pregnancy: A longitudinal cohort study

6.1. Abstract

Objectives: Pregnancy has been described as a 'teachable moment' for behaviour change, which presents an important opportunity for health promotion within antenatal care settings. However, no pregnancy-specific model has been developed or tested in the context of health behaviour change during pregnancy. This study aimed to investigate and compare the utility of the Capability-Opportunity-Motivation Behaviour (COM-B) and Teachable Moments (TM) models, to explain health behaviour change during pregnancy, within the context of eating behaviour.

Design: Longitudinal cohort study

Methods: Five hundred and sixteen women completed a survey at between 12-16 weeks gestation (T1). Follow-up data were collected at 20-24 weeks (T2), 36-40 weeks (T3), and 6-12 weeks postnatally (T4). The primary outcome was eating behaviour. To assess the utility of the COM-B model, perceived capability, opportunity, and motivation to eat healthily were measured. To assess the utility of the TM model, risk perceptions, self-image, and affective response were measured.

Results: Overall, the COM-B model explained 18.4% of the variance in eating behaviour, whilst the TM model explained 9%. Both models explained the most variance in eating behaviour at T1 and T3, compared with T2 and T4. Small changes were observed in eating behaviour and the model constructs over the time period studied, although these were not clinically meaningful.

Conclusions: Neither the COM-B nor TM model provide a satisfactory explanation of eating behaviour during pregnancy, however the findings suggest that certain stages of pregnancy may create more salient opportunities for behaviour change. The findings also support claims that motivation may not play a key role in directing eating behaviour during pregnancy. Further research is needed to explore the role of timing in antenatal behaviour change.

The development of a pregnancy-specific model is necessary to optimise understanding of pregnancy as a teachable moment for behaviour change.

6.2. Introduction

Pregnancy has been suggested to be an opportune time for health professionals to support women to initiate, or maintain, healthy behaviours. Increased contact with health professionals during this time and increased receptivity to health messages means that pregnancy is often described as a 'teachable moment' (Phelan, 2010). That is, a significant health event that motivates individuals to adopt risk-reducing health behaviours (McBride et al., 2003). Lifestyle changes made during pregnancy have implications for long-term health outcomes of both the mother and child, as the potential exists for newly initiated healthy behaviours to be maintained after birth.

McBride et al. (2003) first attempted to conceptualise the teachable moment within the context of smoking cessation. Their model (referred to hereon as the TM model) is comprised of three main psychological constructs underlying a health event, thought to act upon an individual's motivation to change their health behaviour, their self-efficacy, and acquisition of skills. These include an increased emotional or affective response, a change in self-concept or social role, and increased perceived risk and outcome expectancies. This model provides a compelling argument for conceptualising pregnancy as a teachable moment, as women are likely to experience heightened emotion in relation to their pregnancy, a redefining of social role and self-concept as they prepare for the transition to motherhood, and an increase in perceived risk related to the health of the unborn child and to themselves (Phelan, 2010).

However, Olander et al. (2016) argue that the Capability-Opportunity-Motivation Behaviour model (COM-B; Michie et al., 2011) may offer an enhanced understanding of pregnancy as a teachable moment. The COM-B model suggests that behaviour change has three necessary determinants: physical and psychological capability, physical and social opportunity, and reflective and automatic motivation. Within the context of pregnancy, these determinants are suggested to more usefully, and insightfully, explain behaviour change by moving beyond the traditional model of motivation, and

considering that changes in capability and opportunity may also create opportune moments for intervention (Olander et al., 2016).

Whilst both the COM-B and TM models appear to explain pregnancy as a teachable moment, neither has been tested prospectively in a population of pregnant women. Given that both models are used to explain antenatal behaviour change (e.g., eating behaviour), it is important to understand the efficacy of these models within this context. Further to this, pregnancy is often conceptualised as one teachable moment in and of itself (e.g., Atkinson et al., 2016; Phelan, 2010). However, it has been suggested that multiple teachable moments may occur throughout pregnancy, triggered by individual significant events, such as receiving confirmation of the pregnancy or attending the initial booking appointment, or more broadly related to different gestational trimesters (Olander et al., 2016). It is therefore important to consider the full spectrum of opportunities that pregnancy presents for health behaviour change and investigate how well existing behaviour change models account for these.

Making healthy changes to diet and eating behaviour during pregnancy is a key priority for many women (Maher & Lowe, 2015). Guidelines from the National Institute of Health and Care Excellence (NICE, 2021a) recommends that health professionals discuss diet and nutrition with women from the first antenatal contact onwards, providing additional support for women with raised BMIs (NICE, 2010b). Thus, utilising this teachable moment to support women to initiate, or maintain, these healthy changes is of utmost importance. Not least because of the numerous poor maternal and fetal outcomes associated with poor diet or excessive weight gain during pregnancy (Kominiarek et al., 2018; Poston et al., 2016; Yang et al., 2019). In 2017, 21.6% of women in England were recorded as having a BMI of 30 or over at their booking appointment, which poses an increasing challenge for maternity and neonatal service provision (Public Health England, 2019). This far exceeds the prevalence of other risky health behaviours, such as smoking (10.4% at the time of delivery; NHS Digital, 2020), making it a significant public health priority. Understanding the extent to which existing models explain antenatal health behaviour, and

identifying opportunities for behaviour change throughout pregnancy and the immediate postnatal period, will facilitate the development of more targeted interventions to improve maternal and infant health.

The purpose of this study was to investigate and compare the utility of the COM-B model and TM model to explain health behaviour change during pregnancy, within the context of eating behaviour. The aims of the study were to:

1) Describe how the constructs of the COM-B model, the constructs of the TM model, and eating behaviour change over time.

2) Investigate whether the COM-B model or TM model better explains eating behaviour during pregnancy.

3) Examine whether certain time-points throughout pregnancy act as more salient teachable moments than others.

6.3. Methods

6.3.1. Study design

This study is a longitudinal, prospective cohort study exploring changes in eating behaviour during pregnancy.

6.3.2. Setting

Recruitment took place between February and June 2020. Shortly after commencing recruitment it was announced that pregnant women were a high risk group for contracting COVID-19 (16/03/2020; Department of Health and Social Care & Hancock, 2020) and the first national lockdown was enforced in England (23/03/2020 – 23/06/2020). Two further lockdowns were subsequently imposed (05/11/2020 - 02/12/2020, and 06/01/2021 – 08/03/2021). Data collection was ongoing until February 2021. From hereon, the term 'lockdown' will refer to any point after 16/03/2020.

6.3.3. Sample and recruitment

Women were recruited using both active and passive recruitment methods. Active recruitment took place in seven NHS maternity units in the North-West of England. Research midwives approached women face-to-face to invite them to participate and maternity units also advertised the study using flyers and posters, where appropriate. Passive recruitment involved advertising the study online using various channels, including paid adverts (e.g., Facebook, Instagram), social media/forum posts (e.g., Twitter, Reddit, MumsNet), university mailing lists, and recruitment websites (see Appendix E-G for recruitment materials).

Women were eligible to participate if they were over the age of 18 and between 12-16 weeks pregnant at the time of recruitment. Women also needed to be receiving maternity care in the UK, with a singleton pregnancy, and able to read

and write in English to participate. Women unable to provide informed consent were not eligible to participate (see Appendix H for consent form).

As an incentive, participants were offered the opportunity to be entered into a prize draw to win a £100 shopping voucher, for each of the four surveys they completed. Women were provided with necessary details about study participation, but no additional information on the topic under investigation was provided (see Appendix I for participant information sheet).

6.3.4. Data collection

Data were collected at four time-points: between 12-16 weeks of pregnancy (T1), 20-24 weeks (T2), 36-40 weeks (T3), and 6-12 weeks postnatally (T4). Informed consent was gained at each time-point. T1 surveys were completed online using Research Electronic Data Capture (REDCap) tools hosted at the sponsoring university (Harris et al., 2009, 2019), or in a paper format. All follow-up surveys were completed online. Data collected in maternity settings included the use of both online and paper surveys (see Appendix J for survey).

Participant contact details and their expected due date were collected at T1 to allow for further follow-up and for the dates of the follow-up surveys to be plotted. Participants were sent a link to the follow-up surveys either by email and/or text message, depending on the contact details provided, and were sent a reminder after two weeks for the antenatal surveys and after four weeks for the postnatal survey.

Favourable ethical opinion was granted by the Health Research Authority (HRA) and the NHS Research Ethics Committee (REC) (IRAS ID: 264741; REC Reference: 19/NW/0674) (see Appendix K & L for approvals).

6.3.5. Survey measures

Unless specified, items were generated for the present study. Details of the measures used are presented in Table 6.1.

6.3.6. Analysis

Data were analysed using IBM SPSS Statistics, version 25. Data were cleaned and composite scores created, where <20% data were missing, for all model constructs and the PUQE items. Frequencies and descriptive statistics were generated to assess sample characteristics and mean scores at each time-point for all available data. Independent t-tests and chi squared tests were conducted to compare variable means at T1 for different demographic groups, to further explore the data and check for differences between groups. Mixed regression models were performed to compare changes in scores over time in order to make use of all available data at each time-point. Multiple linear regression models were used to identify which model better explains eating behaviour, controlling for time, age, ethnicity, BMI, education, IMD decile, parity, gestational diabetes, prior pregnancy complications, experience of sickness/nausea, and pre/post lockdown recruitment. Controlling for the same potential confounders (without time), individual regression models built for each time-point were then used to assess the associations between model constructs and dietary quality, to identify if certain time-points act as more salient teachable moments than others during pregnancy. Experience of sickness/nausea and perceived risk to baby were not included for the T4 analysis as these were not measured at this time-point. Adjusted R^2 is reported for all regression analyses.

Table 6.1. Survey measures

Variable	Measure	Description
Demographic and medical characteristics	Items were created for the survey or based on response items from the 2011 UK census (Office for National Statistics, 2011).	N/A
Nausea and/or vomiting frequency	The Pregnancy Unique-Quantification of Emesis scoring system (PUQE; Koren et al., 2005).	The PUQE was used to measure severity of nausea and vomiting in the study sample, as it was hypothesised that these symptoms may affect participants' eating behaviour. Participants were asked to rate their physical symptoms using a 5-point response scale. These ratings were summed to create a composite score indicating no symptoms (0-3), mild (4-6), moderate (7-12), or severe symptoms (≥13).
Perceived risk	Items were based on a measure developed by McBride et al. (2017).	Participants were asked to respond to four statements assessing their level of concern about their health and that of their baby during their pregnancy using a 7-point scale (ranging from "strongly disagree" to "strongly agree"). Two composite scores were created using pro-rated averages (perceived risk to self and perceived risk to baby).
Self-image	As above.	Participants were asked to rate how they felt about becoming a mother on a 7-point scale (ranging from "negative" to "positive"), to select one of three statements that best reflected how they currently felt about themselves ("I feel better about myself", "I feel worse about myself", "there has been no change in how I feel about myself"), and to rate on a 7-point scale (ranging from "strongly disagree" to "strongly agree") their agreement with the statement *"most people important to me think I will be a good mother"*. A composite score was created using pro-rated averages (self-image).

Variable	Measure	Description
Worry	As above.	Participants were asked to respond to two statements assessing levels of worry about their health and that of their baby during their pregnancy, using a 5-point scale (ranging from "not worried at all" to "very worried"). A composite score was created using pro-rated averages (worry).
Positive and negative affect	The Positive and Negative Affect Scale (PANAS; Watson et al., 1988).	The PANAS was used to measure positive and negative affect, as it was originally used alongside the measure developed by McBride et al. (2017). Participants were asked to rate the extent to which they had experienced 20 emotions in the past few weeks using a 5-point scale (ranging from "very slightly or not at all" to "extremely"). Two composite scores were created using pro-rated averages (positive affect and negative affect).
COM-B constructs	Items were based on a measure developed by Taylor et al. (2016).	Participants were asked to rate their agreement with 18 statements relating to their perceived capability to eat healthily, (e.g., "I find it easy to eat healthily"), perceived opportunity, (e.g., "It is easy for me to eat healthily at home and at work"), and motivation (e.g., "I have healthy eating goals that I want to achieve"), using a 7-point scale (ranging from "strongly disagree" to "strongly agree"). Composite scores were created for each of the model constructs using pro-rated averages.

Variable	Measure	Description
Eating behaviour	The Short Form Food Frequency Questionnaire (SFFFQ; Cleghorn et al., 2016).	The SFFFQ was selected to use as an appropriate measure of dietary quality as it was developed in a UK adult population including women of reproductive age. Whilst the measure does not account for the specific dietary recommendations of pregnant or breastfeeding women, broad food groups are used to assess dietary quality (e.g., 'fruit', 'beans or pulses', 'fibre-rich breakfast cereal') which does not limit reporting. Participants were asked to report the frequency with which they had eaten various food items during a "typical" week over the previous month, using an 8-point scale (ranging from "rarely or never" to "5+ a day") and a six-point scale (ranging from "rarely or never" to "7+ times a week"), to rate thirteen food items and seven food items, respectively. These scores were combined to create a single dietary quality score ranging from 5 to 15, which indicated optimum dietary intake of these foods. A healthy diet was defined as having an overall dietary quality score of >12, as stated in the original measure.

6.4. Results

Five hundred and sixteen participants completed the survey at the first time-point (T1). Two hundred and sixteen (41.9%) participants were recruited online and 300 (58.1%) via NHS maternity services. Three hundred and two (58.5%) participants participated using the online survey and 214 (41.5%) using the paper version. Most participants (n=302, 58.5%) were recruited prior to lockdown.

Participant attrition was relatively high, with 305 (59.1%), 210 (40.7%), and 198 (38.4%) participants providing data at T2, T3, and T4, respectively (see Figure 6.1 for an overview of the data collection process). One hundred and forty-four participants provided data at all four time-points (27.9%). Twelve participants withdrew from the study after completing the T1 survey, four at T2, eight at T3, and two at T4.

6.4.1. Recruitment

41.5% (n=214) of participants were recruited post-lockdown. Compared to those recruited pre-lockdown, these participants perceived greater risk to their own health (mean difference 0.67 (95% CI, 0.94 to 0.39), p<.001) and to the health of their baby (mean difference 0.72 (95% CI, 1.03 to 0.41), p<.001). Greater levels of worry about their health and that of their baby (mean difference 0.46 (95% CI, 0.63 to 0.29), p<.001), as well as greater perceived capability to eat healthily (mean difference 0.33 (95% CI, 0.55 to 0.11), p=.004) were also reported.

Participants who were recruited online (n=216, 41.9%) reported greater risk perceptions about their own health (mean difference 0.86 (95% CI, 0.59 to 1.14), P<.001) and that of their baby (mean difference 0.96 (95% CI, 0.66 to 1.27), P<.001), higher levels of worry about their health and that of the baby (mean difference 0.52 (95% CI, 0.35 to 0.69), P<.001), and higher levels of
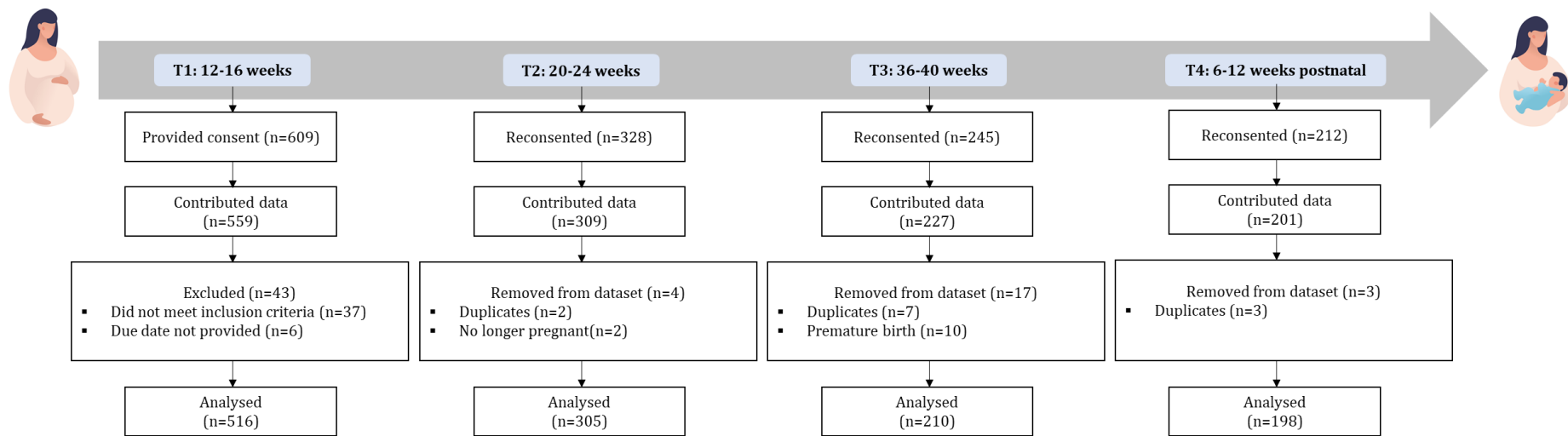
Figure 6.1. Data collection process

negative affect (mean difference 0.17 (95% CI, 0.04 to 0.29), P=.009) than those recruited in maternity care settings. This is congruent with the above findings relating to lockdown recruitment, as the majority of participants completing online surveys were also recruited post-lockdown.

6.4.2. Missing data

For the composite scores of key variables, the amount of missing data was low, with 2.8% missing at T1, 4% at T2, 3% at T3, and 6.5% at T4, for those who completed the survey. There was a general trend in missing data increasing slightly as participants progressed through the surveys, but overall, the spread of missing data was fairly even across variables at each time-point and there did not appear to be a pattern of missingness.

At T1, participants who provided data at all four time-points (n=144, 27.9%) reported higher levels of perceived risk about their own health during pregnancy (mean difference 0.31 (95% CI, 0.62 to 0.00), p=.049) and greater levels of worry about their own health and that of their baby during pregnancy (mean difference 0.21 (95% CI, 0.40 to 0.02), p=.03) than participants who did not complete all four surveys. No association was found between survey completeness and age (p=.09), ethnicity (p=.72, Fisher's Exact Test), or prior pregnancy difficulties or complications (X^2 (1)=0.35, p=.62), and parity (X^2 (1)=1.05, p=.33). However, participants who were educated to a postgraduate or higher level were more likely to provide data at all four time-points (p=.03, Fisher's Exact Test), as were those who were recruited online (X^2 (1)=5.44, p=.02), and those from higher IMD quintiles (X^2 (4)=11.47, p=.02).

6.4.3. Sample characteristics

Participants were aged between 18 and 45 years (M= 30.1; SD=4.8). The majority of participants were from White backgrounds (n=474; 91.9%), married (n=259, 50.2%), and in full-time employment (n=312, 60.5%). Most participants had obtained a higher or postgraduate education level qualification

(n=302, 58.5%), and more participants lived in the most deprived 10% of areas in England (n=74, 14.3%) than in any other decile. At T1, 41.1% of participants had a healthy BMI (n=212).

Participants had a mean gestational age of 13.5 weeks (range=11-16 weeks, SD=1.2), 20.7 weeks (range=19-25 weeks, SD=1.0), and 36.4 weeks (range=36-40 weeks, SD=0.9) at T1, T2, and T3, respectively, and a mean of 6.5 weeks (range= 2-12 weeks, SD=1.6) postpartum at T4. The largest proportion of participants had no existing children (n=249, 48.3%).

17.6% of participants reported experiencing difficulty conceiving prior to their current pregnancy (n=91) and 5.0% (n=26) had used assisted reproductive technology to conceive. These figures are broadly reflective of those reported in the general population (Human Fertilisation and Embryology Authority, 2021; NICE, 2013; Office for National Statistics, 2020). However, 26.0% of participants had experienced at least one prior miscarriage (n=134) and 1.4% had experienced a stillbirth (n=7), which appears to be higher than general population rates (Office for National Statistics, 2021; Quenby et al., 2021). See Table 6.2 for sample characteristics.

6.4.4. Pregnancy difficulties or complications

Participants who reported experiencing any type of prior pregnancy difficulties or complications (n=204, 39.5%) reported higher levels of worry about their own health and that of their baby during their pregnancy (mean difference 0.19 (95% CI, 0.02 to 0.37), P=.03) than those participants who had not experienced this.

6.4.5. Sickness and nausea

At T1, most participants reported experiencing mild (n=225, 43.6%) or moderate (n=134, 26%) symptoms of nausea and vomiting. At T2 and T3, the majority of participants reported experiencing no symptoms (T2: n=204,

66.9%; T3: n=126, 60%). See Supplementary Material (Appendix M) (Table S1) for all scores across time-points.

6.4.6. Gestational diabetes

By T3, 7.6% (n=16) of participants reported developing gestational diabetes. This is similar to rates of gestational diabetes reported in the general population of pregnant women in Europe (5.4%; Eades et al., 2017). On average, these participants reported higher dietary quality scores (mean difference 1.07 (95% CI, 0.12 to 2.01), p=.03) than participants without gestational diabetes at T3.

Table 6.2. Sample characteristics at T1

Characteristics	All participants (n=516)
Mean age in years (range, SD)	30 (18-45, 4.8)
Weeks pregnant/postpartum (range, SD)	
T1	13.5 weeks (11-16, 1.2)
T2	20.7 weeks (19-25, 1.0)
T3	36.4 weeks (36-40, 0.9)
T4	6.5 weeks postpartum (2-12, 1.6)
Number of children (%)	
0	249 (48.3%)
1	166 (32.2%)
2	72 (14.0%)
3+	23 (4.5%)
Missing	6 (1.2%)
Prior pregnancy difficulties (%)	
Difficulty conceiving	91 (17.6%)
Assisted pregnancy	26 (5.0%)
Miscarriage	134 (26.0%)
Stillbirth	7 (1.4%)
Ethnic group (%)	
White	474 (91.9%)
Mixed/Multiple ethnic groups	15 (2.9%)
Asian/Asian British	9 (1.7%)
Black/African/Caribbean/Black British	3 (0.6%)
Other ethnic groups	3 (0.6%)
Missing	12 (2.3%)
Martial status (%)	
Single	23 (4.5%)
In a relationship	226 (43.8%)
Married	259 (50.2%)
Separated	3 (0.6%)

Characteristics	All participants (n=516)
Divorced	1 (0.2%)
Missing	4 (0.8%)
Employment status (%)	
Employed full-time	312 (60.5%)
Employed part-time	90 (17.4%)
Self-employed full-time	14 (2.7%)
Self-employed part-time	12 (2.3%)
Full-time student	9 (1.7%)
Part-time student	2 (0.4%)
Unemployed	63 (12.2%)
Other	11 (2.1%)
Missing	3 (0.6%)
Education level (%)	
Postgraduate education	130 (25.2%)
Higher education	172 (33.3%)
Further education	140 (27.1%)
High school	62 (12.0%)
No formal qualifications	9 (1.7%)
Other	1 (0.2%)
Missing	2 (0.4%)
Levels of neighbourhood deprivation* (%)	
1 (most deprived 10%)	74 (14.3%)
2	41 (7.9%)
3	43 (8.3%)
4	40 (7.8%)
5	35 (6.8%)
6	37 (7.2%)
7	34 (6.6%)
8	37 (7.2%)
9	45 (8.7%)
10 (least deprived 10%)	39 (7.6%)
Missing	91 (17.6%)
BMI category at T1 (kg/m^2)(%) **	
Severely obese (>40)	12 (2.3%)
Obese (30-39.9)	99 (19.2%)
Overweight (25 -29.9)	152 (29.5%)
Healthy weight (18.5 – 24.9)	212 (41.1%)
Underweight (<18.4)	8 (1.6%)
Missing	33 (6.4%)

*Based on the English Indices of Deprivation deciles (Ministry of Housing Communities & Local Government, 2019)
**Based on NICE guidance (NICE, 2014b)

6.4.7. Examining changes in model constructs and eating behaviour over time

6.4.7.1. Changes in COM-B model constructs over time

Participants' perceived capability to eat healthily was significantly lower at T4 than at T1 (mean difference -0.24 (95% CI, -0.46 to -0.02), p=.03), T2 (mean difference -0.37 (95% CI, -0.60 to -0.13), p<.001), and T3 (mean difference -0.35 (95% CI, -0.57 to -0.14) p<.001).

Similarly, perceived opportunity to eat healthily was significantly less at T4 than at T1 (mean difference -0.41 (95% CI, -0.59 to -0.23) P<.001), T2 (mean difference -0.44 (95% CI, -0.64 to -0.24) p<.001), and T3 (mean difference -0.30 (95% CI, -0.49 to -0.11), p<.001).

There were no statistically significant differences in participants' motivation to eat healthily from T1 through to T4.

6.4.7.2. Changes in TM model constructs over time

There were no statistically significant differences in participants' perceived risk to their own health from T1 through to T4. However, participants' perceived risk towards the health of their baby was significantly higher at T2 than T1 (mean difference 0.25 (95% CI, 0.04 to 0.47), p=.01).

There were no statistically significant differences in participants' self-image from T1 through to T4.

Participants' levels of worry about their health and that of the baby reduced significantly from T1 to T4 (mean difference -0.25 (95% CI, -0.44 to -0.07), p=.002), and from T2 to T4 (mean difference -0.28 (95% CI, -0.47 to -0.10), p<.001).

Positive affect significantly increased across time-points. Levels of positive affect were significantly higher at T2 (mean difference 0.17 (95% CI, 0.07 to 0.27), p<.001), T3 (mean difference 0.15 (95% CI, 0.04 to 0.26), p=.002), and T4 (mean difference 0.34 (95% CI, 0.20 to 0.48), p<.001), than at T1. Positive affect at T4 was also significantly higher than at T2 (mean difference 0.17 (95% CI, 0.03 to 0.31), p=.01) and T3 (mean difference 0.19 (95% CI, 0.05 to 0.33), p=.002).

There were no statistically significant differences in negative affect at different time-points.

6.4.7.3. Changes in eating behaviour over time

After initially increasing from T1 (M=9.68, SD=1.98) to T2 (M=9.97, SD=2.02), dietary quality decreased over subsequent time-points (T3: M=9.82, SD=1.86; T4: M=9.55, SD=1.86), with a significant decrease in quality from T2 to T4 (mean difference -0.39 (95% CI, -0.77 to -0.02), p=.03).

Mean scores for the COM-B and TM model constructs and dietary quality at each time-point are presented in Table 6.3 and in Figures 6.2-6.4.

Table 6.3. Mean scores for model constructs and dietary quality at each time-point, for all available data

	12-16 weeks (T1) n=516		20-24 weeks (T2) n=305		36-40 weeks (T3) n=210		6-12 weeks postnatal (T4) n=198	
	n	M (SD)	n	M (SD)	n	M (SD)	n	M (SD)
COM-B constructs								
Capability	494	5.21 (1.29)	292	5.38 (1.18)	202	5.36 (1.07)	183	4.99 (1.21)
Opportunity	497	4.94 (1.07)	292	4.99 (1.03)	202	4.85 (1.00)	184	4.55 (1.12)
Motivation	498	5.16 (0.89)	292	5.15 (0.97)	202	5.13 (0.91)	184	5.30 (0.95)
TM constructs								
Risk to self	509	2.73 (1.59)	293	3.02 (1.56)	205	3.01 (1.54)	187	2.93 (1.64)
Risk to baby	509	3.45 (1.80)	292	3.74 (1.62)	205	3.70 (1.68)	-	-
Worry	508	2.46 (0.99)	293	2.58 (0.93)	204	2.42 (1.01)	187	2.28 (0.96)
Positive affect	498	3.15 (0.80)	294	3.31 (0.76)	205	3.30 (0.74)	187	3.49 (0.76)
Negative affect	498	2.17 (0.70)	294	2.13 (0.63)	205	2.14 (0.58)	187	2.13 (0.71)
Self-image	502	5.70 (1.01)	294	5.73 (1.09)	205	5.76 (1.00)	185	5.56 (1.20)
Dietary quality	500	9.68 (1.98)	291	9.97 (2.02)	202	9.82 (1.86)	183	9.55 (1.86)
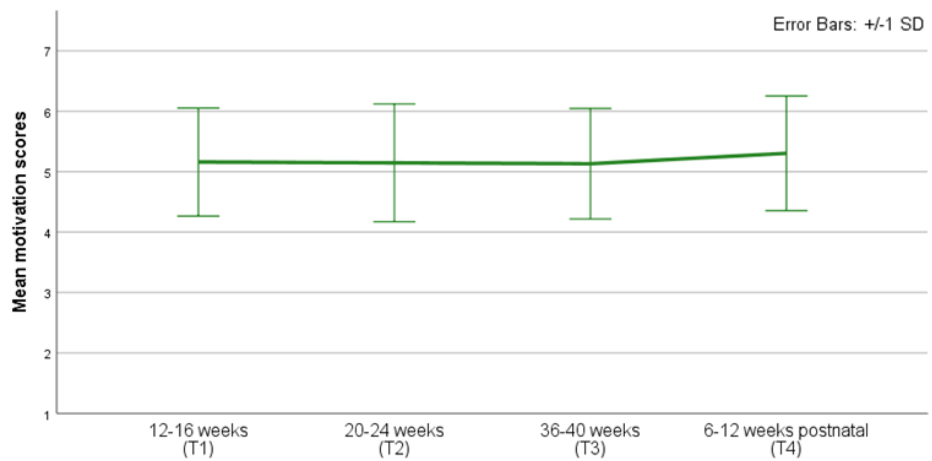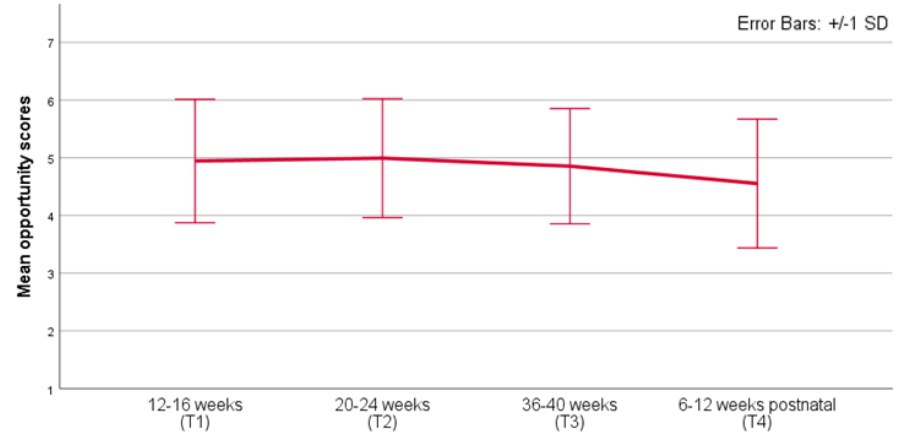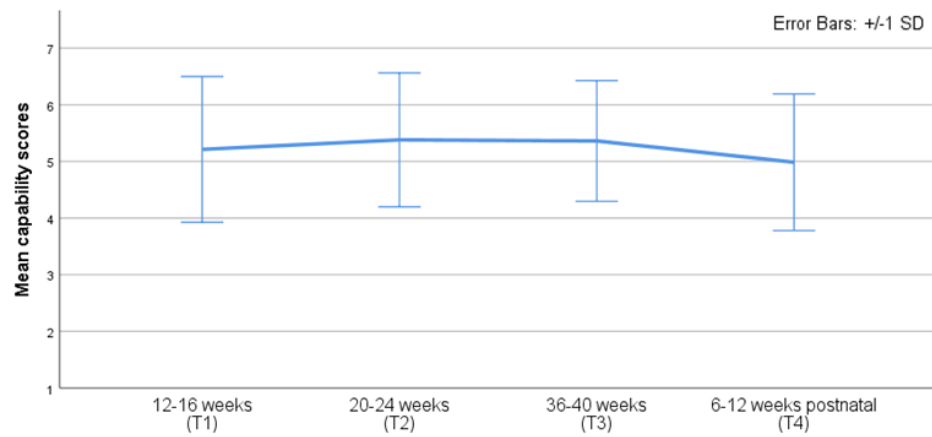
Figure 6.2. Mean scores for capability, opportunity, and motivation across time-points
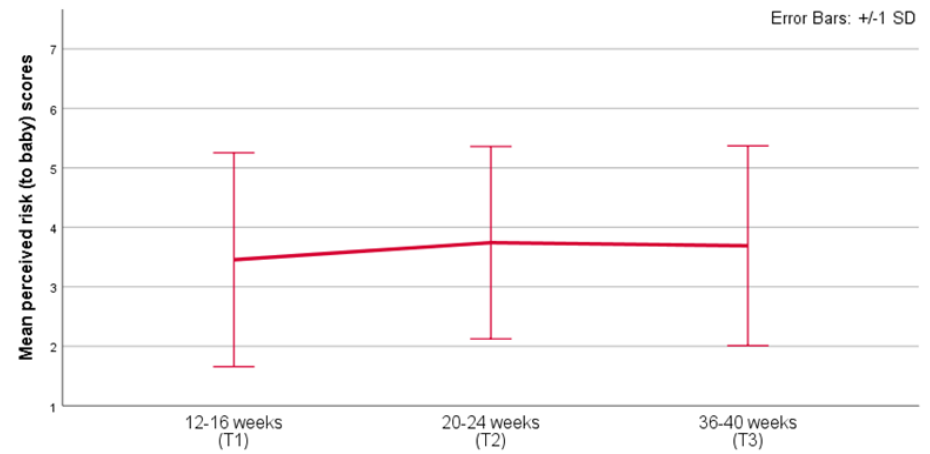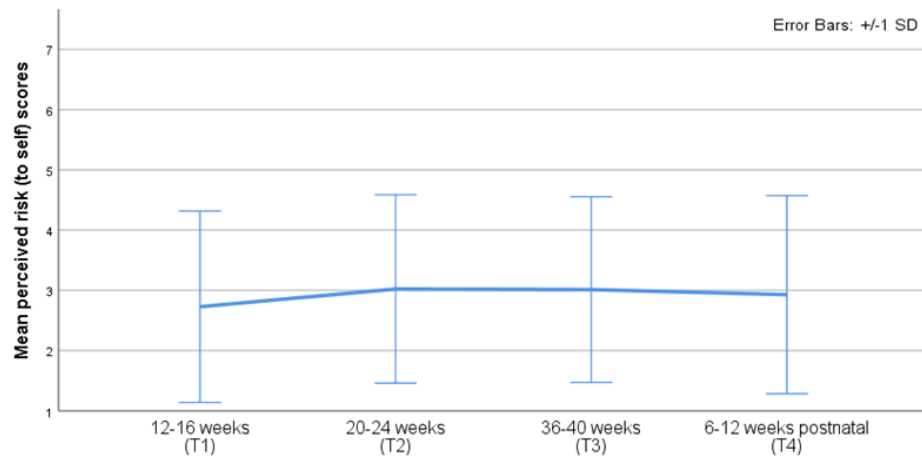
NB: perceived risk to baby was not measured at T4.
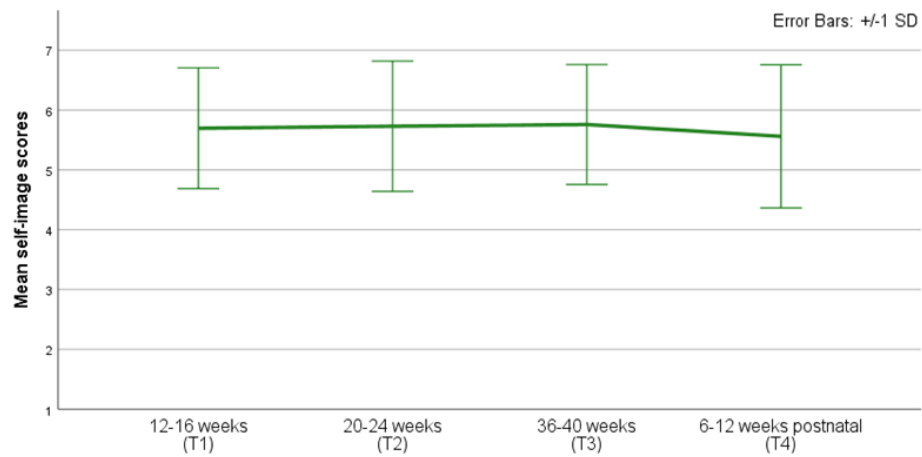
Figure 6.3. Mean scores for perceived risk to self, perceived risk to baby, and self-image across time-points
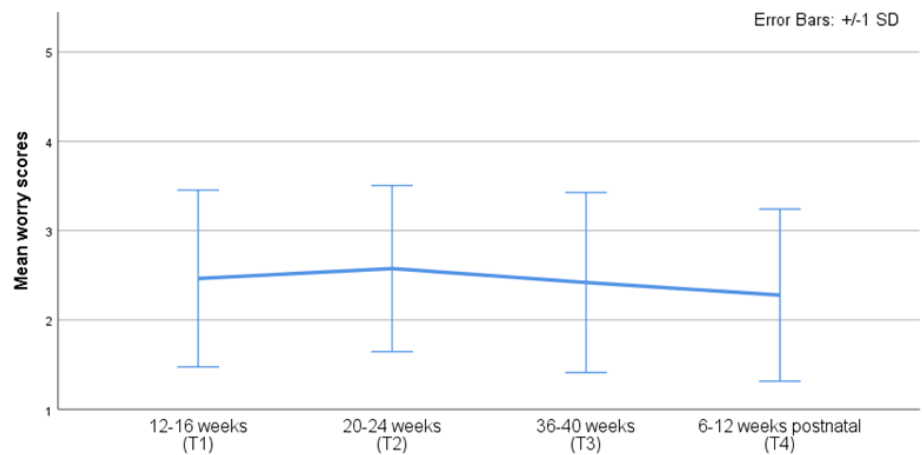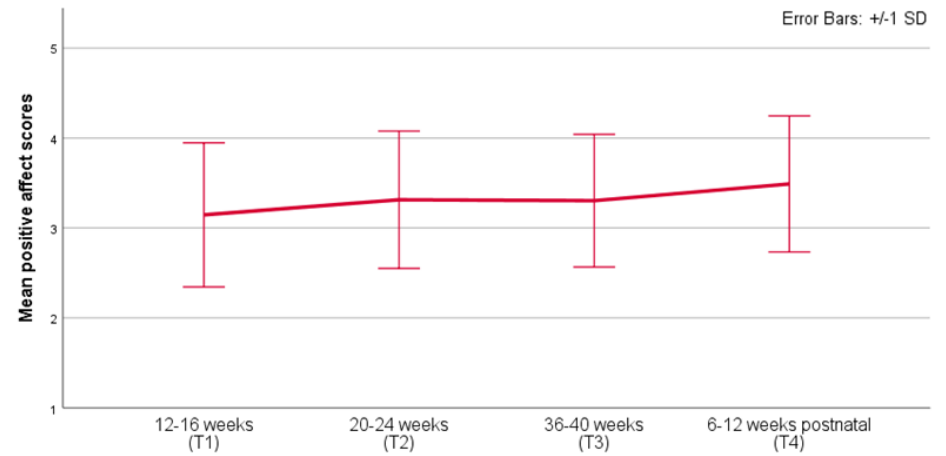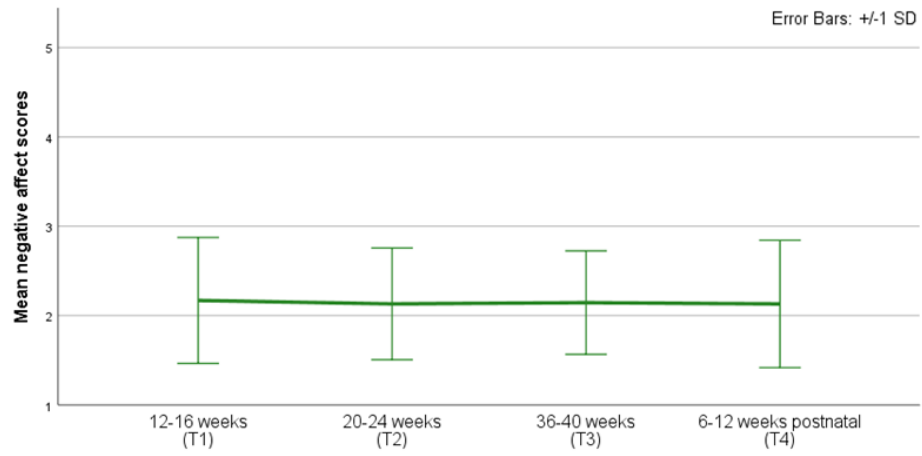
Figure 6.4. Mean worry, positive and negative affective scores across time-points

6.4.8. Investigating whether the TM model or COM-B model better explains eating behaviour during pregnancy

6.4.8.1. Overall variance in eating behaviour explained by the COM-B model

After including potential confounders, for every one unit increase in perceived capability score the dietary quality score will on average increase by 0.30 (95% CI, 0.06 to 0.53, p=.01) and for every one unit increase in opportunity score the dietary quality score will on average increase by 0.42 (95% CI, 0.11 to 0.73, p=.008). There was no statistically significant association between motivation and dietary quality. These constructs account for 18.4% of the overall variance in dietary quality when including confounding variables.

6.4.8.2. Overall variance in eating behaviour explained by the TM model

After including potential confounders, for every one unit increase in positive affect score, the dietary quality score will on average increase by 0.29 (95% CI, 0.02 to 0.56, p=.04). There was no statistically significant association between negative affect, worry, self-image, or risk perception scores and dietary quality scores. These constructs account for 9% of the overall variance in dietary quality.

When excluding model constructs, the confounding factors accounted for 6.8% of the overall variance in dietary quality.

A summary of the regression coefficients are presented in Table 6.4.

Table 6.4. Regression analysis summary for model constructs predicting dietary quality

	B	95% CI	β	p	Adjusted R² including potential confounders	Adjusted R² without constructs
COM-B constructs					.184	.068
(Constant)	8.02	[4.81, 11.24]		<.001		
Capability	0.30	[0.06, 0.53]	0.18	.01		
Opportunity	0.42	[0.11, 0.73]	0.20	.008		
Motivation	0.08	[-0.17, 0.33]	0.04	.54		
TM constructs					.090	.068
(Constant)	10.69	[6.98, 14.40]		<.001		
Risk to self	0.13	[-0.05, 0.31]	0.10	.14		
Risk to baby	-0.08	[-0.26, 0.09]	-0.07	.36		
Worry	0.08	[-0.24, 0.39]	0.04	.64		
Positive affect	0.29	[0.02, 0.56]	0.12	.04		
Negative affect	-0.35	[-0.73, 0.03]	-0.11	.07		
Self-image	0.13	[-0.09, 0.35]	0.07	.25		

6.4.9. Examining whether certain time-points act as more salient teachable moments than others during pregnancy

6.4.9.1. Variance in eating behaviour explained by the COM-B model at different time-points

Across time-points, the amount of variance in dietary quality explained by the COM-B model constructs was fairly similar, with 19.2%, 13.8%, 18.6% and 16.9% of the overall variance in dietary quality explained at T1, T2, T3, and T4, respectively. In line with the previous findings, there was a significant association between perceived capability (unstandardised B 0.58 (95% CI, 0.22 to 0.93) p=.002) and opportunity (unstandardised B 0.61 (95% CI, 0.07 to 1.14) p=.03), and dietary quality scores, at T1 and T3, respectively.

6.4.9.2. Variance in eating behaviour explained by the TM model at different time-points

The TM model constructs account for 9.1%, 2.7%, 12.5%, and 4.5% of the overall variance in dietary quality at T1, T2, T3, and T4, respectively. At T2, a significant association was found between positive affect and dietary quality scores (unstandardised B 0.68 (95% CI, 0.11 to 1.25) p=.02). There were no other significant associations at any time-point.

Although dietary quality scores remained relatively stable over time, the constructs of both models accounted for the most variability in dietary quality at T1 and T3. See Table 6.5 for a summary of the regression analysis for model constructs predicting dietary quality when adjusting for potential confounders at each time-point.

Table 6.5. Regression analysis summary for model constructs predicting dietary quality when adjusting for potential confounders at each time-point

	12-16 weeks (T1)			20-24 weeks (T2)			36-40 weeks (T3)			6-12 weeks postnatal (T4)		
	B [95% CI]	P	Adjusted R²	B [95% CI]	p	Adjusted R²	B [95% CI]	p	Adjusted R²	B [95% CI]	p	Adjusted R²
COM-B constructs			.192			.138			.186			.169
(Constant)	7.77 [2.95, 12.59]	.002		5.56 [-1.36, 12.48]	.11		8.51 [2.45, 14.57]	.006		11.56 [5.20, 17.92]	.001	
Capability	0.58 [0.22, 0.93]	.002		-0.09 [-0.60, 0.42]	.73		0.16 [-0.31, 0.63]	.51		0.02 [-0.45, 0.49]	.92	
Opportunity	0.15 [-0.33, 0.64]	.54		0.71 [-0.01, 1.44]	.05		0.61 [0.07, 1.14]	.03		0.64 [-0.04, 1.32]	.07	
Motivation	0.09 [-0.33, 0.50]	.68		0.31 [-0.19, 0.81]	.22		-0.12 [-0.59, 0.35]	.61		0.06 [-0.40, 0.52]	.80	
TM constructs			.091			.027			.125			.045
(Constant)	8.43 [2.17, 14.68]	.009		10.91 [3.52, 18.29]	.004		11.48 [4.33, 18.62]	.002		13.20 [4.95, 21.46]	.002	
Risk to self	0.24 [-0.02, 0.51]	.07		-0.09 [-0.46, 0.28]	.62		0.17 [-0.18, 0.53]	.34		0.03 [-0.24, 0.30]	.80	
Risk to baby	0.12 [-0.16, 0.39]	.40		-0.07 [-0.43, 0.30]	.72		-0.23 [-0.56, 0.10]	.17		-	-	
Worry	-0.30 [-0.85, 0.25]	.28		0.13 [-0.50, 0.76]	.68		0.19 [-0.35, 0.72]	.49		0.01 [-0.50, 0.51]	.99	
Positive affect	0.25 [-0.16, 0.66]	.23		0.68 [0.11, 1.25]	.02		-0.12 [-0.62, 0.39]	.65		0.22 [-0.38, 0.81]	.47	
Negative affect	-0.29 [-0.88, 0.31]	.35		0.11 [-0.69, 0.91]	.79		-0.47 [-1.21, 0.27]	.21		-0.24 [-0.92, 0.45]	.50	
Self-image	0.18 [-0.24, 0.59]	.40		-0.11 [-0.49, 0.27]	.56		0.33 [-0.08, 0.74]	.11		0.16 [-0.23, 0.55]	.42	

6.5. Discussion

This study investigated the extent to which the COM-B and TM models explain health behaviour change during pregnancy, within the context of eating behaviour. The results reveal small changes in eating behaviour and the model constructs throughout pregnancy and the early postnatal period. Both models explained the most variance in eating behaviour in early- and late-pregnancy, compared with mid-pregnancy and the postnatal period. Overall, the COM-B model explained more of the variance in eating behaviour, than the TM model.

Whilst the COM-B and TM models have been suggested to be useful models to understand pregnancy as a teachable moment, both assume that women's behaviour will be influenced by simultaneous changes in the individual psychological constructs. The findings of this study revealed marginal changes in these individual constructs at different points throughout pregnancy; for example, women's worries about their health and that of their baby decreased slightly over time, whilst levels of positive affect increased. Risk perceptions about the health of the baby also increased slightly from early- to mid-pregnancy, and capability and opportunity were lowest in the postnatal period. Although these findings were statistically significant, the changes observed were arguably too small to be clinically meaningful. However, our findings suggest that there may be some fluidity in the extent to which these psychological constructs are experienced throughout pregnancy and the postnatal period. This is important as neither the COM-B nor TM model consider that the salience of their respective constructs might change at different points in time. Consequently, previous research has suggested that these models may be limited when applied to the context of pregnancy, due to the changeable nature of the pregnancy experience and the static understanding of behaviour change that these models offer (Rockliffe et al., 2021a, 2021b). It will therefore be important to further explore nuances in the salience of the constructs over time, in future work.

Minimal changes in eating behaviour were also found throughout pregnancy, and whilst there was a statistically significant difference from T2 to T3, this did not reflect a meaningful change. Similar findings have been reported elsewhere in the literature which suggest that eating behaviour remains relatively stable throughout pregnancy (Crozier et al., 2009; Cucó et al., 2006). This may be as a result of advice received from healthcare professionals to maintain a healthy diet, in line with current clinical guidance in the UK (NHS, 2020c; NICE, 2008). More marked changes have been reported in relation to other health behaviours such as smoking and alcohol use (Crozier et al., 2009). Neither the COM-B model nor TM model were developed in the context of eating behaviour but were tested within this context as there is an important need to support women to make healthier changes in this area, as previously discussed. McBride et al. (2003) have also argued that focusing on a single behaviour in this way facilitates comparison across studies and enables testing to assess whether teachable moments exist for other behavioural outcomes. As such, it may be advantageous to explore the utility of the COM-B and TM models to explain changes in other health behaviours, including those that are pregnancy-specific (e.g., vitamin supplementation, adherence to dietary recommendations).

Overall, the COM-B model explained more of the variance in eating behaviour than the TM model. This finding supports the supposition made by Olander et al. (2016) that the COM-B model may offer a more meaningful explanation of pregnancy as a teachable moment by moving beyond the concept of motivation as the primary driver for behaviour change. This argument was supported in this study as an association was found between capability and opportunity and eating behaviour, but not between motivation and eating behaviour. This may also explain why associations were not found between many of the TM model constructs and eating behaviour, as to a large extent they reflect changes in both automatic and reflective motivation (Olander et al., 2016).

The COM-B model explained 18.4% of the variance in eating behaviour. This finding is broadly consistent with other studies that have investigated the utility of behaviour change models to explain eating behaviour in various contexts

(ranging from 3.4% to 23%; Malek et al., 2017; McEachan et al., 2011; Willmott et al., 2021). Nonetheless, our findings indicate that a large proportion of the variance in eating behaviour is explained by unmeasured factors, again demonstrating the inability of both the COM-B and TM models to sufficiently explain eating behaviour during pregnancy. Further research is therefore necessary to develop a model of behaviour change that is specific to women's pregnancy experience, in order that it can more fully explain and conceptualise the psychological mechanisms underpinning behaviour change at this time, not otherwise captured by existing models.

In thinking about the unexplained, or unmeasured, variance explaining eating behaviour, it is possible that certain facets of the COM-B constructs may not have been captured using the study measures. For example, participants' physical capability was assessed using items that asked about capability to prepare and eat healthy foods. However, pregnancy symptoms, such as sickness and nausea, often restrict women's capability to eat (Crozier et al., 2017), which may not have been fully captured. Similarly, physical opportunity was measured using items asking about ease of healthy eating at home and work, for example. However, socioeconomic deprivation is a factor understood to restrict physical opportunity to eat healthily (Marmot et al., 2020), which will also not have been fully reflected in the data collected. Some of the variance unaccounted for by the COM-B constructs may therefore still reflect capability, opportunity, and motivation, but require a more sensitive measure to effectively record these aspects. With regards to the TM model, previous research has suggested that when applied to pregnancy, the model fails to account for non-psychological factors such as practical and environmental factors, social influences, and physical pregnancy symptoms (Rockliffe et al., 2021b). These may therefore reflect some of the unmeasured factors contributing to eating behaviour that the TM model failed to include.

Another source of variance could be experience in prior pregnancy, as the current study sample included women with different parity. Whilst this was controlled for in the analysis, we acknowledge that this will not have removed

all effects, as these may differ depending on the woman's prior experience of pregnancy. As such, it may be valuable for future research to explore the utility of the COM-B and TM models to explain eating behaviour separately in nulliparous and multiparous women, to identify potential differences that may have implications for the tailoring of theory and intervention design.

Both the COM-B model and TM model were found to explain the most variance in eating behaviour in early- (12-16 weeks) and late-pregnancy (36-40 weeks), compared with mid-pregnancy (20-24 weeks) and the postnatal period (6-12 weeks postpartum). This suggests that there may be certain stages of pregnancy that present more effective opportunities, or teachable moments, for women to change their eating behaviour. These findings support claims made by Olander et al. (2016) who suggested that certain gestational stages, or antenatal events, may act as individual teachable moments. For example, receiving confirmation of the pregnancy, or attending initial antenatal appointments may help to encourage change (Olander et al., 2016), whereas first trimester nausea or sickness, or increased fatigue experienced in the last trimester may act as a barrier (Cheng et al., 2015; Rockliffe et al., 2021a).

These findings strengthen the argument for the development of a pregnancy-specific model of behaviour change that considers the potential for certain stages of pregnancy to provide more opportune moments for change. However, it is evident that further research is needed to better understand the influence of timing on women's health behaviour. Utilising a qualitative approach may provide an enhanced understanding of the different factors influencing women's eating behaviour at different time-points throughout pregnancy, that goes beyond that captured using a quantitative approach. Furthermore, it is important to consider the different influences on women's eating behaviour during the antenatal and postnatal period, and associated implications for the development of behavioural support during these times.

6.5.1. Strengths and limitations

This is the first study to compare existing models of behaviour change in the context of antenatal eating behaviour. Longitudinal data were collected from a large sample of women throughout the duration of their pregnancies, providing new insight that has highlighted the insufficiency of existing models to explain eating behaviour during pregnancy. However, there are several limitations that must be considered.

Firstly, the vast majority of participants in the sample were from a White background. Whilst a high proportion of residents in England and Wales identify as White (86%; Office for National Statistics, 2015) the sample in this study exceeds this (91.9%). This therefore limits our ability to generalise the findings to women from non-White backgrounds in England, which may be problematic given disparities in pregnancy outcomes experienced by women from Black and Asian ethnic backgrounds (MBRRACE-UK, 2020). A review of the literature identified areas of inequality affecting women from ethnic minority backgrounds which included communication issues and the relationship women had with their midwife (Khan, 2021). Receiving a lack of support or advice from health professionals may act as a barrier to behaviour change due to reduced social opportunity or psychological capability (COM-B model), or lowered risk perceptions (TM model). An absence of data from these women may therefore mean that the data are biased, by not reflecting these experiences. It is therefore important to keep this in mind when interpreting the findings. Future work would benefit from taking a purposive recruitment approach in order to reach different ethnic groups.

A further limitation is that the study relied on the use of self-report measures. Whilst this was the most appropriate method to collect longitudinal data from a large sample, it is important to acknowledge that self-report questionnaires are susceptible to social desirability biases. It is possible that women under-reported the amount, or types, of food they consumed in order to avoid perceived judgement. Similarly, women may have provided more positive

responses to questions surrounding self-image as a new mother, as it may be perceived to be socially unacceptable to admit that others do not believe you would be a good mother (Meeussen & Van Laar, 2018; Staneva et al., 2017). In terms of the data collected, this would mean it could potentially be skewed in an upward direction for these items, inflating the importance of positive self-image, for example, on eating behaviour.

Participants were recruited around the time the first UK lockdown was enforced. Research conducted during lockdown reported heightened levels of perceived threat (Qi et al., 2020) and elevated anxiety in pregnant women related, in part, to concern about threat to their lives and that of their baby (Lebel et al., 2020). Similar differences were found in our sample comparing T1 scores of those recruited before and during lockdown. Furthermore, changes in dietary intake have been reported during this time (Whitaker et al., 2021; Zhang, Zhang, et al., 2020) and recent research has shown that women who were pregnant during the pandemic reported higher levels of negative affect and lower levels of positive affect than women pregnant before the pandemic (Berthelot et al., 2020). To account for any differences in scores of those recruited pre- or post-lockdown, this factor was included as a potential confounder in the main analysis. However, it is important to consider other impacts of the pandemic beyond those of lockdown, such as the role of obesity and diabetes in increased COVID-19 disease severity (Holly et al., 2020). Over a fifth of participants in this study were categorised as obese or severely obese at T1, and a proportion of participants also reported being diagnosed with gestational diabetes at T3 (although these were consistent with prior reports in English and European populations, respectively). As such, this may have contributed to increased risk perceptions relating to their own health or that of their baby.

6.5.2. Implications for theory and clinical practice

The study findings revealed that the role of motivation in women's eating behaviour was not as salient as the role of capability and opportunity in

directing behaviour, which is important given the onus often placed on motivation as a tool to change behaviour. In clinical practice it may therefore be advantageous to provide support around capability and opportunity, in addition to motivation. For example, ensuring appropriate provision of information (psychological capability) or being mindful of practical barriers faced by women from socioeconomically deprived backgrounds (physical opportunity), such as high food costs, time constraints, or lack of availability of healthy food.

From a clinical perspective, the findings highlight the importance of considering gestational stages when delivering interventions or health promotional advice. NICE guidelines (2021a) recommend that information about diet and nutrition are provided at the first antenatal appointment, and that the delivery of information (not specific to diet and nutrition) should be tailored to the timing and stage of a woman's pregnancy. Beyond this however, there is limited guidance provided about the provision of behaviour change advice, or about the influence of different gestational stages on a woman's ability to change her behaviour. Going forward it will be important to develop a pregnancy-specific model of behaviour change that can help to support healthcare professionals in delivering appropriately timed interventions that are sensitive to the unique physiological and psychological events occurring throughout the antenatal period.

6.5.3. Conclusions

Whilst the COM-B model explained more variance in eating behaviour during pregnancy than the TM model, neither model provides a sufficient explanation. However, both models explained more variance in eating behaviour in early- and late-pregnancy than in mid-pregnancy or the postnatal period, suggesting certain gestational stages might afford more effective teachable moments. Furthermore, motivation may not play a key role in eating behaviour change. Further research is required to better understand the influence of timing in eating behaviour during pregnancy, and for the development of a pregnancy-specific model of behaviour change.

CHAPTER SEVEN

7. Study four: A qualitative investigation of influences on eating behaviour throughout pregnancy

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7.1. Abstract

Background: Pregnancy is often conceptualised as a 'teachable moment' for health behaviour change. However, it is likely that different stages of pregnancy, and individual antenatal events, provide multiple distinct teachable moments to prompt behaviour change. Whilst previous quantitative research supports this argument, it is unable to provide a full understanding of the nuanced factors influencing eating behaviour. The aim of this study was to investigate influences on women's eating behaviour throughout pregnancy.

Methods: In-depth interviews were conducted online with 25 women who were less than six-months postpartum. Interviews were audio-recorded and transcribed verbatim. Data were analysed thematically.

Results: Five themes were generated from the data that capture influences on women's eating behaviour throughout pregnancy: 'The preconceptual self', 'A desire for good health', 'Retaining control', 'Relaxing into pregnancy', and 'The lived environment'.

Conclusions: Mid-pregnancy may provide a more salient opportunity for eating behaviour change than other stages of pregnancy. Individual antenatal events, such as the glucose test, can also prompt change. In clinical practice, it will be important to consider the changing barriers and facilitators operating throughout pregnancy, and to match health advice to stages of pregnancy, where possible. Existing models of teachable moments may be improved by considering the dynamic nature of pregnancy, along with the influence of the lived environment, pregnancy symptoms, and past behaviour. These findings provide an enhanced understanding of the diverse influences on women's eating behaviour throughout pregnancy and provide a direction for how to adapt existing theories to the context of pregnancy.

7.2. Introduction

Supporting women to make positive changes to their health behaviour during pregnancy is an important part of antenatal care to optimise maternal and fetal health. Making healthy changes to dietary behaviour in particular, can reduce the risk of developing a myriad of pregnancy-related conditions and complications, such as gestational diabetes, gestational hypertension, preeclampsia, caesarean section, and miscarriage (Poston et al., 2016; Yang et al., 2019). The benefits of making healthy dietary changes during pregnancy extends beyond this period, as these changes may be maintained post-pregnancy, improving long-term health outcomes for both the mother and child. This is important, as poor diet is a modifiable behavioural risk factor for non-communicable diseases, which has the greatest financial impact on the budget of the NHS (Scarborough et al., 2011; World Health Organisation, 2020).

During pregnancy, women's motivation to improve their health behaviours may increase (e.g., Dencker et al., 2016; Lindqvist et al., 2017), which presents an opportunity for health professionals to deliver health promotion at a time when women may be more receptive to this information. For this reason, pregnancy is often referred to as a 'teachable moment' for behaviour change (McBride et al., 2003).

Teachable moments are thought to occur when a health event increases an individual's perception of risk and outcome expectations, prompts a strong affective or emotional response, and results in a redefinition of self-concept or social role (McBride et al., 2003). This model provides a level of explanation that can be applied to pregnancy, as this is a health event that requires women to consider risk and outcomes in relation to their own health and that of the unborn child, that may provoke strong emotions such as elation or fear, and for nulliparous women in particular, may provoke a change in self-identity as they adopt the new maternal role (Phelan, 2010).

The Capability-Opportunity-Motivation Behaviour model (COM-B; Michie et al., 2011) has also been suggested to be a useful tool to understand pregnancy as a teachable moment. Whilst McBride et al.'s (2003) model (referred to hereafter as the TM model) incorporates psychological constructs thought to impact upon motivation, self-efficacy, and skill acquisition, the COM-B model also considers the impact of capability and opportunity on women's gestational health behaviours, providing an alternative explanation by which to understand pregnancy as a teachable moment (Olander et al., 2016).

Pregnancy, as a teachable moment, is often discussed as one static health event (e.g., Atkinson, et al., 2016; Phelan, 2010). However, pregnancy typically lasts up to 42 weeks and is a continually evolving process from both a physiological and psychological perspective. Therefore, it may be the case that multiple events occurring throughout pregnancy act as individual teachable moments, such as confirmation of the pregnancy, feeling fetal movements for the first time, or attending the first antenatal appointment (Olander et al., 2016).

Different stages of pregnancy may also create more salient opportunities for behaviour change than others (Olander et al., 2016; Rockliffe et al., 2022). For example, women frequently experience nausea and sickness during the first trimester of pregnancy (Bustos et al., 2017), which according to the COM-B model may reduce their physical capability to eat healthily. As such, the second or third trimesters of pregnancy may afford more effective opportunities for change once physical capability is restored. Furthermore, sense of maternal identity starts to develop around the end of the first trimester for some women, once there is visible evidence of the pregnancy (Atkinson et al., 2016). According to McBride et al. (2003), this may increase motivation to change dietary behaviours due to a redefinition of identify and self-concept at this stage.

A recent longitudinal study from the UK reported that both the COM-B and TM models explained a greater proportion of the variance in eating behaviour during early- and late-pregnancy, compared to mid-pregnancy and the

postnatal period, suggesting that certain stages might afford more salient teachable moments for change, than others (Rockliffe et al., 2022). Whilst these findings highlight that women may require alternative support at different stages of their pregnancy, the quantitative approach adopted does not provide scope for a nuanced understanding of the factors influencing behaviour at different stages throughout pregnancy. A qualitative approach can more fully investigate women's experiences through in-depth enquiry.

This study aimed to explore the influences on women's eating behaviour throughout pregnancy.

7.3. Methods

7.3.1. Sample and recruitment

One-to-one, in-depth interviews were conducted with women who were less than six months postpartum. Participants were recruited after pregnancy so that they were able to reflect on their entire pregnancy experience. Women were eligible to participate if they were over 18 years old and had received maternity care in the UK for a singleton pregnancy. Women who were advised to change their diet due to high-risk status, or who had been on a specialist care pathway for a medical diagnosis that required dietary modification (e.g., gestational diabetes, obesity), were ineligible to participate. All eligible women who expressed an interest in taking part were offered an interview.

Participants were recruited online using social media platforms and forums (e.g., Twitter, Facebook, Reddit) (n=9), through word-of-mouth (n=7), and by re-contacting eligible participants from a previous research study (n=9) (Rockliffe et al., 2022) (see Appendix N & O for recruitment materials). A prize draw to win a £100 shopping voucher was offered as an incentive to participate. To ensure ethnic diversity in the sample, a purposive recruitment approach was utilised (Bloor & Wood, 2006). Women interested in participating contacted the first author directly, who provided a copy of the participant information sheet (see Appendix P) and assessed eligibility via email. Participants from a previous study (Rockliffe et al., 2022) who had provided consent to take part in further research were re-contacted via email after determining eligibility using previously collected data.

7.3.2. Procedure

Interviews were conducted online using video conferencing software (Zoom) between November 2020 and February 2021. This methodology was deemed most appropriate to explore the topic in depth, whilst adhering to COVID-19 government restrictions that were in place at the time (Gray et al., 2020; Lobe et

al., 2020). All participants provided written consent and completed a demographic survey prior to participating, using an online form (see Appendix Q & R). Interviews were audio-recorded and transcribed verbatim. All participants were sent a copy of a debrief sheet following the interview (see Appendix S).

An in-depth interview schedule was used to guide the discussion (see Appendix T), which focused on eating behaviour throughout pregnancy. The interview was divided into three sections relating to early-, mid-, and late-pregnancy. For each section of the interview participants were asked if they could recollect their eating behaviour and any changes made during each phase of the pregnancy.

To aid participant recall, an individualised visual timeline was created in advance of the interviews. The timeline was based on the date the participants gave birth (information which was gathered via the demographic survey) and plotted key antenatal appointments (e.g., booking appointment, glucose test) and events (e.g., religious festivals, COVID-19 lockdowns) that would have occurred during each participant's pregnancy (see Figure 7.1). The timeline was shared with participants using the 'share screen' function at three points throughout the interview, to support the interview schedule. This approach borrows from visual elicitation methods, which have been shown to be effective in aiding participant recall (Grant et al., 2019; Sheridan et al., 2011).

To aid reflexivity, the lead researcher completed a reflective diary entry after each interview and produced a reflective account of the online interviewing process which was submitted for publication (Rockliffe, 2022). These activities enhanced the interview process by allowing the researcher to reflect on each participant interaction, potential biases and researcher influence, and to consider what went well and how the interviews could further be improved.
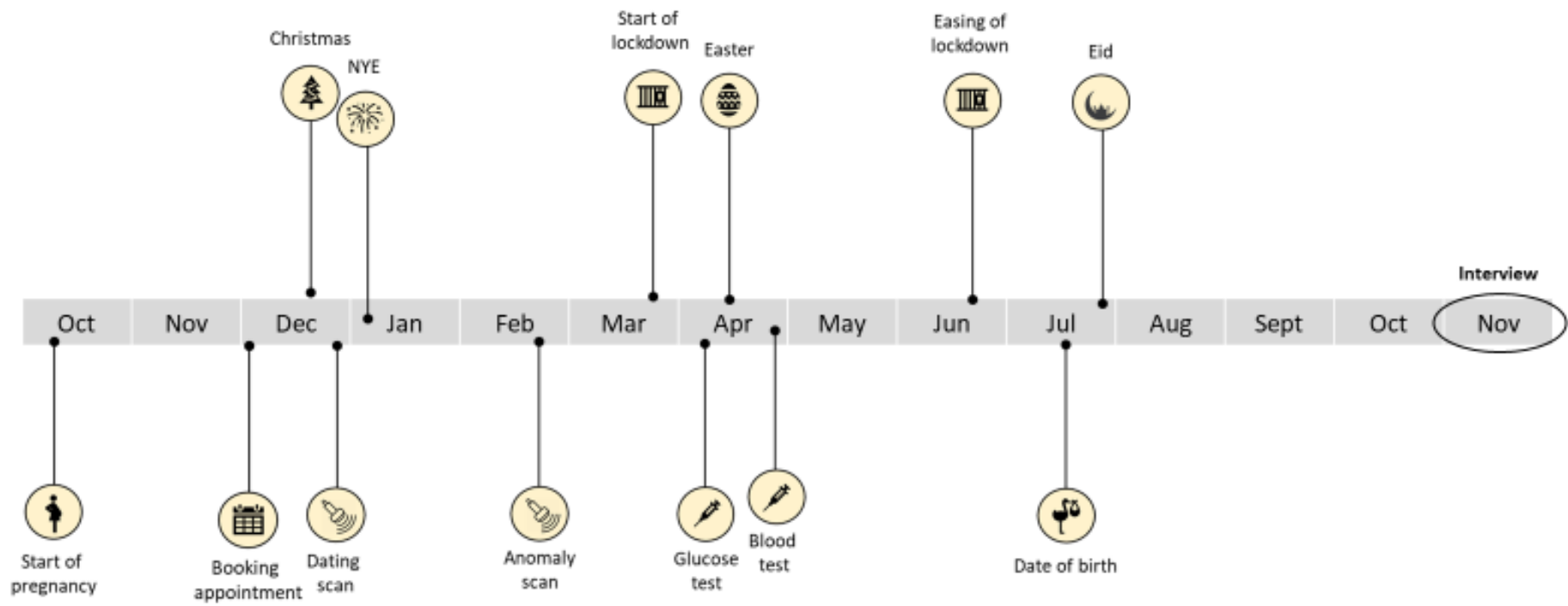
Figure 7.1. Visual timeline example

All interviews were conducted by the lead researcher, who is a White female in her mid-thirties. At the time, the researcher was undertaking a PhD, although had prior experience in qualitative methods. No prior relationship was established with participants prior to the interviews taking place, and no information or characteristics were disclosed about the researcher beyond name and occupation, with the exception of one participant who had been introduced to the researcher by a mutual contact.

Ethical approval was obtained from the University of Manchester Ethics Committee (2020-9584-16317) (see Appendix U for approvals).

7.3.3. Analysis

Data were analysed thematically according to the six steps outlined by Braun and Clarke (2006), using NVivo 12 Plus (QSR International Pty Ltd, 2018). An inductive approach was taken. In the first phase of the analysis, the lead author familiarised herself with the raw data before applying initial codes, line-by-line, to all data (phase two). These codes were then reviewed and refined. The codes were initially organised by phase of pregnancy that they related to. Following discussion and joint interpretation of the data with the research team, the revised codes were then grouped to form thematic categories (phase three) and organised to create a hierarchical thematic 'map' (phase four). This thematic map was subsequently revised and reorganised as appropriate, and the theme names defined (phase five). The themes were further refined during the write-up phase of the analysis (phase six). Analysis of completed interviews was conducted alongside ongoing data collection to allow for refinements to the interview schedule, although no major changes were made, and to assess the richness and sufficiency of the data in relation to the original research question (Braun & Clarke, 2021).

7.4. Results

Interviews were conducted with 25 women and lasted an average of 44 minutes (range 30–60 minutes). Participants were between 25-43 years old (mean=34) and were between 5-24 weeks postpartum (mean=15 weeks). Participant ethnicities included White British (n=18, 72%), Other White (n=3, 12%), Mixed/Multiple ethnic groups (n=3, 12%), and Asian/Asian British (n=1, 4%), which is reflective of the population in England and Wales (Office for National Statistics, 2015). Most participants were primiparous (n=14, 56%), married (n=18, 72%), and in full-time employment either at the time of the interview, or prior to going on maternity leave (n=15, 60%). Most participants had achieved a postgraduate qualification (n=16, 64%). Level of deprivation within the sample, as measured using Index of Multiple Deprivation (IMD) quintiles (Ministry of Housing Communities & Local Government, 2019), was varied, however most participants (n=10, 40%) lived in the least deprived areas in the country. Most participants also fell into the healthy weight BMI category (n=13, 52%). Participant characteristics are presented in Table 7.1.

Five themes were generated from the data that reflect various factors influencing eating behaviour throughout pregnancy. These themes are entitled 'The preconceptual self', 'A desire for good health', 'Retaining control', 'Relaxing into pregnancy', and 'The lived environment' (see Figure 7.2 for thematic diagram). Participant quotes are presented within the text to illustrate these themes. A summary of the barriers and facilitators to healthy eating behaviour identified within the themes, as related to specific stages of pregnancy, is presented in Table 7.2.

Table 7.1. Participant characteristics

Characteristics	All participants (n=25)
Mean age in years (range)	34 (25-43)
Mean weeks postnatal (range)	15 (5-24)
Number of children	
1	14 (56%)
2	10 (40%)
3+	1 (4%)
Ethnic group	
Asian/Asian British	1 (4%)
Mixed/Multiple ethnic groups	3 (12%)
White British	18 (72%)
Other White	3 (12%)
Marital status †	
Single	1 (4%)
In a relationship	5 (20%)
Married	18 (72%)
Employment status	
Full-time	15 (60%)
Part-time	9 (36%)
Unemployed	1 (4%)
Education level	
Postgraduate education	16 (64%)
Higher education	9 (36%)
Levels of neighbourhood deprivation † *	
1 (most deprived 20%)	2 (8%)
2	3 (12%)
3	4 (16%)
4	7 (28%)
5 (least deprived 20%)	3 (12%)
BMI category (kg/m^2) † **	
Obese (30-39.9)	3 (12%)
Overweight (25 -29.9)	8 (32%)
Healthy weight (18.5 – 24.9)	13 (52%)

† Total ≠ 25 as data not provided by every participant
*Based on IMD quintiles (Ministry of Housing Communities & Local Government, 2019)
**Based on NICE guidance (NICE, 2014b)
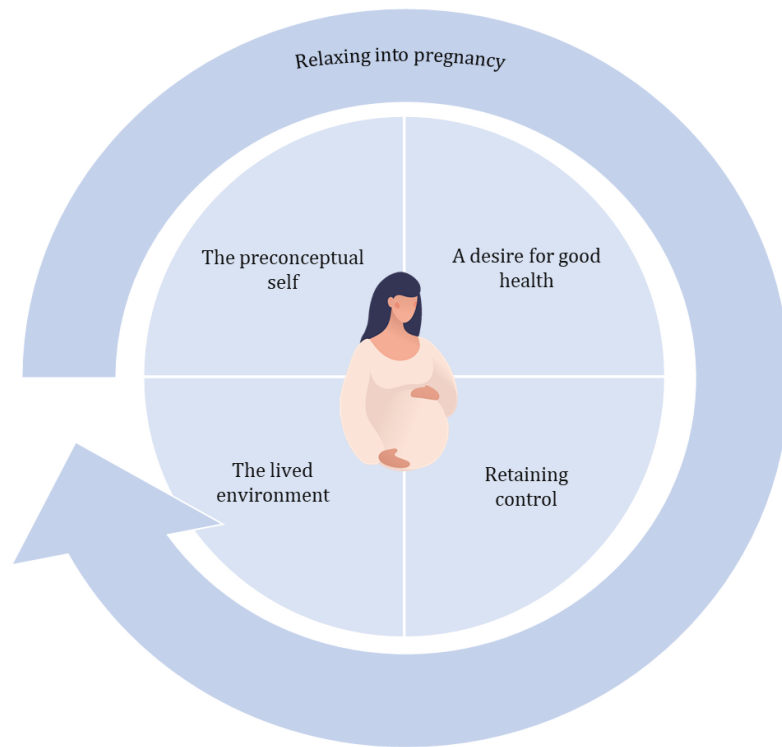
Figure 7.2. Thematic diagram

Table 7.2. Summary of barriers and facilitators to healthy eating behaviour specific to the stages of pregnancy

	Barriers	**Facilitators**
Early-pregnancy	• Physical symptoms	• Heightened anxiety, especially for those who had previously suffered pregnancy loss or complications
Mid-pregnancy	• Feeling back to normal/reduced physical symptoms • Being visibly pregnant • Eating for two • Receiving healthy scan/test results	• Feeling back to normal/reduced physical symptoms • Increased connectedness with the pregnancy • Receiving healthy scan/test results
Late-pregnancy	• Anxiety surrounding birth plans • Being visibly pregnant • Eating for two • Feeling fed up/the physical burden of pregnancy • Belief baby will not be affected by food choices so late in pregnancy • Receiving healthy scan/test results	• Feeling back to normal/reduced physical symptoms • Concerns about gestational weight gain • Thinking about future postnatal health • Upcoming glucose test • Receiving healthy scan/test results

7.4.1. The preconceptual self

Throughout pregnancy, women's decisions about their eating were influenced to some degree by established preconceptual factors. These included their pre-conceptual identity, their previous pregnancy experiences (or lack thereof), and their established eating behaviours.

7.4.1.1. Pre-conceptual identity

Women's preconceptual identity impacted on the decisions they made about their eating in both positive and negative ways. This included their self-image (e.g., as a *"healthy person"* or a *"thin person"* [P6]), their occupation (e.g., in a healthcare setting), interests (e.g., science, nutrition), and attitudes, all of which facilitated healthy choices. Cultural heritage also played into some women's food preferences and choices, which could sometimes lead to less healthy decisions.

> *"I'm from a French background, you know. I can bet you my grandmother didn't give up camembert and red wine when she was pregnant, and her children turned out fine, so [laughs], you know, I'm afraid to say, I indulged a little bit"* (P1)

7.4.1.2. Previous pregnancy experience

The experience of a prior pregnancy could act as both a barrier or a facilitator to healthy eating. Women who had previously experienced undesirable pregnancy outcomes (e.g., surgical delivery due to high birthweight) were often keen to make healthy choices to avoid similar experiences. Likewise, some women were keen to replicate positive pregnancy experiences, such as gaining limited weight, and this also acted to facilitate healthy eating.

Women felt more confident in their ability to manage their diets in subsequent pregnancies. However, reduced anxiety and reduced novelty or excitement

surrounding these pregnancies sometimes encouraged a more relaxed approach to eating, including the consumption of 'unsafe' foods.

> *"I just think I wasn't as anxious about being pregnant as I was the first time because obviously it's new the first time you're doing it and the second time, it's a typical second child syndrome, isn't it? Where you're like, oh – not you don't care as much but you're just a bit more relaxed" (P16)*

Multiparous women were keen to model healthy eating behaviours for existing children, and to stay healthy in order to care for them. Consuming sufficient calories to support breastfeeding was also important to those also nursing young babies. However, looking after small children could also prevent making healthy choices, particularly when women were time-poor, or using food-related activities to entertain them (e.g., baking).

> *"It was things like apple and peanut butter in the day or, you know, throw in some butter with my broccoli at lunch. Things that I'd be happy if he were to say, "Can I have some?" I'd go, yeah. That would have existed before the pregnancy because that's just part of our family culture" (P8)*

7.4.1.3. Established eating behaviours

The way in which women ate prior to becoming pregnant was typically sustained throughout pregnancy. Women's food choices were also dictated by pre-existing medical conditions, medical family history, or existing intolerances. Some women reported having problematic relationships with food prior to getting pregnant, owing to pre-existing weight concerns and/or a history of dieting or disordered eating. This sometimes led to increased consciousness and control around food, or alternatively, increased relaxation and unrestrained eating.

"I think, [it] was maybe tied in a little bit to like previously having an eating disorder and previously having very controlled eating [...] There was part of me that, I suppose, felt like, oh, I'm eating for two. You know, this is my chance to eat whatever I want and not worry about it..." (p6)

7.4.2. A desire for good health

A desire to support the health of their baby, as well as their own health, was a factor that influenced eating behaviour throughout women's pregnancies. These desires were often driven by risk perceptions and related concerns, which could result in anxiety and heightened emotions.

7.4.2.1. Health of the baby

The first twelve weeks of pregnancy could be particularly anxiety-inducing, especially for women who had previously suffered pregnancy complications or loss. During this early stage, concerns about nutrition and food safety, and risk of pregnancy loss encouraged women to make positive changes to their eating behaviour. As their pregnancies progressed, women's concerns often turned to the results of upcoming scans and tests (e.g., the glucose test), which prompted some women to alter their diet by omitting sugary foods.

"I thought that if I had a week where I didn't have any kind of chocolate or cakes [...] that when I came to do the glucose test I wouldn't have any of those things in my system" (P15)

More generally throughout pregnancy, women cited concerns about causing harm to the baby, about the baby's development, and about pregnancy conditions or complications. This motivated some women to make more healthy food choices and/or to ensure they followed advice and recommendations relating to the consumption of 'unsafe' foods. However, the extent to which women adhered to professional advice was influenced by their own risk perceptions.

To further support their baby's development, women also reported making a conscious effort to eat certain foods for the nutritional properties, or to avoid the development of allergies (e.g., avoiding certain nuts). Women reported increasing consumption of foods such as spinach or red meat to increase iron levels or increasing milk consumption for the calcium content. Similarly, some women were keen to facilitate future breastfeeding by gaining an 'appropriate' amount of weight or changing the types of foods eaten to encourage milk production.

> *"…I breastfed my first baby for a year. And I had a really good milk supply and I ate porridge every day and I pretty much ate spinach every day as well. And so I was like, I need to start eating my porridge and spinach again" (P10)*

7.4.2.2. Health of the mother

Their own health and wellbeing was also an important consideration for women throughout pregnancy. Dietary changes were sometimes made to relieve fatigue or ease water retention, by consuming additional calories or carbohydrates, or by reducing salt and increasing water intake, respectively. Shielding during the COVID-19 pandemic heightened perceived risk for some women who were motivated to make healthy choices in response. In some cases, unhealthy foods were perceived to serve an important role in supporting personal health.

> *"This is something that is maintaining my health [laughs], even though it's chocolate and, er, pastries and things like that" (P8)*

Concerns about gestational weight gain and postnatal weight retention sometimes encouraged deliberate food restriction. As women progressed into the latter stages of pregnancy, these worries heightened for some, as they became more self-conscious of their growing bodies. At this stage, women also began to think about the impact of their diet on their postnatal health and

functioning. For some, a perceived benefit to maintaining a healthy diet in late-pregnancy was the potential for a healthy diet to support post-birth recovery, both mentally and physically. Towards the end of their pregnancies, women reported introducing foods into their diet thought to be beneficial for uterine health, such as raspberry leaf tea, or foods thought to help induce labour, such as pineapple or curry.

> *"By that stage, I was trying all sorts of things, as you do, eating dates, because they're supposed to shorten the cervix, and drinking red raspberry leaf tea by the gallon" (P1)*

Women's mental and emotional health also acted to influence eating behaviour throughout pregnancy. A sense of wellbeing and feeling *"healthy"* [P23] motivated some women to make heathier choices, whereas negative emotional states (e.g., feeling anxious, stressed, tired, bored) were reported to encourage poorer food choices and 'comfort eating'. Higher levels of stress and anxiety were reported in early- and late-pregnancy. In early-pregnancy, increased anxiety acted to heighten the protective behaviours of some women (i.e., avoidance of 'unsafe' foods). In late-pregnancy, anxiety could be trigged by the uncertainty surrounding birth plans due to COVID-19 restrictions. In response, some women reported altering their behaviour, often in an unhealthy direction.

> *"… there were points where I had relatives texting me, saying, 'Are you going to be able to have your home birth? They've suspended it in our bit of the country,' you know. So, the stress of that was certainly a factor in having baked goods around…" (P1)*

7.4.3. Retaining control

Women perceived a lack of control in varying aspects of their lives throughout their pregnancies. As such, they were keen to retain control over their eating behaviour and as a facet of that, to proactively seek information and reassurance.

7.4.3.1. Control

Whilst women had little influence over the physical changes taking place in their bodies, as well as the changing COVID-19 landscape, maintaining a healthy diet allowed them to retain a sense of control. This was something that endured throughout pregnancy for many women. This desire for control was especially important to those who had previously experienced pregnancy complications or loss, as well as to those who described having a natural inclination to control aspects of their lives. However, for some women this desire to control resulted in restrictive eating behaviours.

> *"You can't control a lot of things in pregnancy. You can't control, you know, whether you feel sick or you feel tired, but you can control, I guess, your food intake and what's therefore being transferred to the baby…" (P2)*

7.4.3.2. Seeking information and reassurance

In line with their desire to retain control, some women were keen to make informed decisions about their eating by challenging lay advice and seeking out information themselves. Women reported using sources such as social media, books, podcasts, apps, and websites, to aid their decision-making. However, some women reported having difficulty in obtaining information about culturally specific foods (e.g., traditional Chinese food) or assessing food safety risk while abroad. Confusing or contradictory information sometimes encouraged a more relaxed approach to decision-making about certain foods.

> *"…the more I read, the more conflicting advice I found […] I think in the end I just thought, I'm just going to eat my normal healthy diet, it'll be fine, you know" (P1)*

Women also relied upon information and advice from health professionals (e.g., midwives, mental health professionals) and NHS guidance. The NHS website in particular, was a highly valued resource, above all others. Receiving

professional support provided women with reassurance to maintain current eating behaviours (whether healthy or unhealthy), as did receiving healthy scan and test results, although this also motivated positive behaviour change for some.

> *"…but for the health and safety kind of things, I do tend to use the NHS because I trust them more" (P12)*

Receiving additional support whilst being under the care of a specialist clinic (e.g., rainbow clinic[7]) acted as an additional driver for some women to make improvements to their eating behaviour. However, women reported experiencing a decline in motivation where insufficient professional support or advice was provided. This issue was compounded by the lack of face-to-face contact during lockdown. Some multiparous women believed they received limited support from health professionals, based on the assumption they had existing knowledge from their prior pregnancies.

> *"…there was definitely a lack of – a real fall off of motivation because it was just like they [health professionals] don't even care" (P8)*

7.4.4. Relaxing into pregnancy

Women's experience of eating during pregnancy was influenced by their changing physical and emotional state. Faced with physical pregnancy symptoms in early-pregnancy, women tried their best to 'weather the storm'. However, as their pregnancies progressed, many experienced a return to 'normal' in terms of their physical symptoms and an increased sense of connectedness and confidence surrounding their pregnancy. This often encouraged women to loosen the reins on their eating behaviour.

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[7] A rainbow clinic is a specialist antenatal service providing care for women who have previously experienced a stillbirth or neonatal death (see Tommy's, 2021).

7.4.4.1. Weathering the storm

Physical symptoms such as nausea and sickness, were frequently cited as a barrier to healthy eating in early-pregnancy. Whilst some women experienced only mild symptoms, others reported feeling out of control during this time, eating only what they were able to *"keep down"* [P6]. Women described being unable to do anything other than surrender to how they were feeling during this time.

> *"Yeah, I couldn't stop – literally, I'd got no control over – I was out of control. Like not like crazy out of control, but I had no control - 'cos the taste in my mouth, that and the sickness controlled everything, absolutely everything" (p3)*

In navigating this period of pregnancy, women allowed themselves to be guided by their intuition, by listening to their body, and responding to what they perceived to be their needs or those of the baby. The understanding that the symptoms should be transient allowed women to accept the changes to their eating behaviour and relinquish control, although some women reported feelings of guilt at not having been able to consume a nutrient-rich diet.

> *"...so yeah, just sort of went into the pregnancy and said, 'Whatever my body needs to do, my body will do. I'll go with that and then I'll sort the damage out after'" (P3)*

Whilst sickness and nausea often improved over time, some women experienced these symptoms throughout the entirety of their pregnancy. Heartburn and fatigue were frequently experienced in the later stages of pregnancy, acting as an additional barrier to healthy eating in mid– to late-pregnancy.

"So a lot of the choices that I was making between I would have thought maybe twenty-six weeks and thirty weeks, those few weeks, were more so to do with what's not going to give me heartburn, rather than what's the healthier option" (P15)

7.4.4.2. A return to normal

By mid-pregnancy, the severity of physical symptoms lessened for many women, allowing them greater freedom and control over their eating behaviour. Women reported feeling *"back to normal"* [P24] and most like their pre-pregnancy selves. In some cases, women described forgetting or focusing less on their pregnancy during this stage, which could make it more challenging to make healthy choices. Increased energy levels during this phase facilitated home cooking and/or a reduction in snacking. As such, some women took this opportunity to compensate for poor eating behaviours earlier in pregnancy.

"...I think I allowed myself this time to just sort of get through the first trimester and do what you've got to do [...] I thought, right, I need to make up for it now and I definitely did make more of an effort to be healthy" (P25)

7.4.4.3. Connectedness and confidence

As their pregnancies progressed past the 12-week point and into mid-pregnancy, women described feeling more connected with their baby and the idea of being pregnant. This was driven by progressing past what was perceived to be the *"point of no return"* [P24] with regards to termination, by finding out the sex of the baby, starting to feel the baby moving, and/or becoming visibly pregnant. This enhanced connectedness encouraged some women to modify their eating behaviour in positive ways.

"Yes, that was the key thing, and I thought, if I get to twenty weeks, you know, he could probably survive. And it wasn't until then – I mean, I wasn't silly with my diet, like I said, but it was that scan that made me sort of – made it all real, I suppose" (P19)

Women's increased confidence in the viability of their pregnancy was reinforced by healthy antenatal appointments or scans throughout the remainder of the pregnancy. As a result, some women relaxed, or maintained, their eating behaviour, confident in the knowledge their pregnancy was progressing well. As they reached the final stages of pregnancy, this sense of confidence continued to grow, which encouraged some women to become *"complacent"* [(P23)] with their eating behaviour.

7.4.4.4. Loosening the reins

Being pregnant acted as justification for some women to relax their attitude towards their food choices, with some claiming to be *"eating for two"* [(P6)], frequently occurring in mid- to late-pregnancy. The development of a visible bump provided justification for increased intake and more indulgent food choices, and served as a visible indicator to others of their pregnant status. Some women believed that any undesirable outcomes related to their unhealthy diet could be rectified in the postnatal period by resuming healthy habits.

Compensatory rationales were often used throughout pregnancy to justify unhealthy changes in eating behaviour, based on the principle that these choices did not matter if they had been physically active or made otherwise *"good"* [(P14)] food choices. Similarly, food was sometimes used as a replacement for alcohol where women were unable to join in with others who were drinking socially.

Eating behaviours were further relaxed during the latter stages of pregnancy, as women neared their due date. The physical burden of a full-term pregnancy rendered women tired and *"fed up"* [(P12)] which lowered their resolve to maintain

healthy habits. At that stage in pregnancy, some women believed the baby would no longer be affected by their food choices.

> *"…I got to twenty weeks and then loosened the reins a little bit on that. I definitely went through the second half of the second trimester, and the third trimester, was a lot more loose with what I was eating" (P15)*

The desire to relax their eating behaviours was sometimes driven by a desire to embrace their changing body, an experience that was described as *"empowering"* [(P15)] and providing a sense of *"freedom"* [(P15)] from societal body standards. Learning that their gestational weight gain was not as great as expected also provided reassurance and encouraged the maintenance or further relaxation of their diets.

7.4.5. The lived environment

Beyond the physical and emotional influences women reported throughout their pregnancy, factors within their lived environment acted to facilitate and hinder healthy eating behaviour, including both the physical environment and norms and judgement experienced in the social environment.

7.4.5.1. The physical environment

Women reported living busy lives whereby convenience foods were sometimes relied upon. The ready availability of unhealthy foods in and around their physical environment encouraged less healthy food choices, particularly whilst at home during lockdown. However, lockdown eliminated the temptation to purchase food during the working day, or to dine out in the evenings, which somewhat restricted the potential for unhealthy food choices. Accordingly, when food establishments re-opened, some women were keen to support local businesses and to take advantage of the government's 'eat out to help out' scheme (Hutton, 2020), which sometimes meant making less healthy choices.

"...working from home there's always an opportunity to eat. So yeah, I think lockdown very much had an impact on me eating more during pregnancy because it was so readily available" (P21)

Being at home during lockdown and having a structured routine allowed some women to better focus on being healthy and controlled with the food they prepared. However, food shopping during the pandemic hindered healthy eating intentions where women made rushed decisions whilst visiting the supermarket, if others were doing the food shop on their behalf, or where online shopping made it difficult to check the 'safety' of some food items. During this time, food was also reported to be used as an activity in-and-of-itself or a *"treat"* [P11], and was sometimes used to punctuate points of the working day or week, which could lead to less healthy choices.

"...[when] I feel like I was at my healthiest was probably during that period because we were eating three times a day, and we were eating probably not so massive portions either..." (P16)

More generally, seasonal events, such as holidays and religious festivals, were reported to reduce healthy eating, although the start of a new year encouraged positive changes. The weather was also reported to affect food choices, with hot weather encouraging lighter meal choices (e.g., salads) or reduced intake, and cooler temperatures calling for more *"comforting"* [P12] meals (e.g., casseroles). The prospect of wearing more revealing clothes in hot weather also motivated healthy eating for some.

7.4.5.2. Social norms and judgement

For many women, their eating behaviour was influenced by the opinions and behaviours of others, which often endured throughout pregnancy. Where those around them supported or encouraged their eating behaviour, whether it be healthy or unhealthy, this could influence food choices. In particular, women's partner's eating behaviour, their opinions, and involvement in meal preparation

and decision-making, were reported to heavily influence women's food choices, in both positive and negative ways.

"... he's constantly buying me treats, and it's really nice but also I'm constantly eating the treats because, you know, I've not got the willpower to not eat them if they're there, [...] So yeah, that definitely played a part as well in what I ate, I think" (P14)

The behaviour of other pregnant women was often used as a comparator to their own and to justify food choices. For example, learning that other women had consumed unhealthy diets but gone on to have a healthy pregnancy provided a sense of reassurance for some women about their own diets. Conversely, learning of others' unhealthy behaviours or negative pregnancy outcomes sometimes acted as a motivator to improve their own behaviour.

"[I] joined a WhatsApp group with other local mums – and they would post things like, 'Oh, I've had McDonald's for breakfast' or 'I've just had a massive Yule log' and I'm like, oh, I'm okay to have a piece of cake, you know" (P23)

Knowing inherently that eating unhealthily was *"not the right thing to be doing"* [P5], some women feared ridicule from family, or judgement from health professionals based on concerns for the baby's health. Relatedly, some women viewed the lack of social interaction experienced during lockdown, and potential for judgement, as an opportunity to indulge themselves whilst being protected from the gaze of others, should they gain weight. Similarly, for women in early-pregnancy, it came as some relief to be at home without work colleagues present to observe unusual eating patterns that might otherwise reveal their pregnant status.

"When I was nauseous, I would have like – eat crackers to like settle my stomach. And working from home was really good for that... You know, I felt like, because I was at home, I didn't have to hide that kind of behaviour" (P6)

7.5. Discussion

This study identified five overarching themes that reflect the different factors influencing women's eating behaviour throughout pregnancy. These themes capture, at a broad level, influences that are present throughout the entirety of pregnancy. However, there is nuance that reflects barriers and facilitators to healthy eating behaviour specific to certain stages of pregnancy. Moreover, the findings suggest that certain stages of pregnancy create more salient opportunities for behaviour change. For example, sickness and nausea during the early stage of pregnancy is a key barrier to healthy eating, however from mid-pregnancy onwards, a reduction in symptoms and increased sense of connectivity with the pregnancy facilitates healthy change. Therefore, mid-pregnancy provides a window-of-opportunity when women may be more receptive to health promotional advice and are more physically capable of making healthy changes. These findings support previous research which has suggested that behaviour change interventions should be tailored to pregnancy stage to enhance efficacy (Rockliffe et al., 2022).

Within the data it was also evident that individual antenatal events sometimes motivate healthy changes. For example, women reported altering their diets in advance of their glucose test. This finding supports claims made by Olander et al. (2016) who argue that there may be several individual teachable moments that occur throughout a woman's pregnancy journey. This contrasts with the conceptualisation of pregnancy as one teachable moment in-and-of-itself (Atkinson et al., 2016; Phelan, 2010). However, for some women, receiving healthy test results acted as a barrier to change, as they felt reassured their baby was healthy. This highlights the bidirectional nature of some of the factors identified.

The findings demonstrate that factors influencing behaviour change during pregnancy are nuanced and emphasise the dynamic and changeable nature of pregnancy as a health event, on both a physical and psychological level. Both the COM-B and TM models (McBride et al., 2003; Michie et al., 2011) present

heuristics that suggests the mechanisms underpinning behaviour change occur simultaneously, which therefore limits the extent to which these models can be applied within the context of pregnancy (Rockliffe et al., 2022).

Regardless, the influencing factors identified in the analysis are reflected, to some extent, in the psychological constructs of both models. The COM-B model fully reflects the factors identified in this study, likely due to the fact the model is a general behaviour system designed to be applied to various contexts (Michie et al., 2011). However, several factors identified in this study are absent from the TM model heuristic. These include the physical environment, aspects of the social environment, and the influence of pregnancy symptoms. This is consistent with what has previously been reported in the literature (Rockliffe et al., 2021b). However, the findings from the current study build on this, by also identifying established eating behaviour as additional factor not otherwise reflected in the TM model, which is a facet of women's preconceptual identity.

Limited research has explored the influence of preconceptual identity on antenatal health behaviours, however, previous studies have highlighted the importance of identity more generally on eating behaviour. In particular, research has found that viewing oneself as a 'healthy eater' can predict healthy eating behaviour (Brouwer & Mosack, 2015; Carfora et al., 2016; Strachan & Brawley, 2009). This is consistent with our findings, which suggested that a 'healthy eater' identity facilitated healthy behaviours during pregnancy. Past behaviour and self-identity have also been identified as two key psychological constructs influencing eating behaviour (Canova et al., 2020; Carfora et al., 2016), which further supports our findings. Research has also found that past behaviour can predict future eating behaviour, which is in line with our findings that suggest that established eating behaviour and previous pregnancy experiences influenced antenatal eating behaviour (Canova et al., 2020; Carfora et al., 2016; Evans et al., 2017).

These findings highlight the role of the 'self' in understanding eating behaviour. Whilst the TM model suggests that a redefinition in self-concept or social role is

a key psychological mechanism underpinning behavioural change, the findings from this study consider that established identity and behaviour, rather than a redefinition per se, may also play an important role in influencing behaviour. As such, the development of a pregnancy-specific model of behaviour change including a construct that reflects preconceptual identity, or the 'self', would be particularly valuable.

7.5.1. Strengths and limitations

This study provides new insight into the variety of influences on women's eating behaviour throughout pregnancy, as well as stage-specific influences. However, there are several limitations that should be acknowledged. The participants included in the sample were mainly women from White British backgrounds, all of whom had completed higher or postgraduate education, which may indicate self-selection bias. These similarities in demographic characteristics mean that the findings of this study may not reflect the experiences of women from other backgrounds or identify influencing factors specific to those groups of women. For example, women from Black and Asian ethnic backgrounds report experiencing issues with communication and relationships with healthcare providers (Khan, 2021), which may impact on their willingness to seek support regarding diet and nutrition, as well as limit the scope for health professionals to support behaviour change during routine consultations.

Many of the participants reported that they valued having a healthy diet. It may be the case that social desirability bias affected the way in which participants responded to the interview questions, as healthy eating can be viewed as an external demonstration of 'good mothering' (Atkinson et al., 2016) and admitting to the contrary may therefore feel socially unacceptable to some women (Meeussen & Van Laar, 2018; Staneva et al., 2017). These altered narratives mean that key influences may have been missed in the current study. Alternatively, self-selection bias may have meant that women with healthier diets were more motivated to participate in a study about eating behaviour.

Failing to capture the experiences of women with less healthy diets however limits our understanding of the broad range of factors influencing different women. For this reason, it will be important for future work to sample purposively to ensure recruitment of a more diverse sample of women in order to overcome these issues.

An additional consideration is that many of the participants in this study were pregnant throughout lockdown. Women's pregnancy experiences during this period will be unique, in relation to the practical aspects of their pregnancy (e.g., attending antenatal appointments alone, birth plans), as well as the psychological and emotional aspects (Lebel et al., 2020; Qi et al., 2020). Whilst it is unclear to what extent this will have impacted on the eating behaviour of the participants who took part in this study, other research has reported changes in the dietary intake of pregnant women during this time (Whitaker et al., 2021; Zhang, Zhang, et al., 2020). It is therefore important to keep this in mind when interpreting the findings.

7.5.2. Implications for theory and clinical practice

The findings from this study have implications for the delivery and timing of interventions in both research and clinical practice. Whilst much of the clinical guidance in antenatal care fails to consider the impact of timing in health promotion (NICE, 2021a), our findings suggest that certain stages of pregnancy, or antenatal events, may provide more opportune moments for health professionals to intervene and deliver health promotional advice. For example, during mid-pregnancy, when women have restored physical capability to eat healthily. Furthermore, maintaining an awareness of women's preconceptual identity (i.e., understanding existing lifestyles and behaviours) may enable health professionals to better support women. Alternatively, encouraging a change in health identity (e.g., as a 'healthy eater') has been suggested to be a potentially effective approach to support women in improving their eating behaviour and sustaining these changes in the long-term (Morris et al., 2020). Going forward, enhanced recommendations are necessary to better support

health professionals to provide appropriate advice, matched to the different stages of pregnancy.

From a theoretical perspective, the study findings highlight the limitations of both the TM model and COM-B model when applied to the context of pregnancy. The changeable nature of pregnancy and potential for different stages to create more salient teachable moments is at odds with the static view of behaviour change afforded by existing models. Furthermore, the TM model failed to account for several factors identified as influencing eating behaviour. This emphasises the need for the development of an enhanced pregnancy-specific model of behaviour change, that considers the unique and dynamic nature of pregnancy as a health event.

7.5.3. Conclusions

During pregnancy, certain stages, or antenatal events, provide more salient opportunities for behaviour change, than others. Existing models of teachable moments fail to account for the changeable nature of pregnancy, as well as the influence of the lived environment, pregnancy symptoms, and established eating behaviour. These findings provide a direction for how to adapt existing theory in order to develop an enhanced pregnancy-specific model of behaviour change. In clinical practice, it will be important to consider the different barriers and facilitators presenting throughout the antenatal period and for health promotional advice to be matched to pregnancy stage, where possible.

CHAPTER EIGHT

8. Theory development

8.1. Chapter overview

In this chapter, the development of a pregnancy-specific model of behaviour change is reported. The rationale for developing this model is provided and the key findings and theoretical considerations for each of the four studies within this thesis are summarised. The process of developing and designing the model is then described, including the key design considerations and the process of developing and defining the model constructs. Finally, the model heuristic is depicted.

8.2. Introduction

Using theory in intervention development is necessary in order to target causal factors of behaviour and to understand methods of change and the pathways through which change may occur (Bartholomew & Mullen, 2011; Michie et al., 2008). The Medical Research Council (MRC), NICE, and the National Institute for Health Research (NIHR) all recommend the inclusion of theory in behaviour change interventions (NICE, 2014a; Skivington et al., 2021). However, this guidance is often overlooked and as such, behavioural interventions trialled in clinical settings are frequently unsuccessful at changing target behaviour or affecting primary outcomes (Brown et al., 2012; Coleman et al., 2012; Currie et al., 2013; Dodd et al., 2008; Flannery et al., 2019; Kennelly et al., 2018). The importance of developing and utilising relevant theory is therefore paramount.

Within the context of pregnancy, a specific model of behaviour change does not exist. Interventions that utilise theory within antenatal settings therefore rely on models that have not been developed in this context, and that until this point, have remained largely untested within pregnant populations. It is crucial that interventions designed to support maternal behaviour change are underpinned by not only theory, but theory specific to the context in which it is applied. As such, there is an urgent need to develop a pregnancy-specific model

of health behaviour change that can be used effectively to inform clinical interventions and better support women during pregnancy.

The overarching aim of this thesis was to understand pregnancy as a teachable moment by developing a pregnancy-specific model of health behaviour change. To achieve this, four studies were conducted, all of which aimed to provide an understanding of antenatal health behaviour change, two of which also examined the utility of existing behavioural models within the context of pregnancy. The first two studies in the thesis focused on a range of behaviours, whilst the latter two focused on eating behaviour only. The findings from these four studies are synthesised within this chapter, to contribute to an enhanced understanding of pregnancy as a teachable moment for health behaviour change and the development of a pregnancy-specific model, within the context of eating behaviour.

8.3. Key findings and theoretical considerations

8.3.1. Study one: Systematic review

The systematic review and meta-synthesis identified a myriad of internal and external factors that influence dietary behaviour, physical activity, smoking, and alcohol use during pregnancy. These factors were captured within three broad themes that reflected women's experiences or perceptions of antenatal health behaviour change. These themes were entitled 'A time to think about me', 'Adopting the 'good mother' role', and 'Beyond mother and baby'.

The factors identified as influencing behaviour change were reflected, to some extent, by the psychological constructs of the TM model. For example, the sub-theme entitled 'knowledge, understanding, and advice', relates to the 'risk perceptions and outcome expectancies' construct, whilst the theme 'adopting the 'good mother' role' could be seen reflected in the 'redefinition of self-concept or social role' construct of the model. Based on these findings, these constructs appear to be useful elements of the TM model that can be applied to pregnancy. Furthermore, the themes identified reflect both intrinsic and

extrinsic motivations, as defined in Self-Determination Theory (SDT; Ryan & Deci, 2000). This has implications for theory development as intrinsic motivation can result in improved performance of a target behaviour (Ryan & Deci, 2000).

A key finding from this study was that the influencing factors related to all four behaviours, to some extent. In terms of theory development, this is an important finding, as it suggests that a model may not need to be behaviour-specific if the same factors influence several different behaviours. Similarly, developing a theory that *is* behaviour-specific may be usefully applied to different health behaviours if the relevant influencing factors are targeted by the model constructs.

Another finding of interest was that some of the factors identified as influencing health behaviour could act as both a barrier and a facilitator to change (e.g., increased judgement and societal pressure encouraged some women to stop smoking, whilst for others it increased their desire to smoke) and some factors encouraged both healthy and unhealthy behaviours (e.g., perceived risk encouraged some women to improve their diets, whilst others ceased all physical activity). This bidirectional behaviour is not consistent with how the TM model constructs are proposed to work, as the authors claim that the greater the extent to which each of the constructs are acted upon, the greater the likelihood of a teachable moment occurring. This may be specific to pregnancy and highlights the importance of considering individual differences in behaviour change. As such, it will be advantageous to consider this in the development of a pregnancy-specific model.

8.3.2. Study two: Theoretical mapping exercise

The findings from the theoretical mapping exercise revealed that the COM-B and TM models were limited when applied to the context of pregnancy, although both offer valuable insight for the development of a pregnancy-specific model. All of the nine sub-themes generated from the first study mapped to the

constructs of the COM-B model, suggesting that all constructs play a role in directing behaviour. However, three of the nine sub-themes did not map to the constructs of the TM model, highlighting a gap in the model. These unmapped sub-themes reflected non-psychological factors, including social influences, practical and environmental influences, and physical pregnancy symptoms. The addition of model constructs that reflect these external factors would therefore be valuable. Despite this, it was evident that the TM model provided a superior conceptual understanding of pregnancy as a teachable moment than the COM-B model. This is likely due to the fact that the TM model *is* a model of teachable moments that is situation-specific, whereas the COM-B model is a general 'behaviour change system' that is behaviour-specific (Michie et al., 2011).

Of those non-psychological factors, pregnancy symptoms were identified as a factor that will often change across gestation. For example, symptoms of sickness and nausea often subside after the first twelve weeks (Bustos et al., 2017). Both the COM-B and TM models present heuristics that suggest that the mechanisms underpinning behaviour change occur simultaneously, limiting the extent to which these models can be used to understand pregnancy as a teachable moment. The role of timing in antenatal behaviour change is something that warrants further investigation, however considering timing within the development of a new behavioural model would contribute important insight that is specific to the pregnancy experience.

Some overlap between the psychological constructs of each model was observed in the analysis. For example, the same sub-themes mapped to the automatic motivation construct of the COM-B model as to the 'increased emotional or affective response' component of the TM model, and the same sub-themes that mapped to the psychological capability component of the COM-B model also mapped to the 'risk perceptions and outcome expectancies' component of the TM model. This finding was reassuring, as it suggests a level of congruence between aspects of both models and highlights these as constructs that may be important to incorporate in a pregnancy-specific model.

An additional finding of interest was that for each of the models there were certain constructs to which a larger proportion of the sub-themes were mapped (i.e., more sub-themes mapped to the motivation constructs of the COM-B model, than to the capability or opportunity constructs). This may suggest that certain model constructs play a bigger role in directing behaviour than others, although future research will be required to explore this.

8.3.3. Study three: Longitudinal cohort study

The findings from the longitudinal cohort study revealed that neither the COM-B model nor TM model provide a satisfactory understanding of pregnancy as a teachable moment for behaviour change, within the context of eating behaviour. Small changes were observed in eating behaviour and the model constructs over the time period studied. Whilst this suggests that there may be some fluidity in the extent to which these constructs are experienced throughout pregnancy, these findings were not clinically meaningful and as such, do not contribute useful insight for theory development.

The analysis revealed that the COM-B model explained more of the variance in eating behaviour than the TM model. This supports the findings from the second study, which found that all sub-themes from the systematic review could be mapped to the constructs of the COM-B model, compared with the TM model which failed to capture three sub-themes. However, the COM-B model is a general behaviour system designed to be applied to various contexts (Michie et al., 2011), which may be the reason the model explained more of the variance.

An association was not found between the motivation construct of the COM-B model and eating behaviour, which supports the claims made by Olander et al. (2016) that the COM-B model may offer a more meaningful explanation of pregnancy as a teachable moment, by moving beyond the concept of motivation as the primary driver for behaviour change. Accordingly, an association was not found between the 'risk perceptions and outcome expectancies' construct and

'redefinition of self-concept or social role' construct of the TM model and eating behaviour, as these have been suggested to reflect motivational changes (Olander et al., 2016). Understanding that the role of motivation may not be as salient as the role of capability or opportunity in directing women's eating behaviour is an important finding that will add value to a pregnancy-specific model. However, this finding is in contrast to those of the first two studies, which identified both intrinsic and extrinsic motivations as influencing behaviour, all of which mapped to the motivation construct of the COM-B model. Furthermore, a greater proportion of sub-themes mapped to the motivation construct than to capability or opportunity. This discrepancy is difficult to reconcile but may be due to the fact that the mapping exercise was based on an analysis focusing on four health behaviours, whereas the third study focused on eating behaviour alone. Motivation may therefore play a greater role in physical activity or smoking behaviours, for example, than it does eating.

Importantly, the COM-B model and TM model were found to explain the most variance in eating behaviour in early-pregnancy and late-pregnancy, compared to mid-pregnancy and the postnatal period. This suggests that certain stages of pregnancy might provide more opportune moments for behaviour change than others. This has important implications for the development of a pregnancy-specific model, as considering the impact of timing will facilitate the delivery of more appropriately timed interventions, which may better support women to improve their health behaviour. These findings support those of the second study and further highlight the inadequacy of the COM-B and TM models to provide a meaningful understanding of pregnancy as a teachable moment. This is due to the assumption that the mechanisms underpinning behaviour change occur simultaneously.

8.3.4. Study four: Interview study

The findings from the interview study identified five themes that reflect factors influencing women's eating behaviour throughout pregnancy. These were

entitled 'The preconceptual self', 'A desire for good health', 'Retaining control', 'The lived environment', and 'Relaxing into pregnancy'. The findings suggested that mid-pregnancy may provide a more salient opportunity for eating behaviour change than other stages of pregnancy. Individual antenatal events, such as the glucose monitoring test, were also identified as prompting behaviour change for some women. These findings are in line with those of studies two and three, both of which highlighted the role of timing as an influence on behavioural change during pregnancy. The findings from this study built upon this, to identify more clearly which stages of pregnancy provide more salient opportunities for change, and the various factors influencing behaviour across the gestational period. These findings further reinforced the limitations of the COM-B and TM models by failing to account for the changeable nature of influencing factors during pregnancy.

Similarly to the findings of the systematic review, some of the factors identified in this study had a bidirectional influence on eating behaviour. For example, receiving healthy scan and test results encouraged some women to maintain existing healthy eating behaviours, whereas others reported relaxing their eating habits, safe in the knowledge their baby was healthy. This is an important feature of behaviour change in the context of pregnancy and one that will be important to consider in the development of a pregnancy-specific model, as previously discussed.

8.3.4.1. Theoretical mapping exercise

Based on the findings from the interview study, a second theoretical mapping exercise was conducted, to further understand the way in which pregnancy may act as a teachable moment for health behaviour change. Using a deductive approach, the sub-themes generated in the analysis were mapped to the individual constructs of the COM-B and TM models, utilising the same approach adopted in the second study.

This task was carried out independently by the PhD candidate (LR) and one supervisor (DS). The results of both mapping exercises were then compared and contrasted to assess congruence. Where there were discrepancies or disagreements, this was resolved through discussion and by reflecting on personal interpretations of the sub-themes and/or model constructs. A final version of the mapping was then agreed upon, which is presented in Figures 8.1 and 8.2.

The mapping exercise revealed that all of the sub-themes were adequately reflected in the constructs of the COM-B model, similarly to the findings from the second study. However, the sub-themes 'weathering the storm', 'the physical environment', and aspects of 'social norms and judgement', did not map to the TM model, which is in line with previous findings. 'Established eating behaviours' was also not accounted for in the TM model, which was not reflected in the mapping from study two. Established eating behaviours are a facet of preconceptual identity. Whilst McBride et al. (2003) suggest that a redefinition in social role or self-image is a key psychological construct underpinning the creation of teachable moments, the interview findings suggest that preconceptual identity and past behaviour have an enduring influence on behaviour throughout pregnancy. This is therefore important to consider in the development of a pregnancy-specific model.

Whilst not included in the final manuscript, this exercise corroborated the findings from study two and generated additional insight into the role of past behaviour and identity, and the failure of existing models to account for these influences. Thus, increasing understanding about the applicability of the COM-B and TM models in the context of pregnancy, using different data.

Behaviour

Capability → Motivation ← Opportunity

Physical

4.1. Weathering the storm

4.2. A return to normal

Psychological

3.1. Control

3.2. Seeking information & reassurance

Automatic

1.1. Preconceptual identity

1.2. Previous pregnancy experience

1.3. established eating behaviours

4.4. Loosening the reins

Reflective

2.1. Health of the baby

2.2. Health of the mother

3.1. Control

4.3. Connectedness & confidence

4.4. Loosening the reins

Social

5.2. Social norms & judgement

Physical

3.2. Seeking information & reassurance

5.1. The physical environment

- - - - represents a sub-theme that has been mapped to multiple constructs

Figure 8.1. Mapping of sub-themes to the COM-B model constructs

4.3. Connectedness & confidence

4.4. Loosening the reins

Increased affective or emotional response

1.2. Previous pregnancy experience

2.1. Health of the baby

2.2. Health of the mother

Risk perceptions and outcome expectancies

3.1. Control

3.2. Seeking information & reassurance

4.2. A return to normal

Cueing event

Redefinition of self-concept or social role

1.1. Preconceptual identity

1.2. Previous pregnancy experience

4.3. Connectedness & confidence

5.2. Social norms & judgement

- - - - represents a sub-theme that has been mapped to multiple constructs

Sub-themes not mapped to the model

1.3. Established eating behaviours

4.1. Weathering the storm

5.1. The physical environment

Aspects of sub-themes not mapped to the model
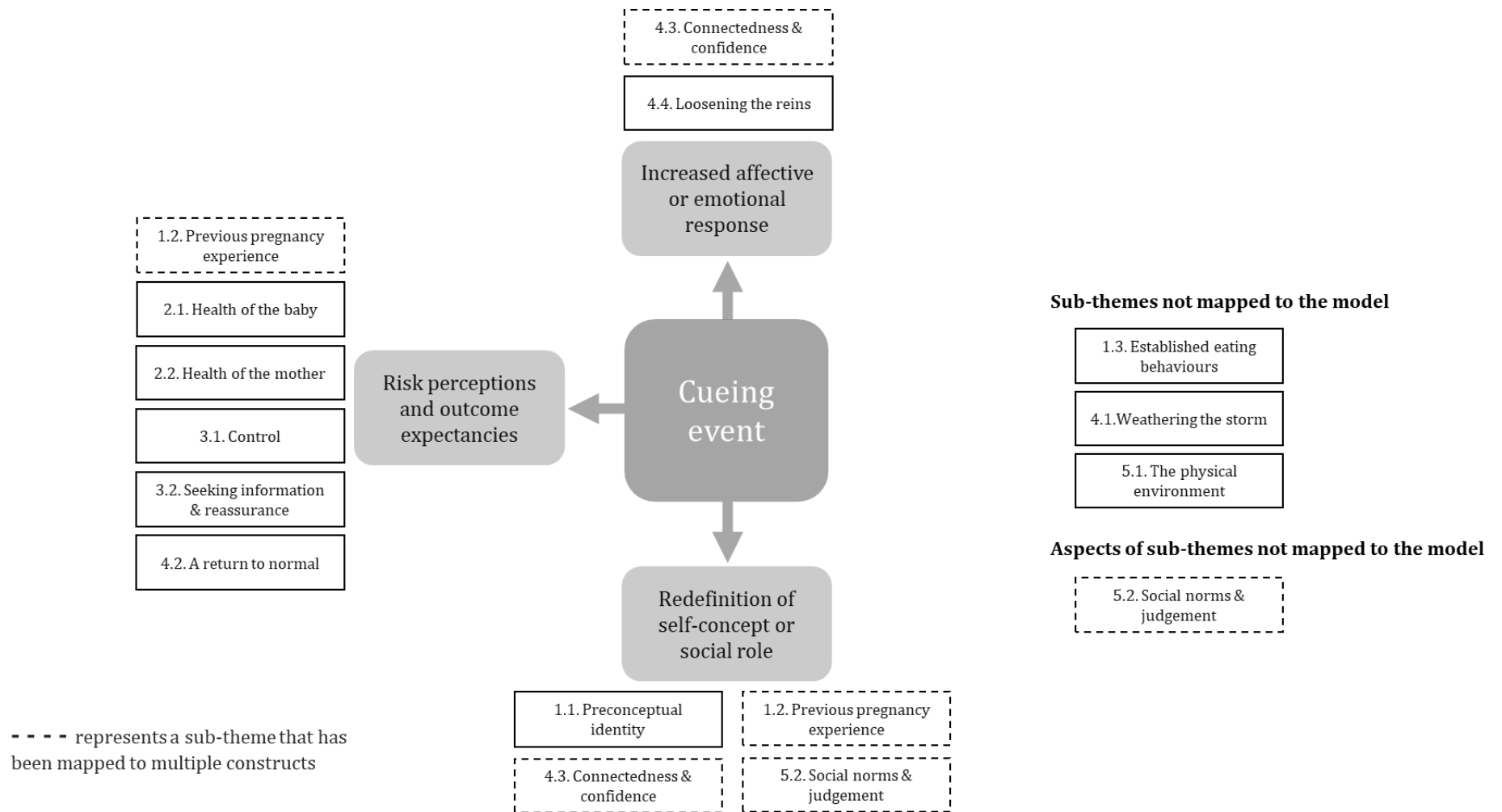
5.2. Social norms & judgement

Figure 8.2. Mapping of sub-themes to the TM model constructs

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An overview of the key findings from all four studies and related theoretical considerations are presented in Table 8.1. An overview of the strengths and weaknesses of both the COM-B model and TM model when applied to the context of pregnancy, based on the study findings, is presented in Table 8.2.

Table 8.1. Overview of key study findings and theoretical considerations

Study	Key findings and theoretical considerations
Study one: Systematic review	• The factors identified reflected some of the TM model constructs, such as 'redefinition of self-concept or social role' and 'risk perceptions and outcome expectancies' • The findings revealed both extrinsic and intrinsic motivations for behaviour change • The influencing factors identified from the analysis applied to all four behaviours to some extent • In some cases, the same factors acted as barriers and facilitators to different women, or encouraged healthy and unhealthy behaviour
Study two: Theoretical mapping exercise	• All sub-themes mapped to the COM-B model • Three sub-themes did not map to the TM model. These were all non-psychological factors • Both models are limited when applied to the context of pregnancy • The TM model provides a more conceptual understanding of pregnancy as a teachable moment than the COM-B model • Neither model accounts for the changing salience of factors influencing health behaviour • The TM model does not explain the bidirectionality of some behaviours • Overlap of constructs was observed between models (i.e., automatic motivation and emotional response; psychological capability and risk perceptions) • More sub-themes mapped to certain model constructs than others

Study	Key findings and theoretical considerations
Study three: Longitudinal cohort study	- The COM-B model explained more variance in eating behaviour than the TM model - Neither model provides a satisfactory explanation of eating behaviour during pregnancy - More variance in eating behaviour was explained in early- and late-pregnancy than in mid-pregnancy or the postnatal period - Small changes observed in the psychological constructs suggest there may be some fluidity in the extent to which these constructs are experienced throughout pregnancy - Neither the COM-B model nor TM model account for changes in the salience of their respective constructs - No association was found between motivation and eating behaviour
Study four: Interview study	- Certain stages of pregnancy, or individual antenatal events, may provide more salient opportunities for change, than others - Some factors identified had a bidirectional influence on eating behaviour - Pregnancy is a dynamic process which neither the COM-B nor TM models account for - The COM-B model fully reflected the sub-themes generated from the analysis - The TM model failed to capture several sub-themes - Preconceptual identity and past behaviour may play an important role in directing behaviour

Table 8.2. Overview of relative strengths and weaknesses of the COM-B and TM models as applied to the context of pregnancy

Study	Behavioural context	TM model	COM-B model
Study one: Systematic review	Dietary behaviour, physical activity, smoking, alcohol use	• 'Redefinition of self-concept or social role', and 'risk perceptions and outcome expectancies' were reflected in the findings	• Not discussed

Study two: Theoretical mapping exercise	Dietary behaviour, physical activity, smoking, alcohol use	• Provides a more conceptual understanding of pregnancy as a teachable moment
		• Failed to account for three sub-themes that reflect:
		  ○ Physical symptoms
		  ○ Practical & environmental influences
		  ○ Social influences
		• Fails to account for bidirectionality of behaviours
		• Does not account for changing salience of constructs
			• All sub-themes mapped
			• Lacks a conceptual understanding of pregnancy
			• Does not account for changing salience of constructs

Study three: Longitudinal cohort study	Eating behaviour	• Explained the most variance in eating behaviour in early- and late-pregnancy • Explained less of the variance in eating behaviour than the COM-B model • Only positive affect was associated with eating behaviour	• Explained a greater proportion of the variance in eating behaviour than the TM model • Explained the most variance in eating behaviour in early- and late-pregnancy • Motivation was not associated with eating behaviour

Study four: Interview study	Eating behaviour	• Failed to account for four sub-themes that reflect:
		  ○ Physical symptoms
		  ○ Past behaviour
		  ○ The physical environment
		  ○ Social influences
		• Does not account for changing salience of constructs
			• All sub-themes mapped
			• Does not account for changing salience of constructs

8.4. Designing a pregnancy-specific model of behaviour change

Having summarised the central findings and theoretical implications from the respective studies, the key considerations for the design of a pregnancy-specific model (referred to as the PS model from hereon) were identified and are presented below.

8.4.1. Key design considerations

8.4.1.1. Construct integration

Taken together, the findings from the previous studies suggest that all constructs of both the COM-B and TM models provide a valuable contribution to understanding pregnancy as a teachable moment for health behaviour change. All constructs should therefore be incorporated, in some form, in the PS model.

8.4.1.2. Conceptual foundations

Whilst the importance of incorporating the existing model constructs in the PS model has been determined, the study findings suggest that a key limitation of the COM-B model, when applied to the pregnancy context, was its generalised design and lack of conceptual understanding relating to the teachable moment concept. The TM model, whilst providing a superior conceptual understanding of teachable moments, is not specific to pregnancy. One of the most important design considerations therefore, is for the PS model to provide an enhanced conceptual understanding of pregnancy as a teachable moment for health behaviour change.

8.4.1.3. Behavioural context

The first two studies in this thesis focused on dietary behaviour, physical activity, smoking, and alcohol use. However, studies three and four narrowed the scope by focusing on eating behaviour alone, for reasons previously

discussed. Given that all empirical understanding in this thesis was gained in the context of eating behaviour, a key feature of the PS model is its basis in this health behaviour. This is similar to the TM model which was developed in the context of a single heath behaviour; smoking cessation. Whilst it will be important to consider the applicability of the PS model to other health behaviours, McBride et al. (2003) have argued that focusing on a single behaviour in this way facilitates comparison across studies and enables testing to assess whether teachable moments exist for other behavioural outcomes.

8.4.1.4. Role of motivation

The findings from the third study suggested that the role of motivation may not be as salient as the role of capability or opportunity in directing women's eating behaviour during pregnancy. The PS model should therefore reflect this by removing motivation as a central construct and considering whether it co-exists alongside other psychological domains and how it may manifest during pregnancy.

8.4.1.5. Directionality of behaviour

As previously discussed, the findings from the first study revealed that influencing factors reflected by the TM model constructs were sometimes bidirectional in nature. This is in contrast with the suggestion that the greater the extent the constructs are acted upon, the greater the likelihood of a teachable moment occurring (McBride et al., 2003). This suggests that a bidirectional model is necessary within the context of pregnancy. The model constructs proposed within the PS model will therefore be theorised to influence behaviour in both negative and positive directions.

8.4.1.6. Role of timing

A key finding from the previous studies was the importance of timing in relation to behaviour change and the delivery of behavioural interventions. For example,

certain stages of pregnancy (e.g., mid-pregnancy), or antenatal events (e.g., the oral glucose monitoring test), may afford more salient opportunities for change than others. It is therefore important to incorporate the concept of timing in the design of the PS model, in order to meaningfully reflect the pregnancy experience and the process of behaviour change during this period.

8.4.2. Developing the model constructs

8.4.2.1. Mapping the COM-B model and TM model constructs

The first step in developing the constructs for the PS model involved exploring the extent to which the COM-B model and TM model constructs overlapped and mapped on to one another. Based on the original model descriptions and the knowledge and insight gained throughout the thesis, a mapping exercise was undertaken by LR which revealed that all the TM model constructs mapped to the constructs of the COM-B model.

8.4.2.2. Re-mapping study findings

To assess the appropriateness of the construct mapping, the sub-themes used in the previous two mapping exercises were grouped under the model constructs to which they were previously mapped. This exercise aimed to assess whether there was cohesion and thematic similarity between the combined sub-themes and constructs. To illustrate; 'risk perceptions and outcome expectancies' (TM model) was mapped to the psychological capability construct (COM-B model). If this was appropriate, the sub-themes mapped to both these constructs would all reflect themes surrounding knowledge, understanding, risk, and information seeking, for example. The results of this exercise revealed that the grouped sub-themes were all broadly consistent and formed a cohesive 'story' relevant to the pregnancy experience.

8.4.2.3. Conceptualisation of constructs

The final step in developing the model constructs involved reflecting on the COM-B model and TM model constructs and the re-mapped sub-themes, to generate an enhanced conceptual understanding of the constructs influencing antenatal health behaviour. Based on this process, six new constructs were generated that reflected physical changes, knowledge acquisition, the social milieu, the lived environment and lifestyle, sense of identity, and risk negotiation.

This mapping exercise is depicted in Table 8.3.

Table 8.3. Mapping exercise used to develop the PS model constructs

Redefined constructs	▪ **Physical changes**	▪ **Knowledge acquisition**	▪ **Social milieu**	▪ **Lived environment & lifestyle**	▪ **Sense of identity**	▪ **Risk negotiation**
COM-B model constructs	▪ Capability (physical)	▪ Capability (psychological)	▪ Opportunity (social)	▪ Opportunity (physical)	▪ Motivation (automatic)	▪ Motivation (reflective)
TM model constructs		▪ Risk perceptions & outcome expectancies			▪ Increased affective or emotional response ▪ Redefinition of self-concept or social role	▪ Risk perceptions & outcome expectancies
Sub-themes from the study two mapping exercise	▪ A desire for good health	▪ A desire for good health ▪ Driven by the health of the baby ▪ Knowledge, understanding, & advice	▪ Driven by roles & expectations ▪ Social influences	▪ Practical & environmental influences	▪ A desire to self-indulge ▪ A desire to retain ownership over body & behaviour ▪ A desire for good health ▪ Driven by the health of the baby ▪ Driven by roles & expectations ▪ Driven by pre-pregnancy attitudes & behaviours	▪ A desire to self-indulge ▪ A desire to retain ownership over body & behaviour ▪ A desire for good health ▪ Driven by the health of the baby ▪ Knowledge, understanding, & advice
Sub-themes from the study four mapping exercise	▪ Weathering the storm ▪ A return to normal	▪ Previous pregnancy experience ▪ Health of the baby ▪ Health of the mother ▪ Control ▪ Seeking information & reassurance ▪ A return to normal	▪ Social norms & judgement	▪ Seeking information & reassurance ▪ The physical environment	▪ Preconceptional identity ▪ Previous pregnancy experience ▪ Established eating behaviours ▪ Connectedness & confidence ▪ Loosening the reins ▪ Social norms & judgement	▪ Previous pregnancy experience ▪ Health of the baby ▪ Health of the mother ▪ Control ▪ Seeking information & reassurance ▪ A return to normal ▪ Connectedness & confidence ▪ Loosening the reins

8.4.3. Defining the model constructs

8.4.3.1. Physical changes

This construct reflects women's experiences of physical bodily changes and pregnancy-related symptoms which may alter their health behaviour, or the absence of these influences, which may facilitate healthy behaviours. In the context of eating behaviour, this might include appetite changes and food aversions, sickness, nausea, or heartburn.

8.4.3.2. Knowledge acquisition

This construct reflects the influence of knowledge and information seeking about health behaviours on women's decision-making. This includes the influence of different sources of information women may rely upon, including that provided by health professionals. This construct also reflects women's interpretation and understanding of information they receive about behaviour change, and the influence of that on their behaviour.

8.4.3.3. Social milieu

This construct reflects two distinct aspects of social influence on women's health behaviour; the influence of women's social relationships and interactions, and the influence of social roles and expectations. The influence of social relationships and interactions on health behaviour includes the level of support women have available, social norms, and the behaviour of those around them. The influence of social roles and expectations includes perceptions of societal pressure to adhere to the 'good mother' role, and relatedly, fear of judgment and stigma where women's behaviour is not perceived to align with societal standards.

8.4.3.4. Lived environment and lifestyle

This construct reflects the influence of women's experiences of their lived environments and lifestyle on their health behaviour. This includes the extent to which the physical environment promotes un/healthy behaviour, for example the availability of un/healthy food options, or accessibility of appropriate support services. It also includes the influence of professional support accessed opportunistically through routine antenatal appointments. Lifestyle factors such as time constraints, financial considerations, convenience, and practical issues (e.g., food shopping, the weather) are also reflected within this construct.

8.4.3.5. Sense of identity

This construct reflects the influence of both enduring and evolving facets of identity on health behaviour. Enduring facets of identity include those established pre-pregnancy that continue to influence behaviour during the antenatal period (e.g., past behaviour and experiences). Evolving aspects of identity include changes that occur as women transition into motherhood and adopt the maternal role and responsibilities. Relatedly, this construct also reflects women's desire to retain control over changing aspects of their identity (e.g., bodily changes, changes to health behaviour), and the desire to prioritise their own physical and emotional needs.

8.4.3.6. Risk negotiation

This construct reflects the influence of perceived risk on women's health behaviour. This includes women's assessment and mitigation of risk based on a desire to protect both her own health and that of her baby, and the ebb and flow of risk perception throughout the pregnancy period. This construct also reflects women's desire to foster a sense of control in response to potential risks and associated behaviours such as information seeking or rejection of advice.

8.4.4. Depicting the model heuristic

Following the development of the model constructs, a visual heuristic was designed to illustrate the proposed behaviour change process, reflecting the six key constructs (see Figure 8.3). In this model, pregnancy is conceptualised as a teachable moment that is supported or hindered by the influence of the respective model constructs.

In the heuristic, the six model constructs are presented three times to reflect the element of timing in antenatal behaviour change, and the influence of the same constructs at different stages of pregnancy. These constructs may vary in salience between or within time-points, although further research is needed to explore this concept further, as previously discussed.

Similarly, the influence of these constructs may also differ for different antenatal events (e.g., booking appointment, glucose monitoring test). Whilst not incorporated in the current heuristic, the model could be tailored and applied to such events, to depict those that afford more salient opportunities for change.

It is important to highlight that the proposed model provides only a basis for understanding pregnancy as a teachable moment. It will be necessary to further develop the model and to explore its applicability in pregnant populations. In particular, a key consideration will be to explore individual differences and the influence of pregnancy history and socio-demographic characteristics on the utility of the model. Further discussion on this is provided in chapter nine.
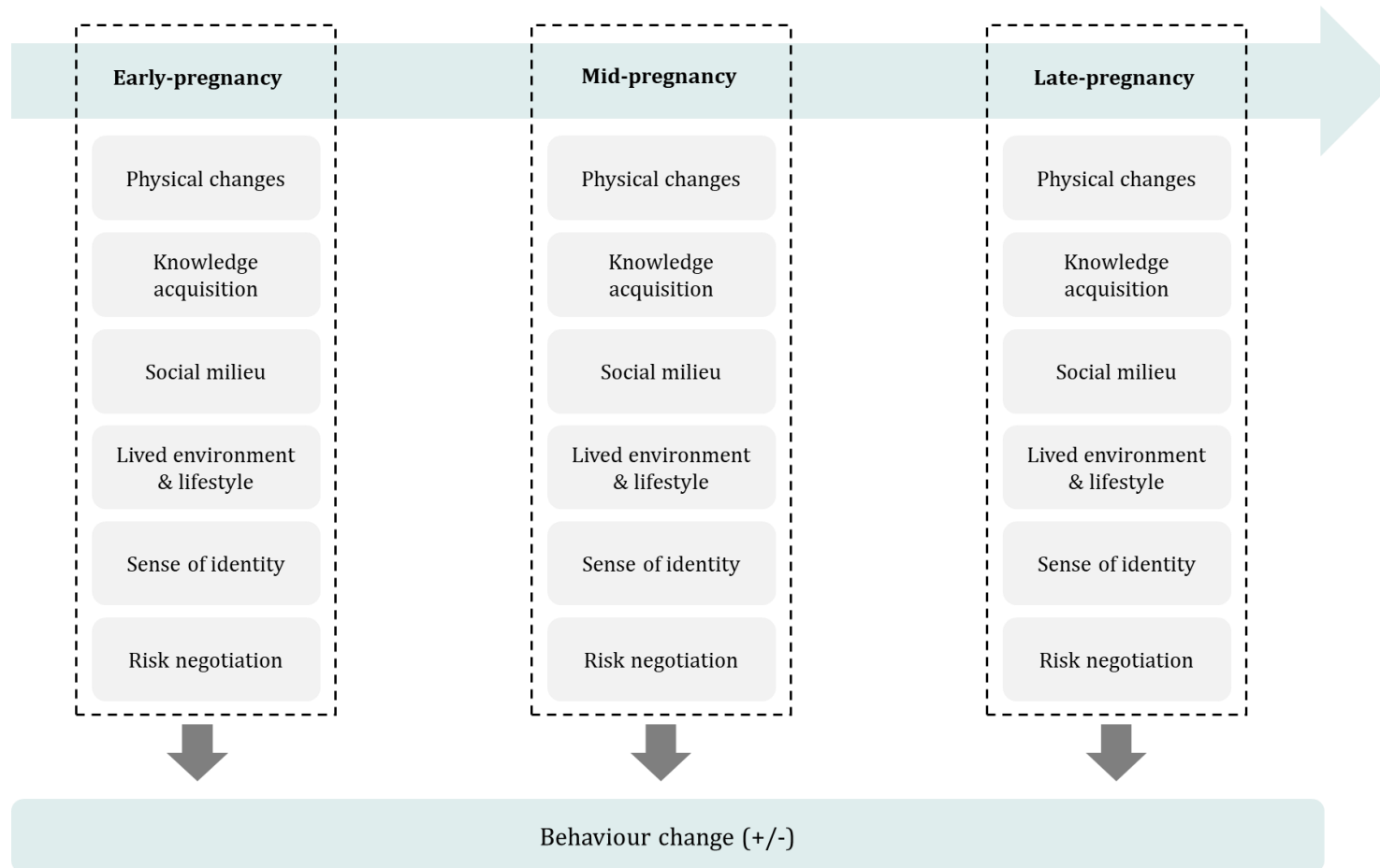
Figure 8.3. The pregnancy-specific (PS) model of health behaviour change

8.5. Chapter summary

This chapter provided the rationale for developing a pregnancy-specific model of health behaviour change, and described the key findings and theoretical considerations from each of the four studies comprised within this thesis. The development of a pregnancy-specific model of behaviour change was described, including the key design considerations and process of developing and defining the model constructs. Finally, the model heuristic was presented. A discussion of the PS model and the thesis more broadly, is provided in chapter nine.

CHAPTER NINE

9. Discussion

9.1. Chapter overview

A discussion of the overall thesis is presented within this chapter. The strengths and limitations of the PS model, and thesis as a whole, are highlighted and implications for clinical practice and future research directions are discussed.

9.2. Summary of key thesis findings

The aim of this thesis was to understand pregnancy as a teachable moment by developing a pregnancy-specific model of health behaviour change. To achieve this aim, four studies were conducted to explore the different influences on women's health behaviour throughout pregnancy, and to test existing models currently used to explain pregnancy as a teachable moment. These included a systematic review and meta-synthesis, a theoretical mapping exercise, a longitudinal cohort study, and an interview study. The findings from these studies were synthesised, and a pregnancy-specific (PS) model of behaviour change was designed and presented.

The PS model heuristic presents six constructs theorised to influence health behaviour change during pregnancy. These are physical changes, knowledge acquisition, the social milieu, the lived environment and lifestyle, sense of identity, and risk negotiation. The development of this model builds upon knowledge offered by existing models of teachable moments, namely the COM-B and TM models, by integrating their respective constructs and reconceptualising them using a pregnancy-focused lens.

The findings from this thesis advance understanding of antenatal behaviour change by underscoring the importance of providing appropriate support for women during pregnancy and the inadequacy of existing models to understand behaviour change during this time. The development of the PS model highlights the unique nature of pregnancy as a series of interrelated health events (rather

than a single event) and the nuanced factors influencing behaviour, not otherwise accounted for in currently accepted behavioural models.

This chapter provides a critical discussion of the four studies and model development, and considers the implications of the research beyond this thesis. An overview of the study strengths and limitations, clinical implications, and future research directions, as reported in the respective chapters, is presented in Table 9.1.

9.3. Strengths and limitations

The studies conducted as part of this thesis have generated novel insight into the phenomenon under investigation, advancing knowledge in this area. The research has been thorough and rigorous, and has employed a mixed methods approach, which has enhanced breadth and depth of understanding. The empirical studies in this thesis were informed by PPI input, which was an invaluable process that improved the readability and appropriateness of the materials, and strengthened the research by ensuring that the approaches taken were fitting and suitable for the target population.

Despite these strengths, there are several limitations that are important to recognise. Firstly, the PS model has been developed in the context of a single, pregnancy-related behaviour, namely eating behaviour. This has some advantages in that it more readily facilitates comparison across studies and enables the model to be tested to assess whether teachable moments exist in other behavioural contexts (McBride et al., 2003). The findings from the first study revealed that similar factors influenced four different behaviours (dietary behaviour, physical activity, smoking, and alcohol use), albeit to varying degrees, which suggests that a behaviour-specific model may potentially be relevant across several health behaviours. However, this may not necessarily be the case; the models upon which the PS model was based have been found to be more useful to explain certain behaviours over others. For example, the COM-B model has been found to be more useful for explaining physical activity than eating behaviour (Willmott et al., 2021), and the TM model is commonly used to

understand smoking behaviour, given that is the context in which it was developed (Baron et al., 2017; McBride et al., 2003, 2017). Without further inquiry, it is unknown whether the PS model can be applied to other areas of behaviour in pregnancy. As such, this should be prioritised as an avenue for future research, to determine the utility of the model within the context of other pregnancy-related and pregnancy-specific health behaviours. It will also be important to consider the size of the behavioural change being made. For example, in the context of pregnancy-related behaviours, ceasing consumption of alcohol may be a relatively small change for someone who drinks infrequently, whereas ceasing smoking cigarettes for someone addicted to nicotine may present very different barriers to change.

Another limitation is the lack of ethnic diversity of participants in studies three and four. Ninety-two percent and 72% of participants, respectively, were from a White background, despite adopting a purposive recruitment approach in study four. Whilst 86% of residents in England and Wales identify as White (Office for National Statistics, 2015), participants in the third study exceeded this. Individuals from non-White backgrounds are commonly understood to be hard-to-reach to recruit into research studies (Jutlla & Raghavan, 2017). This limits our ability to understand the experiences of women from non-White backgrounds and means that the quantitative findings cannot be generalised to women from other ethnic groups. This is problematic given that women from Black, Asian, and Minority Ethnic (BAME) backgrounds experience disparities in pregnancy outcomes and inequalities surrounding health professional communication and care (Khan, 2021; MBRRACE-UK, 2020). Advice received from health professionals has been highlighted as a factor influencing behaviour change in the previous studies and feeds into the 'knowledge acquisition' construct of the PS model. Furthermore, being at increased risk for poor pregnancy outcomes (MBRRACE-UK, 2020) may feed into feelings of worry and heightened risk perceptions, which were also identified as a key construct in the model. These are important issues that may impact negatively on women's health behaviour, which may not be reflected in the findings of this thesis.

In a similar vein, most of the participants in the empirical studies were well-educated and in full-time employment. Given that low educational attainment and unemployment are drivers of health inequalities in England (Marmot et al., 2020; MBRRACE-UK, 2020), it is important that the experiences of women from these backgrounds are reflected. As with the lack of ethnic diversity in the sample, an absence of representation from these groups of women limits the extent to which the study findings can be understood in a wider context. Specifically, women with lower educational levels might interpret health messages differently to those with higher levels of education (Lupattelli et al., 2014), which relates to the 'risk negotiation' and 'knowledge acquisition' constructs of the model. Alternatively, women who are unemployed or in part-time work may perceive greater barriers relating to the cost of healthy food, for example (Graham et al., 2016), which feeds into the 'lived environment and lifestyle' construct. These examples illustrate the necessity of ensuring the recruitment of diverse and representative samples, which should be prioritised in future studies.

Table 9.1. Overview of study strengths and limitations, clinical implications, and future research directions, as reported in the respective chapters

Study	Strengths	Limitations	Clinical implications	Future research recommendations
Study one: Systematic review	• Synthesised common findings from a disparate literature • The review protocol was pre-registered • Conducted rigorously, including non-English language studies and grey literature	• Response bias may have influenced the findings of the included studies • Theses and dissertations were included, which may be of lower quality than peer-reviewed articles • Individual variability (e.g., parity) may have affected the results • Cultural influences on health behaviour, or differences in healthcare advice, will have varied between countries	• Importance of taking a holistic approach to antenatal behaviour change by considering multiple internal and external factors influencing women's decision-making and motivation • Important to deliver clear, appropriate, and consistent behaviour change advice in clinical practice	• Importance of engaging partners in discussions surrounding lifestyle changes • Consider influence of social disadvantage and economic deprivation on health behaviour • Experiential differences between nulliparous and multiparous women • The extent to which influencing factors can be mapped to the COM-B and TM models • Further definition and investigation of the barriers and facilitators to behaviour change identified in the study

Study	Strengths	Limitations	Clinical implications	Future research recommendations
Study two: Theoretical mapping exercise	• Systematic approach to testing theory • Generation of novel findings	• Sub-themes were generated from an analysis focused on pregnancy-related behaviour only • Models may be better suited to understanding certain behaviours over others • The mapping exercise relied on subjective judgements of the authors • Limitations of the original review also have implications for interpreting the findings of this study	• No clinical implications were drawn from the findings of this study as it was focused entirely on the exploration and development of theory	• Longitudinal research to better understand how the models operate at different stages throughout pregnancy and to understand how much variance in behaviour each of the model constructs explain • Qualitative research to explore timing and different factors influencing health behaviour throughout pregnancy • Explore how the same factors can affect behaviour in different ways • Individual mapping tasks for each of the four behaviours included in the review • Explore the utility of the models in the context of other health behaviours

Study	Strengths	Limitations	Clinical implications	Future research recommendations
				• Development of a pregnancy-specific model of behaviour change
Study three: Longitudinal cohort study	• The first study to compare existing models of behaviour change in this context • Data collected from a large sample of participants • Produced new insight into the insufficiency of existing models when applied to pregnancy	• The majority of participants were from White British backgrounds • The study relied on the use of self-report measures • Recruitment took place between February and June 2020, during which time it was announced that pregnant women were a high-risk group for contracting COVID-19 (16/03/2020)	• Providing support around women's capability and opportunity to change their behaviour, rather than their motivation, may be beneficial • Importance of considering gestational stages when delivering behaviour change advice	• Explore how the salience of the model constructs change throughout pregnancy • To explore the utility of the COM-B and TM models to explain other health behaviours • Qualitative research to better understand the role of timing and influences on eating behaviour throughout pregnancy • Using a purposive recruitment approach to reach different ethnic groups • Development of a pregnancy-specific model of behaviour change

Study	Strengths	Limitations	Clinical implications	Future research recommendations
Study four: Interview study	• Provided new insight into influences on women's eating behaviour throughout pregnancy • Identified stage-specific influences on eating behaviour	• Participants were mainly highly educated women from White British backgrounds • Many participants valued having a healthy diet • Participants had been pregnant throughout lockdown	• Importance of considering timing when delivering behaviour change advice • Maintaining an awareness of women's preconceptual identity (i.e., understanding existing lifestyles and behaviours) • Encouraging a change in health identity (e.g., as a 'healthy eater') • Enhanced recommendations are necessary to better support health professionals to provide appropriate advice, matched to the different stages of pregnancy	• To reanalyse the data with a view to map individual antenatal events influencing eating behaviour to a pregnancy timeline • To sample purposively to ensure recruitment of a more diverse sample of women, in relation to ethnicity, education, and eating behaviour • Development of a pregnancy-specific model of behaviour change

9.4. Implications for clinical practice

The development of the PS model has various implications for clinical practice. The model provides a framework that can be used by health professionals to support routine clinical interactions that could inform health professionals' training, clinical care pathways, and the content of the information provided to women.

9.4.1. Routine clinical interactions

The six constructs of the PS model provide a structured framework for health professionals to consider when providing messaging about healthy behaviours during routine antenatal appointments and provide useful targets for providing intervention and support. For example, it may be advantageous to enquire about the severity of physical symptoms women are experiencing and the impact that might have on their health behaviour, as well as the amount of support they have available from those around them. Ensuring women are provided with adequate information to support behaviour change and assess risk appropriately, would also be beneficial. As would establishing the extent to which women's lifestyle and habits, and physical environment, might impact on their behaviour change efforts. In assessing these domains, tailored advice can be provided to better support women to improve their behaviour.

To support health professionals in effectively addressing each of the six model constructs in this context, a set of suggested recommendations have been developed, which are presented in Table 9.2. These recommendations are based on the Behaviour Change Techniques framework (BCTs; Michie et al., 2013), which provides a taxonomy of individual approaches that can be used to encourage behaviour change in various settings. For example, to address the construct 'risk negotiation', health professionals are recommended to communicate accurate information about risks associated with unhealthy behaviours, utilising the BCT of 'health consequences', as low risk perceptions can act as a barrier to change. Furthermore, it is recommended that health

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professionals raise women's awareness of the impact others' behaviour can have on their own, utilising the BCT of 'social and environmental consequences' to address the 'social milieu' construct of the PS model.

9.4.2. Health professionals training

In addition to providing a useful framework to refer to in routine practice, the PS model could be used to inform behaviour change training for health professionals who work with women during the antenatal period (e.g., midwives, obstetricians). For example, by providing a series of training workshops. Whilst all NHS organisations are required to provide training pathways that support health professionals to have opportunistic behaviour change conversations (see the MECC initiative; Public Health England et al., 2016), this approach has not been implemented consistently (Chisholm et al., 2018) and is not specific to pregnancy. Where training is provided, it may differ between Trusts, and on the healthcare professional and their role in the clinical care pathway. As such, many health professionals do not feel well-equipped to have conversations with women around behaviour change (Haighton et al., 2021; Keyworth et al., 2019) and missed opportunities occur during routine care (Keyworth et al., 2018). Designing and delivering training workshops or e-learning based on the PS model, would better equip health professionals to support women during routine clinical interactions, by increasing awareness of factors influencing antenatal behaviour change. Such training would also benefit health professionals by arming them with knowledge and strategies to address barriers to change (see Table 9.2 for recommendations).

9.4.3. Clinical care pathways

Whilst NICE (2021a) provides recommendations for when certain health behaviours should be discussed during the antenatal period, taking into consideration the timing and stage of a women's pregnancy, there is a lack of guidance as to the content of these conversations and how these might differ based on gestational stage. The PS model could therefore be used to develop

these recommendations. By providing guidance on tailoring the content of the conversations, focusing on key model constructs that are more salient at different stages of pregnancy, women may be better supported in changing their behaviour. This could also apply to specialist care pathways such as those for women with gestational diabetes and raised BMIs (NICE, 2010b, 2015). However, further work to develop the PS model in the context of timing is required, as is research to explore the utility of the model for groups of women on differing care pathways.

9.4.4. Timing of information provision

During the antenatal period, women are provided with a great deal of information, though the scope and type varies between maternity providers. The PS model could be used here to inform the timing of the provision of this information, to ensure women are provided with the most useful and appropriate information for their current stage of pregnancy. For example, women may be less receptive to information about healthy eating during early pregnancy, when they are more likely to experience nausea and sickness. Delivering this information during mid-pregnancy once these physical symptoms have eased, may result in higher levels of engagement and receptivity.

9.4.5. Key considerations

It is important to acknowledge that whilst the PS may provide a useful framework to inform various aspects of clinical practice, interactions with health professionals are often time-limited (Whitaker et al., 2016), which may act as a significant barrier to delivering interventions. As such, it may be advisable for health professionals to support women to identify the domains that are priorities for them to change, and to focus only on these throughout the course of their appointments. The 'continuity of carer' initiative within the NHS may support this approach (National Maternity Review, 2021) by regarding this intervention as an ongoing conversation, rather than a 'one-off' opportunity to

influence behavioural change. Further research will be beneficial to identify whether certain model constructs direct behaviour to a greater extent than others, which may aid with identification of appropriate targets for intervention in this context.

A further consideration is the applicability of the PS model to women with various pregnancy histories. In all of the studies, both nulliparous and multiparous women were included, as were those who had previously experienced pregnancy complications, such as miscarriage and stillbirth. However, findings from studies one, three, and four revealed that women's health behaviour can be influenced by both parity and experience of prior complications, such as these. For example, multiparous women with a history of uncomplicated pregnancies sometimes adopted a more relaxed approach to their eating behaviour in subsequent pregnancies. Conversely, women who had previously experienced pregnancy difficulties or complications were found to take a stricter approach to their food consumption, and experienced elevated levels of worry about the impact of their eating behaviour upon their own health and that of their baby. These findings are consistent with what has previously been reported in the literature (Hunter et al., 2017; Shapiro et al., 2017) and suggest that there are differences in the way in which these groups of women experience pregnancy and the psychological mechanisms directing behaviour. It is therefore vital that these factors are considered when discussing behaviour change with women.

For women with complicated pregnancy histories, their experience of worry or anxiety is often related to potential pregnancy outcomes, rather than the health behaviour itself. However, these emotions can drive behavioural changes, as a means to gain a sense of control or alleviate the emotions themselves. The thesis findings show that in this context, women often make positive changes to their eating behaviour, or to other areas of their health. However, the findings also revealed that these emotions can lead to food restriction or a reduction of physical activity.

The observed differences between groups of women has implications for theory development, intervention design, and clinical practice. Critically, a one-size-fits-all approach may be limited in effectiveness for women from certain groups. It is therefore important to consider the differing support needs of women with complicated pregnancy histories. Further testing and development of the PS model is necessary to determine how best to support these groups of women, but it may be beneficial to incorporate the provision of mental health support, in an attempt to reduce worry and anxiety (National Maternity Review, 2021; NHS England et al., 2018).

Table 9.2. Suggested recommendations to support routine clinical interactions

Model construct	Timing	BCTs informing suggested recommendations	Recommendations arising from findings
Physical changes	May be most salient during early- and late-pregnancy	• Social support (practical) • Problem solving/coping planning • Pharmacological support	• Professional expertise should be used to offer advice on managing physical symptoms
Knowledge acquisition		• Persuasive argument • Pros and cons • Comparative imagining of future outcomes • Instruction on how to perform a behaviour • Health consequences • Credible source	• Provide adequate information about performing the desired behaviour • Ensure women understand the benefits of adopting healthy behaviour not only for their baby, but also for themselves • Provision of resources (physical or online) • Highlight importance of credible sources
Social milieu		• Restructuring the social environment • Social and environmental consequences • Social support (emotional) • Social support (practical) • Social support (general)	• Increase awareness that the behaviour of others can influence their own, including that of their partner • Encourage discussions with family and friends surrounding making healthy changes, to facilitate support • Encourage women to attend antenatal appointments to receive appropriate support from relevant health professionals • Make suggestions for antenatal support groups and/or other peer support networks
Lived environment & lifestyle		• Social and environmental consequences • Restructuring the physical environment • Avoidance/changing exposure to cues for the behaviour	• Increase awareness of the influence that the home/work/social environment may have on women's behaviour • Facilitate problem solving to address barriers to healthy behaviours

Model construct	Timing	BCTs informing suggested recommendations	Recommendations arising from findings
Sense of identity		• Identification of self as role model • Identity associated with changed behaviour • Reframing • Discrepancy between current behaviour and goal standard	• Discuss changes to women's identity (e.g., as a new mother) • Highlight the opportunity to redefine oneself and change behaviour • Explore influence of established behaviours, to identify barriers
Risk negotiation	May be most salient during early-pregnancy (higher), especially for women who have previously experienced pregnancy complications or loss, and late-pregnancy (lower)	• Health consequences • Regulate negative emotions	• Ensure women understand risks associated with poor health behaviours, whilst providing support to address worries and anxieties

9.5. Recommendations for future research

9.5.1. PPI feedback

The PS model provides a useful framework to understand health behaviour change during pregnancy, within the context of eating behaviour. As the development of this model is in its infancy, the next step will be to seek feedback on the design of the model from members of a PPI group, to enhance the relevance and appropriateness of the model for pregnant women. Feedback should be purposively sought from women who were less represented in the development of the model such as women from BAME groups or socially deprived backgrounds.

9.5.2. Behavioural focus

After receiving PPI feedback, the model will need to be refined by testing it prospectively in a pregnant population, within the context of eating behaviour, to identify the extent to which the model constructs accurately conceptualise and reflect factors influencing health behaviour during this time. After establishing the utility of the model in the context of eating behaviour, it will be important to test the model in different behavioural contexts that are pregnancy-related, to establish whether the model is more or less applicable to certain health behaviours (e.g., cigarette smoking, alcohol consumption, physical activity) and to identify what modifications might be required. Similarly, it will be advantageous to explore the utility of the model in the context of pregnancy-specific behaviours, such as vitamin supplementation and dietary recommendations, for example. However, these behaviours are distinct to the pregnancy-related behaviours explored in this thesis, as they are temporary changes that arguably benefit the fetus, rather than the mother. As such, further exploratory research may be required to better understand factors influencing these behaviours, before modifying and testing the PS model.

9.5.3. Salience of model constructs

Another important area of research will be to investigate whether certain constructs of the PS model are more salient, or play a bigger role in directing behaviour, than others. In the PS model heuristic, all constructs are presented as equally weighted factors. However, the results of the mapping tasks undertaken in study two and study four, on which this model is based, revealed that more sub-themes mapped to some COM-B model and TM model constructs than others. This may indicate that certain constructs of the PS model play a more important role in directing behaviour than others and should be prioritised in intervention delivery. Further research will be necessary to fully explore this hypothesis.

9.5.4. Relationships between model constructs

It will also be important to determine whether relationships exist between the constructs of the PS model. For example, in the TM model, the key constructs are suggested to increase motivation, self-efficacy, and skills acquisition, which increases the likelihood of a teachable moment occurring. Similarly, the COM-B model depicts a process whereby capability, opportunity, and motivation interact, which then directs behaviour. Understanding this in the context of the PS model would allow for the development of more appropriately designed interventions which may need to target certain constructs before others. For example, it may be the case that 'knowledge acquisition' influences 'risk negotiation' and should be addressed first in clinical interactions.

9.5.5. Role of timing

Based on the study findings, the PS model has incorporated the element of timing into the model heuristic, providing a superior understanding of behaviour change during the antenatal period. However, this needs to be explored more thoroughly in relation to both gestational stages and individual antenatal events. A longitudinal approach could be used to assess the extent to

which the model constructs contribute to a target behaviour at a given time-point (either gestational stage or antenatal event), similarly to the approach taken in the third study. It may also be valuable to carry out work mapping individual antenatal events influencing health behaviour to a pregnancy timeline. This would provide enhanced insight as to whether these occurrences provide more salient opportunities for change than broad gestational stages, which could be used to further develop the PS model.

9.5.6. Influence of background

More broadly, it would be valuable for future research to explore influences on antenatal health behaviour for women from different backgrounds. As previously discussed, the studies within this thesis included mainly White British participants, who were well-educated and in full-time employment. In order to reduce health inequalities in pregnancy outcomes, it is crucial that we understand the different factors affecting behaviour change for women from all backgrounds, and the nuance that may exist for certain demographic groups. This sentiment echoes that of recent reports published by the NHS and Public Health England, prioritising improvements in the equity and equality of maternity care for women from BAME groups and those living in deprived areas (NHS, 2021b; Public Health England, 2020). As such, it will be important to explore the influence of disadvantage, economic deprivation, ethnicity, and healthcare access on women's health behaviour and the relevance of the PS model for women within these groups.

Exploring the utility of the PS model with women with various prior experiences of pregnancy, including parity and pregnancy complications, and for those on differing care pathways, would also provide valuable insight into the applicability of this model to other groups of women, as has been previously discussed. Modification of the model may be necessary in order to reflect nuanced factors influencing health behaviour change and to develop interventions that provide appropriate support.

A summary of the recommendations for future research and model development are provided in Table 9.3.

Table 9.3. Summary of recommendations for future research and model development

Recommendations for future research
• Seek PPI feedback
• Test model in a pregnant population in the context of eating behaviour
• Test the model in other health behavioural contexts, including pregnancy-specific and pregnancy-related behaviours
• Explore the salience of the PS model constructs
• Explore timing (stages and antenatal events)
• Explore the influence of disadvantage, economic deprivation, ethnicity, and healthcare access
• Test model in different groups of pregnant women (nulliparous and multiparous, those with a history of pregnancy complications, those on differing care pathways)

9.6. Conclusions

The findings from this thesis have highlighted the varied influences on women's health behaviour during pregnancy, and limitations of existing behavioural models when applied to this context. The development of a pregnancy-specific model of health behaviour change has contributed an enhanced understanding of pregnancy as a teachable moment and highlighted how women can be better supported during this time. The findings from this research have implications for intervention design and clinical practice, and have identified key areas for future research to explore.

9.7. Chapter summary

In this chapter, a discussion of the overall thesis was presented. The strengths and limitations of the PS model, and the thesis as a whole, were considered, and the implications of the research for clinical practice were highlighted. Lastly, key areas for future research were recommended.

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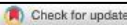
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APPENDICES

Appendix A: Published article on the inclusion of non-English articles in systematic reviews

DISCUSSION PAPER

Research Synthesis Methods WILEY

Including non-English language articles in systematic reviews: A reflection on processes for identifying low-cost sources of translation support

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Abstract

Non-English language (NEL) articles are commonly excluded from published systematic reviews. The high cost associated with professional translation services and associated time commitment are often cited as barriers. Whilst there is debate as to the impact of excluding such articles from systematic reviews, doing so can introduce various biases. In order to encourage researchers to consider including these articles in future reviews, this paper aims to reflect on the experience and process of conducting a systematic review which included NEL articles. It provides an overview of the different approaches used to identify sources of low-cost translation support and considers the relative merits of, among others, seeking support through universities, social media, word-of-mouth, and use of personal contacts.

KEYWORDS

bias, cost savings, language, research activities, systematic review, translations

Highlights

Non-English language (NEL) articles are frequently omitted from published systematic reviews due to financial considerations and time constraints related to document translation. In this article, I reflect on the process of including NEL articles in a large qualitative systematic review and provide an overview of the approaches used to identify low-cost sources of translation support. It is hoped this insight may encourage others to consider including such articles in their future work, irrespective of research discipline.

1 | INTRODUCTION

Non-English language (NEL) articles are commonly excluded from published systematic reviews (e.g., References 1–6). The main reasons for this often relate to practical barriers such as the high cost and time commitment associated with translating articles, as well as lacking language resources such as translators, or translation software.[7]

Whilst some have argued that the exclusion of NEL articles has a limited impact on the findings and overall conclusions of reviews,[6,8,9] excluding such articles may lead to an increased risk of bias,[5,10] or missing key evidence,[11] and may limit the generalisability of findings.[12]

Furthermore, excluding NEL articles from qualitative reviews may mean that participants' experiences of culturally specific issues are not captured, and may serve to limit the transferability of the results.[13]

From a practical perspective, excluding NEL articles during the search stage of a review risks the exclusion of relevant English language articles, where language values have been incorrectly defined or are missing.[12] Excluding NEL articles during the eligibility assessment stage instead allows reasons for ineligibility to be recorded, providing greater transparency about the number of articles excluded on this basis.[10,12]

However, both the Cochrane Handbook and the Campbell Collaboration recommend that authors should assess all relevant articles for inclusion, irrespective of language.[14,15] It is therefore important to ensure barriers to including NEL articles are minimised as far as possible.

Be that as it may, researchers with access to smaller research grants may struggle to meet the costs associated with traditional translation methods, as many researchers are unlikely to have costed for this type of activity.[*] Furthermore, those new to the review process may lack knowledge about where to access translation services or perceive the task of locating affordable translators to be time-consuming.

The purpose of this article is to reflect on my experience of including NEL articles in a recent qualitative systematic review, to provide an overview of the different approaches used to identify sources of low-cost translation support.

2 | THE EXEMPLAR REVIEW

The review conducted was a PhD study exploring factors influencing behaviour change during pregnancy and involved a meta-synthesis of 92 qualitative articles.[16] In total, 17 NEL articles were translated, and nine were included. The languages of these articles were Chinese (1), Danish (1), Finnish (4), French (4), Norwegian (1), Portuguese (1), Russian (2), Spanish (1), and Swedish (2).

Google translate was initially used to assess eligibility of article abstracts. Articles deemed eligible for full-text assessment were then translated by volunteer translators (i.e., students, researchers, other professionals).[†] Thirteen translators completed the tasks, some of whom translated multiple articles. Where possible, Google Translate was used to convert the documents before sending to the translators, who were then asked to proof-read and edit the text.

A nominal payment was offered for completion of the translation. The amount of work per article varied considerably, owing to the length of the document and the language (Google Translate is more effective at translating some languages, than others[17]). The payment offered for each task was therefore adjusted accordingly (ranging from £15 to £40 per article).

To locate low-cost translators, a number of approaches were used, a summary of which is reported herein.

3 | UNIVERSITY

3.1 | Language department

The first approach was to contact the University languages department via email, who forwarded details to their postgraduate students. Seven students responded with offers of help, and of these, three students were allocated the task.

3.2 | Clubs and societies

Through the University, I also contacted student societies specific to the article languages. Both the Nordic Association and the Francophone [French speaking] Society were contacted, requesting translators for the Danish and French articles, respectively. Using this approach, one additional translator was found.

4 | SOCIAL MEDIA

The most successful approach utilised was using social media (Facebook and Twitter) to post requests for translation support. Whilst no offers of help were made in response to the Facebook post, a fairly large response was received on Twitter; Over a three-month period, five requests were posted, which were retweeted 27 times. In response, numerous offers of help were made. Using this approach, six translators were found.

5 | PERSONAL CONTACTS AND WORD-OF-MOUTH

Two translators were also identified using personal contacts and word-of-mouth. One translator was suggested by a colleague, who's mother was an ex-professional French translator, and another by a colleague who had contacts with a Psychology department in Finland.

The last translator was found through re-contacting the 12 translators who had helped previously, to ask if they knew of any Danish-speakers who might be interested in the task. This approach is also known as 'snowball' sampling[18] and was employed having exhausted all previous methods.

6 | ALTERNATIVE APPROACHES

Whilst the purpose of this article is to reflect on my own experiences of sourcing translation support, there are a couple of additional approaches I have since become aware of that I wish to share.

6.1 | Cochrane Task Exchange

Cochrane Task Exchange[19] is an online platform allowing researchers to request, or offer, peer-support for systematic reviews and research synthesis in biomedical science.[20] In way of compensation, those providing research support are offered authorship, acknowledgement, and/or payment. High response rates to tasks posted on the site have been reported, and user feedback has been positive.[20] However, it is important to highlight that this resource may be better suited to identifying translation support for quantitative reviews, although there are no restrictions by methodology.

6.2 | Direct invitation

An additional approach that could be utilised is to identify and contact potential translators directly. Society member directories and bibliographic databases, for example, could be used to identify researchers residing in, or publishing in, the country of interest, who may be well placed to assist.

See Table 1 for a summary of all approaches discussed.

7 | REFLECTIONS ON THE PROCESS

Using the above reported methods to identify potential translators was hugely effective and all 17 articles were

TABLE 1 Approaches for identifying low-cost sources of translation support

Approaches
University language departments
University clubs and societies
Social media
Personal contacts
Word-of-mouth
Cochrane Task Exchange
Direct invitation

translated to a high standard, for a low cost. However, there are some considerations that must be taken into account.

7.1 | Quality

Translation quality is an important consideration when using non-professional translators, especially when conducting qualitative reviews, as it is crucial that the meaning of the data is not lost in the translation process. This was emphasised to all translators who helped with this review, the majority of whom were extremely thorough.

7.2 | Payment

There is a sparsity of guidance available on payment for informal activities such as this and as such, I was concerned that the nominal payments offered may be inadequate. However, it was evident that a number of translators were keen to contribute to the review regardless of payment, or were students who were eager to earn some extra income. Whilst I provided monetary compensation for the work completed, it is important to highlight that authorship or acknowledgement could also be offered as alternative sources of compensation.

7.3 | Lack of contract

The approaches discussed, whilst convenient, depend upon casual arrangements, often with individuals who are not known to the researcher. It was my experience that some translators decided not to complete the work, after committing to the task, for various reasons. Whilst this happened infrequently, a benefit of using a professional service would be that the work is guaranteed to be completed.

8 | CONCLUSION

Whilst it remains an empirical question as to whether different sources of translation support vary in any meaningful way, there is no doubt that reducing barriers to including NEL articles will result in more thorough reviews that are far more representative of the current literature. For researchers who are hesitant about making the decision to include NEL articles in their own work, I am hopeful that the insight shared here might help to facilitate it.

However, it is important to consider that the success I experienced in securing translation support will have

been influenced by the fact that a monetary incentive was offered and that as a PhD student, I may have had more time available to spend identifying translators. I acknowledge that some researchers will continue to experience financial and/or time constraints that prevent them from identifying or accessing even low-cost sources of translation support.

Going forward, it is therefore important for researchers to factor in the costs associated with translating NEL articles when writing grant proposals, and for funding bodies to allocate funding appropriately, to reduce barriers to inclusion.

ACKNOWLEDGEMENTS

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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ENDNOTES

* To provide an example of cost; for a 3000-word document written in French I was quoted between £256- £460, and between £341 - £483, for a 'basic' and 'premium' service, respectively.

† By 'volunteer translators' I am referring to non-professional translators. These volunteers as referred to as 'translators' from hereon.

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Appendix B: Submitted article on online interviewing during the COVID-19 pandemic

Conducting online interviews during COVID-19: A personal reflection

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Abstract

This article provides a reflection on the experience of conducting online interviews as a result of the COVID-19 pandemic. The author examines the potential benefits to using this methodology, above and beyond that of traditional face-to-face interviews, as well as reflecting on some of the drawbacks associated with this approach. The benefits include, among others, convenience, flexibility, improved rapport, and enhanced data generation. The limitations identified include the potential for distractions or interruptions, barriers to reflexivity, and potential sampling biases. The strengths and limitations of online interviewing should be weighed up when designing future research studies. However, it is hoped that going forward the benefits of utilising online interviews will be considered and used to enhance the research process, where appropriate.

Introduction

In qualitative research, face-to-face interviewing has traditionally been considered the 'gold standard' of interviewing methodology, owing to the rich data that can be generated (Oltmann, 2016; Schober, 2018). However, there has been a shift towards the use of alternative interviewing methods in recent years, with numerous articles supporting the use of online interviewing for the collection of high-quality data (Deakin & Wakefield, 2013; Salmons, 2012; Gray, Wong-Wylie, Rempel, & Cook, 2020; Janghorban, Roudsari, & Taghipour, 2014).

Despite this, face-to-face interviews are often used as the primary method of data collection, which can sometimes feel like a default position. When the COVID-19 pandemic began in 2020, in-person interviews were no longer a viable option for many researchers. Those of us in the midst of planning interview studies were forced to re-think our data collection strategies and to adopt online interviewing as the 'new normal' qualitative methodology. As such, a plethora of studies utilising online platforms to interview participants have recently emerged (McNamara, Quinn, Murrin, & Bel-Serrat, 2021; Petersen et al., 2021; Roesler et al., 2021; Silva-Jose, 2022).

In spring 2020, I was in the middle of designing the protocol for an in-depth interview study with postnatal women, exploring their eating behaviour throughout pregnancy. Given the situation and lack of alternative options, the decision was made to conduct all interviews online using Zoom. I went on to carry out interviews with 25 participants from November 2020 to February 2021.

Now that normality has finally resumed, I find myself reflecting on my personal experience of collecting data online and on the benefits, and potential limitations, of having done so. The purpose of this article is to summarise these reflections in an attempt to highlight some of the benefits, and potential drawbacks of this methodology, from the perspective and views of the researcher.

A summary of the potential benefits and limitations discussed in this paper are provided in Table 1.

Table 1. Potential benefits and limitations to online interviewing

Benefits	Limitations
- Ability to recruit a more geographically diverse sample - Fewer resources required (e.g., time, money) - Enhanced richness of data - Reduced barriers to participation (e.g., convenience, comfort) - Improved rapport	- Potential for distractions or poor internet connection to compromise active listening - Barriers to reflexivity - Difficulty assessing non-verbal cues - Increased barriers to participation for those in unsafe or undesirable living situations, or from certain groups - Potential sampling biases

Practicalities and convenience

Conducting interviews from the comfort of my own home was a wholly positive experience for me. From a practical point of view, I was able to interview participants from all over the UK, rather than limiting my sample to the local area. Whilst I was only recruiting a national sample, interviewing online allows for data to be collected from all over the world, should this be desired. Furthermore, being able to conduct the interviews online meant I saved time and money that would otherwise have been spent commuting to the participant's chosen location. As a busy postgraduate student with limited funds, this was extremely beneficial.

However, the ease and convenience of attending interviews with just the click of a button, and the removal of travel-time before and afterwards, lessened the opportunity for reflection. Whilst I endeavoured to write a reflective diary entry after each interview, there were occasions when busy days meant I went straight from a meeting into an interview, or vice versa. I missed having the forced opportunity to reflect on the interview on my return commute. Whilst you can of course allocate extra time in your diary to allow for this, the temptation to use this time more 'productively' may hinder this approach.

Enhanced interview style

An interesting observation for me was the improvement in my interviewing style during this period, which I attribute to being more comfortable in my own home. This was based on feeling more confident conducting the interviews, the rapport I built with participants, and the enhanced level of detail participants provided to my questions.

Interestingly, the physical distance between myself and the participants removed an additional stressor, in terms of my physical awareness. When interviewing in-person, I am often overly aware of my own physicality in the space, especially when in a participant's home, and have an increased awareness of my own body language. Whilst this won't be everyone's experience, I have found that being physically removed from the participant eliminated any need to think about this, allowing me to focus more intensely on the content of the interview.

Whilst I may have been more comfortable not thinking about my own body language during the interviews, a key limitation of using this method is the lack of lack of body language and non-verbal cues from the participant. Whilst you are able to view how someone is physically positioning themselves on camera, the subtle body language and signals conveyed when face-to-face may sometimes be missed. Non-verbal cues play a key role in communication (Burgoon, Manusov, & Guerrero, 2021) and as such, this could potentially limit understanding on the part of the researcher, compromise rapport, and affect data quality.

An additional change I benefitted from was the ability to freely take notes whilst the participant was talking. This is not something I would normally do during in-person interviews, however, conducting them online allowed me to take pages of notes. I hasten to add that I attempted to maintain as much eye-contact (or possibly 'screen-contact') as possible whilst taking notes, to avoid making the participant feel that I am not fully attending to them. This addition of notes has been an invaluable tool and has enabled me to more fully engage with the participant's story, often linking questions to something said much earlier on in the interview to develop a more rounded account of their experience.

Home environment

Whilst interviewing from home was beneficial for me as a researcher, I wondered to what extent the participants themselves preferred the online format. Being able to take part from home, without having to travel elsewhere or have a stranger visit your home, may make the process easier for many. It may also be a less intimidating option for some participants, who might otherwise decline to take part. This may reduce biases otherwise introduced in offline interview studies, if certain groups of individuals are less likely to participate. For example, those with social anxieties, or caring responsibilities that require them to remain at home. Conversely, collecting the data

online may result in over-sampling participants from these groups, resulting in a reverse sampling bias.

However, some participants may be put off taking part if their current living situation or home environment is problematic or undesirable. For those who would otherwise take part if the interview was conducted outside of the home, this may act as a deterrent. It may therefore be helpful in some instances to highlight that participants are welcome to use virtual backgrounds, or keep their cameras turned off. Whilst I highlighted this for participants in this study, all participants chose to keep their cameras on for the duration of the interviews.

An additional consideration is that participating from home means that others may be present during the interview. This could obviously be problematic if the presence of another affects the way in which a participant responds, and compromises confidentiality. Similarly, having other people in the home, albeit not necessarily in the same room, may be off-putting for participants who experience interruptions during the interview. That said, this may also occur in face-to-face settings where the interview is conducted from the participant's home, so is not unique to online interviews. Equally for researchers, conducting interviews from home means we too may experience similar disruptions. Even when doing everything in my power to reduce potential interruptions (including disconnecting the doorbell!) I still experienced disturbances that broke my train of thought and momentarily affected my ability to concentrate on the participant's responses.

Professionalism vs rapport building

Whilst conducting the interviews, I was aware that my home was viewable in the background of the zoom calls, which introduced elements of my personality into the situation. Researchers own characteristics have been suggested to influence the data collected in qualitative interviews (Pezalla, Pettigrew, & Miller-Day, 2012) and as such, I considered whether this may unintentionally influence participant responses and cause bias. Similarly, I reflected on whether it might make a difference should I change location between interviews.

Providing a glimpse of your home and insight into your private life may help to build rapport with some participants, which is important in generating rich and detailed data (McGrath, Palmgren, & Liljedahl, 2019). It may also redress power imbalances in the

researcher-participant relationship. However, it is important to maintain professionalism in this context, and as such, a balance needs to be struck. Ultimately, it is a judgement call on the part of the researcher as to whether or not they feel it may compromise professionalism. Where they believe it might, using a virtual background may provide a solution.

Internet use

Whilst this article largely focuses on the benefits of conducting interviews online, a key consideration is the limitations of the method itself on recruitment and the data collection process. From the researcher's perspective, the internet is at times an unpredictable medium through which to conduct research. Having an unreliable internet connection can be hugely problematic when interviewing, by disrupting the flow of the interview and in worst-case-scenarios, ending it completely. This can affect rapport between the participant and interviewer, which may impact on data quality (Weller, 2017).

From the participants' perspective, conducting interviews online can exclude certain groups of individuals. Typically, this includes those from socioeconomically disadvantaged backgrounds, those experiencing mental health problems, and those who may not be digitally literate (e.g., some older adults) (Kennedy, Holcombe-James, & Mannell, 2021). Whilst engaging with disadvantaged groups may not be the focus of a given study, it is important to be mindful about the impact of these methods on the sample and data, and to consider this when drawing conclusions from research conducted entirely online.

Unfounded concerns

Prior to starting the interviews, I had a few concerns about the online format. In particular, I was slightly worried that the added convenience, and reduced formality of the arrangement might mean participants were more likely to cancel or not attend. I imagine that it is more difficult to cancel or avoid an interviewer who has arranged to come to your house. Happily, I can report that this concern was totally unfounded. It might be that the demographic I was working with were more motivated to participate than others, but all bar one participant attended.

An additional concern was that I might struggle to build rapport with participants over a screen. Having mainly interviewed in-person, I was unsure as to how this new format

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might affect my ability to develop productive interviewer-interviewee relationships. Again, this was a concern that was unfounded. Of all the interviews I conducted I have managed to create a friendly, open environment with the participants. The only caveat to this has been at the very start of the interview as I often found it difficult to generate small talk before commencing the interview. I find that in-person, this small talk often 'warms up' the participant prior to launching into the interview. On reflection I have noted that this talk often revolves around the weather, discussion about your journey to get to the participant's house, or other contextual topics. Without any of that present, I sometimes struggled to know what to say once the participant joined the call, other than immediately commencing the interview, which can feel a little unnatural.

Based on my experiences of conducting online interviews, several practical recommendations to enhance the interview process are presented in Table 2.

Table 2. Recommendations to enhance the online interviewing process

Recommendations
• Prioritise internet connectivity (e.g., closing unused web applications, disconnecting other devices, upgrading internet packages, positioning oneself close to the router)
• Minimise potential for distractions (e.g., unplug the doorbell, turn off phones, close curtains)
• Consider 'small talk' topics for the start of the interview, to improve rapport
• Schedule time for reflexivity after each interview
• Make it clear participants can take part with cameras switched off
• Consider your own environment and use of a virtual background to increase professionalism
• Consider taking notes throughout

Conclusions

Based on my experience I would argue that there are a myriad of benefits to utilising online interviews to collect qualitative data. However, these must be balanced against the potential limitations that have been identified. Being mindful of the drawbacks associated with this approach is important to ensure inclusion and professionalism. I

am hopeful that as we return to a life post-COVID, we learn from our experiences and start to think more openly about using alternative approaches to enhance the research process and improve our practice.

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Appendix C: Supplementary material for study one

S1. PRISMA reporting checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3, 4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5, 6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	5
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5 (S3)
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	S4
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6, 8 (Figure 1)

Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	S5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, 8 (Figure 1)
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	S8, S9
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	9, S10
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-21 & Figure 2
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	N/A
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A

DISCUSSION				
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).		21-25
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).		23-24
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.		25
FUNDING				
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.		25

S2. ENTREQ checklist

Item	Guide and description	Page
Aim	State the research question the synthesis addresses	5
Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology (e.g. meta- ethnography, thematic synthesis, critical interpretive synthesis, grounded theory synthesis, realist synthesis, meta-aggregation, meta-study, framework synthesis).	4, 7
Approach to searching	Indicate whether the search was pre-planned (comprehensive search strategies to seek all available studies) or iterative (to seek all available concepts until theoretical saturation is achieved).	6
Inclusion criteria	Specify the inclusion/exclusion criteria (e.g. in terms of population, language, year limits, type of publication, study type).	5, S3
Data sources	Describe the information sources used (e.g. electronic databases (MEDLINE, EMBASE, CINAHL, psychINFO, Econlit), grey literature databases (digital thesis, policy reports), relevant organisational websites, experts, information specialists, generic web searches (Google Scholar), hand searching, reference lists) and when the searches were conducted; provide the rationale for using the data sources.	6
Electronic Search strategy	Describe the literature search (e.g. provide electronic search strategies with population terms, clinical or health topic terms, experiential or social phenomena related terms, filters for qualitative research and search limits).	S4
Study screening methods	Describe the process of study screening and sifting (e.g. title, abstract and full text review, number of independent reviewers who screened studies)	6, 8 (Figure 1)
Study characteristics	Present the characteristics of the included studies (e.g. year of publication, country, population, number of participants, data collection, methodology, analysis, research questions).	7, S8, S9
Study selection results	Identify the number of studies screened and provide reasons for study exclusion (e.g. for comprehensive searching, provide numbers of studies screened and reasons for exclusion indicated in a figure/flowchart; for iterative searching describe reasons for study	7, 8 (Figure 1)

	exclusion and inclusion based on modifications t the research question and/or contribution to theory development).	
Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings (e.g. assessment of conduct (validity and robustness), assessment of reporting (transparency), assessment of content and utility of the findings).	6
Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings (e.g. Existing tools: CASP, QARI, COREQ, Mays and Pope [25]; reviewer developed tools; describe the domains assessed: research team, study design, data analysis and interpretations, reporting).	6
Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.	6
Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.	9, S10
Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies? (e.g. all text under the headings "results /conclusions" were extracted electronically and entered into a computer software).	6, S5
Software	State the computer software used, if any.	6, 7
Number of reviewers	Identify who was involved in coding and analysis.	7
Coding	Describe the process for coding of data (e.g. line by line coding to search for concepts).	7
Study comparison	Describe how were comparisons made within and across studies (e.g. subsequent studies were coded into pre-existing concepts, and new concepts were created when deemed necessary).	7
Derivation of themes	Explain whether the process of deriving the themes or constructs was inductive or deductive.	7
Quotations	Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations or the author's interpretation	10- 21 & Table 1
Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies (e.g. new interpretation, models of evidence, conceptual models, analytical framework, development of a new theory or construct).	7-21

S3. Eligibility criteria

Inclusion criteria

- Studies containing qualitative data about women's experiences or perceptions of pregnancy-related* health behaviour change during the antenatal period

  - Health behaviours of interest are smoking, alcohol use, diet or physical activity only
  - Studies may include other participant types (e.g. partners, health professionals) but women must be distinguishable in the results
  - Studies may present findings relating to the antenatal and postnatal period (up to 2 years after giving birth), as long as the data relating to the antenatal period is distinguishable
  - Health behaviours and intentions for behaviour change can relate to the antenatal or postnatal period (i.e. a participant in the antenatal period may discuss planning to start exercising once they have had their baby)
  - Intervention studies are eligible if they also contain qualitative data relating to health behaviour change

* Pregnancy-related health behaviours are those that occur outside of pregnancy, that evidence suggests are beneficial to health if *maintained* or *modified* during the antenatal period (e.g. dietary changes, physical activity, smoking cessation, alcohol reduction). Pregnancy-specific behaviours are those that occur during pregnancy ONLY, that evidence suggests are beneficial to health if *initiated* during this period (e.g. recommended dietary changes, recommended vaccinations, recommended supplementation etc.) (See Olander, Smith & Darwin, 2018).

Exclusion criteria

- Studies that use qualitative data collection methods but do not present qualitative findings (e.g. studies that have quantified qualitative responses)
- Studies conducted in low- or middle-income countries (according to country classifications reported by the World Bank, 2019)
- Studies reporting on the content or delivery of interventions
- Studies including women on specialist care pathways for a medical diagnosis including physical and mental health conditions (e.g. gestational diabetes, psychosis)**
- Studies including women who have experienced previous or current pregnancy complications (e.g., small for gestational age [SGA]) or pregnancy was a result of assisted reproductive technology**
- Studies including women under 18 years of age**
- Studies including women who are more than 2 years postnatal**
- Studies focusing on pregnancy-specific behaviours only
- Participants deemed to be of high-risk status and advised not to engage in behaviour of interest
- Letters
- Conference abstracts
- Book chapters
- Reviews

- Commentaries
- Protocols

**unless these women can be differentiated from the population of interest

Olander, E. K., Smith, D. M., & Darwin, Z. (2018). Health behaviour and pregnancy: a time for change. *Journal of Reproductive and Infant Psychology, 36*(1), 1-3. doi:10.1080/02646838.2018.1408965

The World Bank. (2019). World Bank Country and Lending Groups: Country Classification. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519 (Accessed March 2019).

S4. Search strategy

MEDLINE (Ovid)

1. (qualitative or interview* or focus group* or mixed method* or thematic analysis or thematically or theme* or grounded analysis or content analysis or discourse analysis or narrative analysis or conversation analysis or grounded theory or framework analysis or interpretative phenomenological analysis or IPA or ethnograph* or hermeneutic* or phenomenology or experience* or opinion* or attitude* or perception* or belie* or understand* or perspective* or emotion*).ti,ab. or qualitative research/ or interview/ or interview, psychological/ or focus groups/

2. ((Behavio?r* or health behavio?r* or lifestyle or life style).ti,ab. or health behavior/ or life style/) and change*.ti,ab.

3. (obes* or weight or BMI or diet* or food intake or body mass index or overweight or eat*).ti,ab. or obesity/ or obesity management/ or weight loss/ or body mass index/ or diet/ or healthy diet/ or body weight changes/ or overweight/ or body weight/ or diet, reducing/ or weight gain/ or eating/

4. (physical activity or activity or fitness or sport* or exercise).ti,ab. or exercise/ or physical fitness/ or sports/

5. (Cigarette* or tobacco or smok* or nicotine).ti,ab. or tobacco products/ or smoking/ or smoking reduction/ or tobacco smoking/ or smoking cessation/ or cigarette smoking/ or tobacco/ or nicotine/

6. (alcohol* or alcohol consumption).ti,ab. or alcohols/ or drinking behavior/ or alcohol drinking/

7. 2 or 3 or 4 or 5 or 6

8. (Pregnan* or perinatal or prenatal or antenatal).ti,ab. or pregnant women/ or prenatal care/ or pregnancy/

9. 1 and 7 and 8

10. Animal*.ti,ab. or animals/

11. Review*.ti. or review/

12. 9 not (10 or 11)

MIDIRS (Ovid)

1. (qualitative or interview* or focus group* or mixed method* or thematic analysis or thematically or theme* or grounded analysis or content analysis or discourse analysis or narrative analysis or conversation analysis or grounded theory or framework analysis or interpretative phenomenological analysis or IPA or ethnograph* or hermeneutic* or phenomenology or experience* or opinion* or attitude* or perception* or belie* or understand* or perspective* or emotion*).ti,ab. or (qualitative research or interviews or focus groups).de.

2. ((Behavio?r* or health behavio?r* or lifestyle or life style).ti,ab. or (health or life style).de.) and change*.ti,ab.

3. (obes* or weight or BMI or diet* or food intake or body mass index or overweight or eat*).ti,ab. or (obesity or body mass index or diet or body weight or eating).de.

4. "weight loss (maternal)".de.

5. "weight gain (maternal)".de.

6. (physical activity or activity or fitness or sport* or exercise).ti,ab. or (exercise or physical fitness or sport).de.

7. (Cigarette* or tobacco or smok* or nicotine).ti,ab. or (smoking or smoking cessation or tobacco or nicotine).de.

8. (alcohol* or alcohol consumption).ti,ab. or (alcohol or alcohol drinking).de.

9. 2 or 3 or 4 or 5 or 6 or 7 or 8

10. (Pregnan* or perinatal or prenatal or antenatal).ti,ab. or (pregnant women or prenatal care or pregnancy or antenatal care).de.

11. 1 and 9 and 10

12. Animal*.ti,ab. or animals.de.

13. Review*.ti. or (literature reviews or systematic reviews or Cochrane Database of Systematic Reviews).de.

14. 11 not (12 or 13)

PsycINFO (Ovid)

1. (qualitative or interview* or focus group* or mixed method* or thematic analysis or thematically or theme* or grounded analysis or content analysis or discourse analysis or narrative analysis or conversation analysis or grounded theory or framework analysis or interpretative phenomenological analysis or IPA or ethnograph* or hermeneutic* or phenomenology or experience* or opinion* or attitude* or perception* or belie* or understand* or perspective* or emotion*).ti,ab. or qualitative research/ or interviews/ or group discussion/

2. ((Behavio?r* or health behavio?r* or lifestyle or life style).ti,ab. or health behavior/ or behavior change/ or lifestyle/ or lifestyle changes/) and change*.ti,ab.

3. (obes* or weight or BMI or diet* or food intake or body mass index or overweight or eat*).ti,ab. or obesity/ or weight control/ or weight loss/ or body mass index/ or diets/ or food intake/ or overweight/ or body weight/ or weight gain/ or weight control/ or eating behavior/

4. (physical activity or activity or fitness or sport* or exercise).ti,ab. or exercise/ or physical fitness/ or sports/

5. (Cigarette* or tobacco or smok* or nicotine).ti,ab. or tobacco smoking/ or smoking cessation/ or nicotine/

6. (alcohol* or alcohol consumption).ti,ab. or alcohols/ or drinking behavior/ or alcohol drinking attitudes/

7. 2 or 3 or 4 or 5 or 6

8. (Pregnan* or perinatal or prenatal or antenatal).ti,ab. or prenatal care/ or pregnancy/

9. 1 and 7 and 8

10. Animal*.ti,ab. or animals/

11. Review*.ti. or literature review/

12. 9 not (10 or 11)

CINAHL-P (EBSCOhost)

S1   (TI (qualitative OR interview* OR "focus group*" OR "mixed method*" OR "thematic analysis" OR thematically OR theme* OR "grounded analysis" OR "content analysis" OR "discourse analysis" OR "narrative analysis" OR "conversation analysis" OR "grounded theory" OR "framework analysis" OR "interpretative phenomenological analysis" OR IPA OR ethnograph* OR hermeneutic* OR phenomenology OR experience* OR opinion* OR attitude* OR perception* OR belie* OR understand* OR perspective* OR emotion*)) OR (AB (qualitative OR interview* OR "focus group*" OR "mixed method*" OR "thematic analysis" OR thematically OR theme* OR "grounded analysis" OR "content analysis" OR "discourse analysis" OR "narrative analysis" OR "conversation analysis" OR "grounded theory" OR "framework analysis" OR "interpretative phenomenological analysis" OR IPA OR ethnograph* OR hermeneutic* OR phenomenology OR experience* OR opinion* OR attitude* OR perception* OR belie* OR understand* OR perspective* OR emotion*)) OR (MH (qualitative studies OR interviews OR structured interview OR unstructured interview OR semi-structured interview OR focus groups))

S2   (TI (Behavio?r* OR "health behavio?r*" OR lifestyle OR "life style")) OR (AB (Behavio?r* OR "health behavio?r*" OR lifestyle OR "life style")) OR (MH (health behavior OR life style OR life style changes)) AND TI change* OR AB change*

S3   (TI (obes* OR weight OR BMI OR diet* OR "food intake" OR "body mass index" OR overweight OR eat*)) OR (AB (obes* OR weight OR BMI OR diet* OR "food intake" OR "body mass index" OR overweight OR eat*)) OR (MH (obesity OR weight loss OR body mass index OR diet OR body weight changes OR body weight OR diet, reducing OR restricted diet OR weight gain OR weight control OR eating OR eating behavior))

S4   (TI ("physical activity" OR activity OR fitness OR sport* OR exercise)) OR (AB ("physical activity" OR activity OR fitness OR sport* OR exercise)) OR (MH (exercise OR physical fitness OR sports OR physical activity))

S5   (TI (Cigarette* OR tobacco OR smok* OR nicotine)) OR (AB (Cigarette* OR tobacco OR smok* OR nicotine)) OR (MH (tobacco products OR smoking OR smoking cessation OR tobacco OR nicotine))

S6   (TI (alcohol* OR "alcohol consumption")) OR (AB (alcohol* OR "alcohol consumption")) OR (MH (drinking behavior OR alcohol drinking))

S7   S2 OR S3 OR S4 OR S5 OR S6

S8   (TI (Pregnan* OR perinatal OR prenatal OR antenatal)) OR (AB (Pregnan* OR perinatal OR prenatal OR antenatal)) OR (MH (expectant mothers OR prenatal care OR pregnancy))

S9   S1 AND S7 AND S8

S10   TI Animal* OR AB animal* OR MH animals

S11   S9 NOT S10

S12   TI Review* OR (MH (systematic review OR literature review))

S13   S11 NOT S12

S5: Extracted data items

- Article characteristics (title, authors, year, country)
- Source type (i.e. journal article, thesis)
- Study aim/objective
- Health behaviour (diet, physical activity, smoking, alcohol)
- Population of interest
- Participant characteristics (number, age, setting, nulliparous/multiparous, gestational age)
- Dates research conducted
- Gestational phase (antenatal/postnatal period)
- Study type (qualitative/mixed methods)
- Data collection method
- Inclusion and exclusion criteria
- Analysis method
- Results data (findings including author interpretations)

S6. Table of study IDs mapped to thematic framework and health behaviours

Themes	Sub-themes	Dietary behaviour	Physical activity	Smoking	Alcohol use
1. A time to think about 'me'	1.1. A desire to self-indulge	2a-3, 19, 20, 41, 56, 62, 67, 74a, 81, 83, 85, 87	2b, 15, 23, 28, 41, 58, 63, 85	1, 11, 13, 14, 29, 34, 35, 37, 39, 44b, 45, 51, 60, 61, 69, 75, 79, 89	1, 5-7, 13, 18, 29, 31, 33, 35, 39, 42, 51, 71 ,73, 77, 86
	1.2. A desire to retain ownership over body and behaviour	1-3, 5, 21, 38, 43, 56, 58, 59, 62, 63, 66, 67, 72, 74a, 78, 81, 83,	2a, 5, 8, 15, 16, 20, 21, 23, 25, 26, 28, 38, 41, 50, 54, 55, 59, 63, 68, 74a, 82-85, 87	9, 11, 27, 29, 34, 37, 44a-46, 57, 60, 61, 65, 75, 79, 86, 89	6, 13, 18, 29, 31, 39, 42, 51, 71, 73, 86
	1.3. A desire for good health	1-3, 19, 21, 28, 30, 36, 38, 41, 53, 56, 58, 59, 62, 66, 68, 70, 72, 74a, 77, 78, 81, 83, 85, 88	1-2b, 5, 8, 10, 15, 16, 19, 20, 21-23, 25-28, 30, 32, 36, 38, 41, 50, 54-56, 58, 59, 63, 66, 67, 68, 74a, 76, 78, 80, 81, 82-85, 87, 88	1, 4, 9, 11-14, 27, 34, 35, 37, 39, 40, 44a-46, 48, 57, 60, 61, 64, 65, 69, 70, 75, 77, 79, 80, 86, 89	1, 6, 29, 31, 33, 35, 42, 51, 86
2. Adopting the 'good mother' role		2b, 5, 66, 77, 83	5, 28, 63	4, 5, 12-14, 29, 31, 34, 37, 39, 44a-46, 48, 57, 60, 61, 65, 69, 75, 79, 80, 86, 89	1, 5, 6, 13, 29, 31, 33, 42, 47, 51, 73, 86
	2.1. Driven by the health of the baby	1, 2b, 3, 20, 24, 29, 32, 36, 38, 41, 53, 58, 66, 67, 72, 74a, 77, 83, 85	1, 10, 15-17, 20, 23, 26, 28, 30, 32, 38, 41, 51, 54, 55, 59, 63, 67, 68, 74a, 76, 78, 82, 84, 85, 87, 88	1, 4, 9, 11, 14, 24 ,27, 29, 33, 34, 35, 37, 39, 44a-46, 48, 51, 57, 61, 65, 69, 75, 79, 86, 89	1, 6, 13, 18, 29, 31, 33, 35, 39, 42, 47, 51, 71, 73, 86

Themes	Sub-themes	Dietary behaviour	Physical activity	Smoking	Alcohol use
	2.2. Driven by roles and expectations	5, 32, 41, 62, 66, 74b, 83	10, 16, 23, 25, 26, 28, 41, 63, 67, 68, 74a, 82, 84	4, 9, 12, 14, 29, 34, 35, 37, 39, 44a-46, 48, 49, 51, 60, 61, 64, 65, 69, 75, 79, 80, 83, 89	5, 6, 13, 18, 29, 33, 35, 39, 42, 47, 51, 71, 73, 86
	2.3. Driven by pre-pregnancy attitudes and behaviours	2a-3, 24, 58, 62, 74a, 74b, 77, 83	1, 16, 20-23, 25, 28, 32, 36, 41, 50, 55, 58, 59, 63, 68, 76, 78, 82-85, 74a, 74b	4, 9, 11, 13, 14, 35, 37, 44a-46, 51, 60, 61, 65, 79, 80, 86, 89	1, 5, 6, 29, 39, 42, 51, 71, 73, 86
3. Beyond mother and baby	3.1. Practical and environmental influences	2b, 15, 38, 58, 59, 66, 67, 72, 74a, 74b, 78, 81, 83, 88	16, 19 22, 25, 36, 38, 41, 50, 54, 55, 59, 63, 67, 68, 76, 81, 82, 85, 87, 74a, 74b	9, 11, 12, 14, 27, 37, 44a, 44b, 61, 65, 69, 75, 79, 80, 89	31, 86
	3.2. Social influences	2b, 3, 30, 36, 38, 53, 56, 58, 62, 72, 74a, 74b, 78, 81, 83, 85	2b, 5, 10, 16, 19, 20, 22, 23, 25, 26, 28, 30, 32, 36, 38, 41, 50, 55, 58, 66, 68, 74a, 74b 76, 78, 82, 84, 85, 87	1, 9, 11, 12-14, 27, 31, 34, 35, 37, 40, 44a-46, 49, 51, 57, 60, 61, 64, 65, 69, 75, 79, 80, 89	1, 5-7, 13, 18, 29, 31, 33, 35, 39, 42, 47, 51, 71, 73, 86
	3.3. Knowledge, understanding, and advice	2a-3, 19, 20, 22, 24, 25, 38, 52, 53, 62, 63, 67, 72, 74a, 77, 78, 81, 83, 85, 87	2b, 10, 15, 16, 17, 19, 20, 23, 25, 26, 28, 41, 50, 55, 59, 63, 68, 74a, 74b, 76, 78, 82, 84, 87	1, 9, 11, 13, 14, 27, 34, 35, 37, 39, 40, 44a-46, 48, 49, 51, 57, 61, 65, 69, 75, 79, 80, 89	5, 6, 13, 18, 29, 31, 33, 35, 39, 42, 45, 47, 51, 71, 73, 77, 86

S7. List of included studies

1. Agberotimi, V. F. (2013). *Diet and Lifestyle During Pregnancy: Pregnant Women's Stories* [Unpublished undergraduate dissertation]. Dublin Business School.

2a. Allen-Walker, V. (2016). Chapter four: An exploration of the attitudes and opinions of postnatal women towards weighing during pregnancy, and factors influencing weight management during and after pregnancy. In *Exploring the issue of weight management before, during and after pregnancy* [Unpublished doctoral thesis]. Queen's University, Belfast.

2b. Allen-Walker, V. (2016). Chapter five: Exploring the attitudes and opinions of pregnant women towards weight management and pregnancy: A Qualitative Study. In *Exploring the issue of weight management before, during and after pregnancy* [Unpublished doctoral thesis]. Queen's University, Belfast.

3. Andersson, J., & Ernstsson, S. (2017). *"Jag ville ge mitt barn de bästa förutsättningarna": En kvalitativ intervjustudie om tankar kring matvanor under graviditet hos nyblivna förstagångsmammor ["Giving my child the best conditions": A qualitative study regarding first-time mothers thoughts on food habits during pregnancy]* [Unpublished undergraduate dissertation]. Umeå University.

4. Ashwin, C. A., Marshall, J. E., & Standen, P. J. (2012). Exploring women's experiences of smoking during pregnancy and the postpartum. *Evidence Based Midwifery 10*(4), 112-118.

5. Atkinson, L., Shaw, R. L., & French, D. P. (2016). Is pregnancy a teachable moment for diet and physical activity behaviour change? An interpretative phenomenological analysis of the experiences of women during their first pregnancy. *British Journal of Health Psychology, 21*(4), 842-858.

6. Audet, C., April, N., Guyon, L., & De Koninck, M. (2006*). Représentations de la consommation d'alcool pendant la grossesse et perceptions des messages de prévention chez des femmes enceintes [Representations of alcohol consumption during pregnancy and perceptions of prevention messages among pregnant women].* Institut national de santé publique du Québec. https://www.inspq.qc.ca/pdf/publications/547-ConsommationAlcool_Grossesse.pdf

7. Barbour, B. G. (1990). Alcohol and pregnancy. *Journal of Nurse-Midwifery, 35*(2), 78-85.

8. Barhammar, L. (2017). *Gravida kvinnors inställningar och tankar kring kost och motion. En kvalitativ studie om kost- och motionsvanor under graviditeten [Pregnant women's attitudes and thoughts about diet and exercise. A qualitative study about diet and exercise habits during pregnancy]* [Unpublished undergraduate disserration]. Karlstad Universitet.

9. Bauld, L., Graham, H., Sinclair, L., Flemming, K., Naughton, F., Ford, A., McKell, J., McCaughan, D., Hopewell, S., Angus, K., Eadie, D., & Tappin. D. (2017). Barriers to and facilitators of smoking cessation in pregnancy and following childbirth: literature review and qualitative study. *Health Technology Assessment, 21*(36).

10. Bennett, E. V., McEwen, C. E., Hurd Clarke, L., Tamminen, K. A., & Crocker, P. R. E. (2013). 'It's all about modifying your expectations': women's experiences with physical activity during pregnancy. *Qualitative Research in Sport, Exercise and Health, 5*(2), 267-286.

11. Bennett, A. (1999). *The Experiences of African American Women Smoking During Pregnancy: A Conflict of the Self* [Unpublished masters dissertation]. University of California, Berkeley.

12. Bottorff, J. L., Kalaw, C., Johnson, J. L., Stewart, M., Greaves, L., & Carey, J. (2006). Couple Dynamics During Women's Tobacco Reduction in Pregnancy and Postpartum. *Nicotine & Tobacco Research, 8*(4), 499-509.

13. Brahic, J., Thomas, O., & Dany, L. (2015). Alcool et grossesse : une recherche qualitative auprès de femmes enceintes [Alcohol and pregnancy: qualitative research among pregnant women]. *Les Cahiers Internationaux de Psychologie Sociale, 107*(3), 403-434.

14. Bull, L., Burke, R., Walsh, S., & Whitehead, E. (2007). Social attitudes towards smoking in pregnancy in East Surrey: A qualitative study of smokers, former smokers and non-smokers. *Journal of Neonatal Nursing, 13*(3), 100-106.

15. Chana, R., & Haith-Cooper, M. (2019). Diet and physical activity in pregnancy: a study exploring women's beliefs and behaviours. *British Journal of Midwifery, 27*(5), 297-304.

16. Cioffi, J., Schmied, V., Dahlen, H., Mills, A., Thornton, C., Duff, M., Cummings, J., & Kolt, G. S. (2010). Physical Activity in Pregnancy: Women's Perceptions, Practices, and Influencing Factors. *Journal of Midwifery & Women's Health, 55*(5), 455-461.

17. Clarke, P. E., & Gross, H. (2004). Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery, 20*(2), 133-141.

18. Crawford-Williams, F., Steen, M., Esterman, A., Fielder, A., & Mikocka-Walus, A. (2015). "My midwife said that having a glass of red wine was actually better for the baby": a focus group study of women and their partner's knowledge and experiences relating to alcohol consumption in pregnancy. *BMC Pregnancy and Childbirth, 15*(1), 79.

19. Darroch, F. E. & Giles, A. R. (2016). A postcolonial feminist discourse analysis of urban Aboriginal women's description of pregnancy-related weight gain and physical activity. *Women and Birth, 29*(1), e23-e32.

20. Deighton-Smith, N. (2014). *Body image, health, and physical activity in pregnant women: A composite analysis* [Unpublished doctoral thesis]. Leeds Metropolitan University.

21. Devine, C. M., Bove, C. F., & Olson, C. M. (2000). Continuity and change in women's weight orientations and lifestyle practices through pregnancy and the postpartum period: the influence of life course trajectories and transitional events. *Social Science & Medicine, 50*(4), 567-582.

22. Dominguez, M. E. (2016). *Cultural Influences on the Weight, Diet, and Physical Activity of Pregnant Immigrant Latinas* [Unpublished doctoral thesis]. Walden University.

23. Dormer, J. (2019). *Women's experiences of physical activity during pregnancy: an interpretative phenomenological analysis. "just listen to your body"* [Unpublished masters dissertation]. University of Huddersfield.

24. Edvardsson, K., Ivarsson, A., Eurenius, E., Garvare, R., Nyström, M. E., Small, R., & Mogren, I. (2011). Giving offspring a healthy start: parents' experiences of health promotion and lifestyle change during pregnancy and early parenthood. *BMC Public Health, 11*(1), 936.

25. Ekelin, M., Langeland Iversen, M., Grønbæk Backhausen, M., & Hegaard, H. K. (2018). Not now but later – a qualitative study of non-exercising pregnant women's views and experiences of exercise. *BMC Pregnancy and Childbirth, 18*(1), 399.

26. Evans, K., Walters, K. A., Liechty, T., & LeFevour, K. M. (2016). Women's experiences of physically active leisure during pregnancy. *Annals of Leisure Research, 19*(4), 386-404.

27. Fergie, L., Coleman, T., Ussher, M., Cooper, S., & Campbell, K. A. (2019). Pregnant Smokers' Experiences and Opinions of Techniques Aimed to Address Barriers and Facilitators to Smoking Cessation: A Qualitative Study. *International Journal of Environmental Research and Public Health*, 16(15), 2772.

28. Findley, A., Smith, D. M., Hesketh, K., & Keyworth, C. (2020). Exploring womens' experiences and decision making about physical activity during pregnancy and following birth: a qualitative study. *BMC Pregnancy and Childbirth, 20*(1), 54.

29. Ford, K. J. (2013). *Understanding of the Use of Alcohol in Pregnancy Amongst Women in Scotland* [Unpublished doctoral thesis]. University of Liverpool.

30. Gaudet, R. (2018). *La première grossesse normale: Une adaptation occupationnelle extraordinaire insoupçonnée [The first normal pregnancy: An unsuspected extraordinary occupational adaptation]* [Unpublished masters dissertation]. Université du Québec à Trois-Rivières.

31. Gibson, S., Nagle, C., Paul, J., McCarthy, L., & Muggli, E. (2020). Influences on drinking choices among Indigenous and non-Indigenous pregnant women in Australia: A qualitative study. *PLOS ONE, 15*(4), e0224719.

32. Goodrich, K., Cregger, M., Wilcox, S., & Liu, J. (2013). A Qualitative Study of Factors Affecting Pregnancy Weight Gain in African American Women. *Maternal and Child Health Journal, 17*, 432-440.

33. Gouilhers, S., Meyer, Y., Inglin, S., Pfister Boulenaz, S., Schnegg, C., & Hammer, R. (2019). Pregnancy as a transition: First-time expectant couples' experience with alcohol consumption. *Drug and Alcohol Review, 38*(7), 758-765.

34. Grant, A., Morgan, M., Gallagher, D., & Mannay, D. (2020). Smoking during pregnancy, stigma and secrets: Visual methods exploration in the UK. *Women and Birth, 33*(1), 70-76.

35. Grant, A., Morgan, M., Mannay, D., & Gallagher, D. (2019). Understanding health behaviour in pregnancy and infant feeding intentions in low-income women from the UK through qualitative visual methods and application to the COM-B (Capability, Opportunity, Motivation-Behaviour) model. *BMC Pregnancy and Childbirth, 19*(1), 56.

36. Greenhill, E. M. (2019). *A qualitative investigation of social support from partners and primigravid health behaviors* [Unpublished masters dissertation]. Bradley University.

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S8. Characteristics of included studies

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
1	Agberotimi (2013)	Ireland	X	X	X	X	To explore the attitudes of pregnant women towards healthy lifestyle, exploring such issues as smoking, drinking of alcohol and caffeine, and general lifestyle such diet, excising, and sleeping patterns during pregnancy	Not reported	Qualitative	Semi-structured interviews	Thematic analysis
2a	Allen-Walker (2016) (chapter 4)	Northern Ireland	X	X			To explore the attitudes and opinions of postnatal women who had been weighed during pregnancy, towards routine weighing and weight management during and after pregnancy	Nov - Dec 2014	Qualitative	Semi-structured interviews	Thematic analysis
2b	Allen-Walker (2016) [1] (chapter 5)	Northern Ireland	X	X			To explore the opinions and attitudes of pregnant women towards weight management before, during and after pregnancy, and towards routine weighing	Jan 2015 - May 2016	Qualitative	Semi-structured interviews (series)	Thematic analysis
3	Andersson & Ernstsson (2017)	Sweden	X				To explore first-time mothers' approach to the intake of perceived healthy and unhealthy foods during pregnancy, and to what extent they felt that this affected their food intake	Sept 2017	Qualitative	Semi-structured interviews	Content analysis
4	Ashwin et al. (2012) [1]	United Kingdom			X		To explore the experiences of women who stop smoking during pregnancy and may relapse postpartum	Not reported	Qualitative	Semi-structured interviews (series)	Narrative analysis
5	Atkinson et al. (2016) [1]	United Kingdom	X	X	X	X	To explore the potential of Teachable Moments, by in-depth examination of women's experiences of diet and physical activity behaviour change during their first pregnancy	Not reported	Qualitative	Interviews	Interpretative phenomenological analysis
6	Audet et al. (2006) [1]	Canada				X	To find out about pregnant women's perceptions of tobacco and alcohol use during pregnancy and their perceptions of the messages they receive about these behaviours, taking into account their social and economic backgrounds	Apr - Jun 2005	Qualitative	Interviews	Method not specified but analysis process is described

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
7	Barbour (1990) [1]	United States				X	To present the results of an explanatory study that looked at both the drinking behaviours of pregnant women and the factors that influenced them	1987	Qualitative	Open-ended survey items	Not reported
8	Barhammar (2017) [1]	Sweden		X			To investigate women's own attitudes and thoughts about their diet- and exercise habits during their pregnancy, and health in general	Not reported	Qualitative	Interviews	Not reported
9	Bauld et al. (2017) [1]	United Kingdom			X		To explore the barriers to and facilitators of smoking cessation experienced by women during pregnancy and post partum, and elicit views on interventions to support cessation	Nov 2013 - Sept 2014 (pregnant); Jun - Dec 2014 (postnatal)	Qualitative	Interviews (series)	Thematic analysis
10	Bennett et al. (2013) [1]	Canada		X			To qualitatively examine women's experiences with physical activity throughout the course of pregnancy	Not reported	Qualitative	Semi-structured interviews (series)	Interpretative phenomenological analysis
11	Bennett (1999)	United States			X		To examine the experiences and perceptions of pregnant African American smokers	Not reported	Qualitative	Semi-structured interviews	Grounded theory
12	Bottorff et al. (2006) [1]	Canada			X		To explore the influence of couple interactions on women's tobacco reduction within the context of pregnancy and the postpartum period	Not reported	Qualitative	In-depth interviews (series)	Constant comparative analysis
13	Brahic et al. (2015) [1]	France			X	X	To study the norms of alcohol consumption during pregnancy	Not reported	Qualitative	Interviews	Content analysis
14	Bull et al. (2007) [1]	United Kingdom			X		To explore social attitudes towards smoking in pregnancy with parents of preschool children and pregnant women living in two areas of East Surrey	Not reported	Qualitative	Semi-structured interviews	Thematic analysis
15	Chana & Haith-Cooper (2019) [1]	United Kingdom	X	X			To explore barriers and motivations to maintaining a healthy lifestyle during pregnancy	Dec 2016 - May 2017	Qualitative	Semi-structured interviews	Thematic analysis
16	Cioffi et al. (2010)	Australia		X			To describe pregnant women's perceptions and participation in physical activity and identify the factors influencing their decision making	Not reported	Qualitative	Interviews	Method not specified but analysis process is described

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
17	Clarke & Gross (2004) [1]	United Kingdom		X			To examine the potential effect of low-risk pregnancy on women's recreational activity patterns and to explore pregnant women's information sources and beliefs regarding this activity	Not reported	Mixed methods	Open-ended survey items	Method not specified but analysis process is described
18	Crawford-Williams et al. (2015) [1]	Australia			X	X	To identify gaps in knowledge about the effects of alcohol use in pregnancy among pregnant women, newly delivered and their partners	Feb - May 2014	Qualitative	Focus groups	Thematic analysis
19	Darroch & Giles (2016) [1]	Canada	X	X			To explore how urban Aboriginal women understand pregnancy-related weight gain and physical activity	Not reported	Qualitative	Focus groups & semi-structured interviews	Critical discourse analysis
20	Deighton-Smith (2014) [1]	United Kingdom	X	X			To build a composite understanding of factors that have an influence on body image attitudes and coping strategies in nulliparous women	Mar 2011	Qualitative	Semi-structured interviews	Thematic analysis
21	Devine et al. (2000)	United States	X	X			To provide an in-depth understanding of women's experiences of the weight changes of pregnancy and the postpartum period and the strategies that women use to deal with those changes	Not reported	Qualitative	In-depth interviews (series)	Adapted constant comparative analysis
22	Dominguez (2016)	United States	X	X			To explore the effects of culture and acculturation on the diet, physical activity, and weight of pregnant immigrant Latinas of Mexican descent in Watsonville, California	Not reported	Qualitative	Semi-structured interviews	Guided by approaches developed by Miles & Huberman (1994) & Auerbach & Silverstein (2003)
23	Dormer (2019)	United Kingdom		X			To explore the lived experiences of physically active women during pregnancy	Not reported	Qualitative	In-depth, semi-structured interviews	Interpretative phenomenological analysis
24	Edvardsson et al. (2011) [1]	Sweden	X		X		To explore Swedish first-time parents' experiences of health promotion and lifestyle change during pregnancy and early parenthood	Jun - Dec 2010	Qualitative	In-depth, semi-structured interviews	Manifest & latent content analysis
25	Ekelin et al. (2018)	Sweden	X	X			To illuminate non-exercising pregnant women's views and experiences concerning exercise before and during pregnancy	Jan 2015 - Jun 2016	Qualitative	Interviews	Content analysis

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
26	Evans et al. (2016) [1]	Canada		X			To explore women's experiences of physically active leisure during pregnancy	May 2012 - Oct 2014	Qualitative	Interviews (series)	Thematic analysis
27	Fergie et al. (2019)	United Kingdom		X	X		To gain pregnant women's opinions on techniques which they have found to be, or think could be, useful in helping overcome the barriers or enhancing the facilitators towards achieving smoking cessation	Not reported	Qualitative	Semi-structured interviews	Thematic analysis
28	Findley et al. (2020)	United Kingdom	X	X			To explore and develop an understanding of women's experiences of PA during pregnancy and following birth, and decision-making processes in relation to engaging in PA during this time	Not reported	Qualitative	Semi-structured interviews	Thematic analysis
29	Ford (2013)	United Kingdom	X		X	X	To understand the social and cultural context of women's alcohol consumption during pregnancy by examining women's attitudes towards drinking during pregnancy and their awareness of the risks	Not reported	Qualitative	Biographical narrative interviews	Narrative analysis / combined thematic & structural analysis
30	Gaudet (2018)	Canada	X	X			To document the occupations that women have to do or to modify relatively to their pregnancy, to understand the experience of the first-time pregnant woman in relation to these daily changes and to explore how the pregnant woman's preoccupations influence her daily living	Nov 2017 - Apr 2018	Qualitative	Semi-structured interviews & logbook	Method not specified but analysis process is described
31	Gibson et al. (2020)	Australia			X	X	To better understand why messages to abstain may not always be effective with pregnant women and to inform a more tailored approach to health promotion	Nov 2015 - Mar 2016	Qualitative	Interviews & group discussions	Content analysis
32	Goodrich et al. (2013) [1]	United States	X	X			To better inform intervention messages by eliciting information on perceptions of appropriate weight gain, barriers to and enablers of exercise and healthy eating, and other influences on healthy weight gain during pregnancy in overweight or obese African American women	2010 - 2011	Qualitative	Semi-structured, in-depth interviews	Method not specified but analysis process is described

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
33	Gouilhers et al. (2019) [1]	Switzerland			X	X	To explore pregnant women's and their partner's experiences of the transition that occurs when they change their alcohol use	2013 - 2014	Qualitative	Semi-structured interviews (joint)	Thematic analysis
34	Grant et al. (2020) [3]	United Kingdom			X		To gain an in-depth understanding of the health issues affecting 10 low income pregnant women from deprived areas of south Wales, UK	Mar - Aug 2006	Qualitative	Visual elicitation interviews (series)	Thematic analysis
35	Grant et al. (2019) [3]	United Kingdom			X	X	To use creative methods with pregnant women living in deprived areas on a low income in the UK to facilitate discussion of experiences and thoughts in relation to health behaviours and pregnancy and to map these findings to the COM-B Model	Mar - Aug 2016	Qualitative	Visual elicitation interviews (series)	Thematic analysis
36	Greenhill (2019) [1]	United States	X	X			To explore the role of social support in pregnancy	May - Dec 2017	Qualitative	Semi-structured interviews	Content analysis
37	Griffiths (2019) [1]	United Kingdom			X		To explore the perceived barriers and facilitators to stopping smoking during pregnancy and engaging with cessation support for pregnant women and healthcare professionals	Not reported	Qualitative	Interviews	Thematic analysis
38	Groth & Morrison-Beedy (2013)	United States	X	X			To gain insight into how low-income, pregnant, African American women view physical activity and approach nutrition during pregnancy	Not reported	Qualitative	Focus groups	Content analysis
39	Hammer & Inglin (2014)	Switzerland			X	X	To explore differences in how pregnant women perceive the risks related to alcohol and tobacco use in everyday life	May 2008 - Jun 2009	Qualitative	Semi-structured interviews	Thematic analysis
40	Haslam & Draper (2001) [1]	United Kingdom			X		To examine the extent to which pregnant smokers are aware of the health risks, how they rationalize their smoking, the prompts they suggest encourage them to smoke, and to consider the implications for health promotion programmes	Not reported	Qualitative	Interviews	Method not specified but analysis process is described
41	Hassall (2016) [1]	United Kingdom	X	X			To develop a theoretical insight into the factors that influence women's decisions regarding exercise in pregnancy and how they process the influences and multiple alternatives they encounter	Jun 2012 - Dec 2013	Qualitative	Semi-structured interviews (series)	Constant comparative analysis

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
42	Hoffmeister (2016)	Portugal				X	To explore pregnant women's attitudes (in its behavioural, cognitive and emotional aspects) about low risk alcohol consumption during pregnancy	Not reported	Mixed methods	Semi-structured interviews	Not reported
43	Hyman & Dussault (2000)	Canada	X				To explore health behaviours, social support and stress, in a group of pregnant Southeast Asian immigrant women displaying different levels of acculturation	Not reported	Qualitative	Semi-structured interviews	Not reported
44a	Ingall (2011) (chapter 3)	United Kingdom			X		To explore psychological barriers to quitting and to use the findings to devise questions for a semi-structured interview schedule to further investigate in-depth the complexities of psychological barriers to quitting nicotine in pregnancy	Not reported	Qualitative	Focus groups	Interpretative phenomenological analysis
44b	Ingall (2011) (chapter 4)	United Kingdom			X		To identify what psychological barriers exist for pregnant women when attempting to quit smoking and what determinants are associated with successful quitting	Not reported	Qualitative	Semi-structured interviews	Interpretative phenomenological analysis
45	Jennings-Hobbs (2017)[1]	United Kingdom			X	X	To explore pregnant women's experiences of smoking cessation within the contexts of their intimate relationships	Not reported	Qualitative	Semi-structured interviews	Grounded theory / constant comparative analysis
46	Johnson et al. (2019)	United Kingdom			X		To explore the experiences of young women aged 18–20 years who had smoked tobacco at some point during their pregnancy	Not reported	Qualitative	Semi-structured interviews	Descriptive phenomenology
47	Jones et al. (2012)[1]	Australia				X	To explore awareness of, and attitudes towards, alcohol consumption during pregnancy, and the factors that may encourage or inhibit women to abstain from drinking while pregnant	Not reported	Qualitative	Semi-structured interviews	Not reported
48	Kessler & Alversion (2017)[2]	United States			X		To acquire an understanding of factors that influence the desire to quit and maintain smoking abstinence during pregnancy and the postpartum period, and to determine the feasibly of replicating the method for an expanded study	Not reported	Mixed methods	Open-ended survey items	Not reported

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
49	Koshy et al. (2010)[1]	United Kingdom			X		To explore whether pregnant women's perceptions of social support for smoking cessation are indicative of quitting outcomes during pregnancy	2000 - 2003	Qualitative	Interviews (series)	Framework analysis
50	Kreku (2015)	Finland		X			To describe physical exercise during pregnancy, experiences of physical exercise during pregnancy, and counselling about physical exercise received at the maternity clinic	Not reported	Qualitative	Open-ended survey items	Content analysis
51	Laing (2015)	United Kingdom		X	X	X	To explore pregnant women's understanding of their drinking behaviour	Summer 2009 & Spring 2010	Qualitative	In-depth interviews	Thematic coding
52	Lee et al. (2018)[1,2]	Australia	X				To assess, compare and contrast the pregnancy nutrition knowledge of, and sources of nutrition information used by pregnant women, midwives and obstetricians, and to explore the influence that nutrition knowledge has on dietary behaviour of pregnant women and/or nutrition counselling practices of midwives and obstetricians	Sept - Dec 2014	Mixed methods	Semi-structured interviews	Thematic analysis
53	Lee (2016)	United States	X				To understand how Central American immigrant women learn, to generate insight for providers to capitalize on pregnancy as a teachable moment for healthy eating and diabetes prevention	Mar 2014 - Feb 2015	Qualitative	In-depth interviews	Framework analysis
54	Lee et al. (2011)[1]	Taiwan		X			To explore women's exercise beliefs during pregnancy by investigating their behavioral beliefs, normative beliefs and control beliefs	Not reported	Qualitative	Open-ended survey items	Content analysis
55	Leiferman et al. (2011)	United States		X			To examine multilevel barriers and facilitators related to physical activity engagement during pregnancy in women of low socioeconomic status	Not reported	Qualitative	Individual & paired interviews	Method not specified but analysis process is described
56	Marshall et al. (2019)[1]	United States	X	X			To gain further insight into the lives of pregnant youth, specifically around body image, food, exercise, and influences during pregnancy	2016	Qualitative	Social media mining	Method not specified but analysis process is described

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
57	Modi (2008)[1]	United Kingdom			X		To explore user experiences, perceptions and expectations of stop smoking services in pregnancy, in order to identify ways of improving recruitment of women into services and improving quit rates	Not reported	Qualitative	Focus groups	Grounded theory
58	Morris et al. (2020)[1]	United Kingdom	X	X			To explore the factors that influenced women's diet and physical activity during pregnancy and to identify the needs of these women with regards to lifestyle support	Not reported	Qualitative	Semi-structured interviews	Thematic analysis[1]
59	Morrison et al. (2020)[1,2]	United States	X	X			To better understand the knowledge, behaviors, and social factors that influence weight gain among pregnant youth	Not reported	Mixed methods	Semi-structured interviews	Thematic analysis
60	Mostyn Williams (1998)	United Kingdom			X		To explore why nulliparous women continue to smoke in pregnancy	Dec 1994 - Mar 1995	Qualitative	Unstructured interviews	Constant comparative analysis
61	Murray et al. (2014)	Canada			X		To explore the meaning and the totality of the lived experience of smoking in pregnancy	Not reported	Qualitative	Interviews	Informed by van Manen's (1990) approach
62	Nash (2015)[4]	Australia	X				To explore body image in pregnancy through embodied practices including eating, exercising and dressing	2006 - 2008	Qualitative	Interviews (series)	Situational analysis
63	Nash (2011)[1,4]	Australia	X	X			To explore informants' negotiations around the performance of pregnancy "fitness" and "good" mothering through exercise	2006 - 2008	Qualitative	In-depth interviews (series)	Situational analysis
64	Nguyen et al. (2012)	United States			X		To understand what influences resumption of smoking among women who quit smoking while pregnant, with a particular focus on the role of social networks	Jun - Aug 2009	Qualitative	In-depth, semi-structured interviews	Constant comparative analysis
65	Nichter et al. (2007)	United States			X		To explore factors that motivate as well as undermine quit and harm reduction attempts for women who smoke during pregnancy	2000 - 2002	Qualitative	Semi-structured interviews (series)	Method not specified but analysis process is described
66	O'Brien et al (2017)[1]	Ireland	X	X			To explore the various factors within the life course, both past and present, that overweight and obese pregnant women perceive to influence their food choice and physical activity behaviours	Jul 2013 - Jan 2014	Qualitative	Semi-structured, in-depth interviews	Thematic analysis

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
67	Padmanabhan et al. (2015) [1]	United Kingdom	X	X			To examine pregnant women's weight-related attitudes and beliefs (including the weight-related behaviours of diet and physical activity during pregnancy)	Not reported	Qualitative	Interviews	Thematic content analysis
68	Petrov Fieril et al. (2014)	Sweden	X	X			To describe experiences of exercise during pregnancy among women who performed regular resistance training	Not reported	Qualitative	Semi-structured interviews	Content analysis design & thematic analysis
69	Pledger (2015)	United Kingdom			X		To retrospectively examine the needs, motivations and experiences of pregnant women using an NHS stop smoking service	Aug - Sept 2013	Qualitative	Semi-structured interviews	Constant comparative analysis
70	Pletsch & Thornton Kratz (2004)	United States	X		X		To describe factors that motivated women to stop smoking while pregnant and were related to smoking abstinence or resumption postpartum	Not reported	Qualitative	Semi-structured, in-depth interviews (series)	Thematic content analysis
71	Raymond et al. (2009)	United Kingdom				X	To explore pregnant women's attitudes towards alcohol consumption during pregnancy and their attitudes towards sources of information and advice about drinking in pregnancy	2007	Qualitative	Semi-structured interviews	Thematic analysis
72	Reyes et al. (2013) [1]	United States	X				To understand the perceptions of low-income, overweight, and obese, African-American mothers about diet quality in pregnancy, specifically focused on what facilitators and barriers exist to eating healthy	2011	Qualitative	Semi-structured interviews	Used grounded theory principles
73	Scholin et al. (2018) [1]	United Kingdom & Sweden				X	To explore practices and perceptions of alcohol use during pregnancy in England and Sweden, against wider sociocultural factors and the backdrop in differing policy contexts	Oct 2013 - Sept 2014 (England); May 2014 - Aug 2014 (Sweden)	Qualitative	Semi-structured interviews	Thematic analysis

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
74a	Smith (2017) (chapter 6)	United Kingdom	X	X			To explore the barriers/facilitators to leading a healthy lifestyle for overweight pregnant women, the lifestyle advice received by overweight women during pregnancy, and the impact that the issue of weight being raised has on these women	Not reported	Qualitative	Semi-structured interviews	Thematic analysis
74b	Smith (2017)[1] (chapter 7)	United Kingdom	X	X			To explore the barriers and facilitators to leading a healthy lifestyle for overweight pregnant women, and to assess whether these barriers differ for normal weight and obese women	Not reported	Qualitative	Semi-structured interviews	Framework analysis
75	Stricher (2018)	Finland			X		To describe experiences of women who smoked during pregnancy and understand how they felt about intervention over smoking	Apr - Jun 2015	Qualitative	Open-ended survey items	Content analysis
76	Subramanian et al. (2020)	United Kingdom			X		To investigate the barriers and facilitators to physical activity in women who were active prior to pregnancy and the postpartum period, and to explore views on, and requirements for, the development of an intervention to support maintain or increase physical activity levels	Dec 2018 - Jan 2019	Qualitative	Focus groups	Thematic analysis
77	Szwajcer et al. (2007)[1]	The Netherlands	X		X	X	To explore the influence of a life event (pregnancy) on nutrition awareness and the motivations for nutrition behaviour	Not reported	Qualitative	In-depth interviews	Constant comparative analysis
78	Thornton et al. (2006)[1]	United States	X	X			To investigate the influence of social support on weight, diet, and physical activity-related beliefs and behaviors among pregnant and postpartum Latinas	2000 - 2001	Qualitative	In-depth, semi-structured interviews	An inductive analytical procedure was followed
79	Tod (2003)	United Kingdom			X		To explore and explain barriers to smoking cessation in pregnancy	Oct - Dec 2001	Qualitative	Semi-structured interviews	Framework analysis
80	Tombor (2015)[1]	United Kingdom		X	X		To obtain in-depth understanding of pregnant smokers' views on their intrapersonal characteristics and environmental factors in relation to smoking and cessation in order to inform the content specification of a new smartphone app for pregnant smokers	Apr - Oct 2013	Qualitative	Structured interviews	Thematic analysis

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
81	Tovar et al. (2010)[1]	United States	X	X			To evaluate knowledge, attitudes and beliefs regarding weight gain during pregnancy in a predominantly Puerto Rican population	Jan 2008	Qualitative	Focus groups	Method not specified but analysis process is described
82	Trevorrow (2016)	United Kingdom		X			To investigate how women perceive exercising during pregnancy and whether existing technologies could be used to support active behaviors	Not reported	Qualitative	Semi-structured interviews	Interpretative phenomenological analysis
83	Tweheyo (2016)[1]	United Kingdom	X	X	X		To explore how women negotiate pregnancy in the context of food and weight status	Not reported	Qualitative	Semi-structured, in-depth interviews (series)	Interpretative phenomenological analysis
84	van Mulken et al. (2016)	Australia		X			To explore women's physical activity experiences throughout pregnancy and to explore ways in which these experiences were formed, supported and/or opposed by their social environment	Not reported	Qualitative	Semi-structured, in-depth interviews (series)	Modern dialectics (Bitsakis 2002)
85	Warren (2013)[1]	United Kingdom	X	X			To obtain an insight into the views and experiences of overweight pregnant women regarding gestational weight gain, focusing on their intentions relating to dietary and physical activity behaviours during pregnancy	Jan 2010 - Jun 2011	Qualitative	Semi-structured interviews (series)	Framework described by King & Horrocks (2010)
86	Waterson (1992)	United Kingdom			X	X	To explore alcohol use in pregnancy and early motherhood and to contrast levels of drinking and levels of social advantage	Oct - Nov 1985; Jan - Feb 1986	Qualitative	Semi-structured interviews	Not reported
87	Weir et al. (2010)[1]	United Kingdom	X	X			To explore the views and experiences of overweight and obese pregnant women, and inform interventions which could promote the adoption of physical activity during pregnancy	Not reported	Qualitative	Semi-structured, in-depth interviews	Framework analysis
88	Whitaker et al. (2016)[1]	United States	X	X			To use the TPB framework to describe African American and White women's perceptions of weight gain, physical activity, and nutrition during pregnancy using qualitative methods and to explore differences in perceptions by race	Jun - Aug 2014	Qualitative	Interviews	Content analysis

ID	Study	Country	Behaviours coded				Aim	Data collection period	Study type	Data collection method	Analytic method
			D	P	S	A					
89	Wigginton & Lee (2013)	Australia			X		To explore the experiences of stigma of Australian women who continued to smoke while pregnant, and any unintended consequences of their smoking	May - Aug 2011	Qualitative	Semi-structured interviews & email interviews	Thematic analysis

NB. Details reported relate only to pregnant or postnatal women in any given sample, where distinguishable

[1] Data for some participants has been excluded based on the eligibility criteria.

[2] Reporting qualitative phase of the study only.

[3, 4] More than one paper report data from this sample.

S9. Sample characteristics of included studies

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
1	Agberotimi (2013)	Pregnant women	N = 6; age = 25-40; parity not reported	Antenatal	Pregnant	Not reported
2a	Allen-Walker (2016) (chapter 4)	Postnatal women	N = 10; age = >18 (M = 34.5); parity not reported	Postnatal	9 months postnatal	Not reported
2b	Allen-Walker (2016)[1] (chapter 5)	Pregnant women	N = 13; age = 24-40 (average = 31.5); nulliparous & multiparous	Antenatal & postnatal	19-24 weeks pregnant; 5-10 weeks & 27-31 weeks postnatal	Inclusion: Singleton pregnancy, >18 years old, <16 weeks gestation at booking appointment, low risk pregnancy
3	Andersson & Ernstsson (2017)	Postnatal women	N = 8; age = 26-32; parity not reported	Postnatal	4-22 months postnatal	Inclusion: First-time mothers, no present illness affecting food intake, no illness that affected food intake during pregnancy, <2 years postnatal
4	Ashwin et al. (2012)[1]	Pregnant women who quit smoking during pregnancy	N = 27; age = 16-38; parity not reported	Antenatal & postnatal	28 weeks pregnant; 6-8 weeks & 3-6 months postnatal	Not reported
5	Atkinson et al. (2016)[1]	Pregnant women	N = 7; age = 28-42; nulliparous only	Antenatal	24-33 weeks pregnant	Not reported
6	Audet et al. (2006)[1]	Pregnant women	N = 31; age not reported; nulliparous & multiparous	Antenatal	Pregnant	Not reported
7	Barbour (1990)[1]	Pregnant women	N = 20; age = 17-35; nulliparous & multiparous	Antenatal	Third trimester	Not reported
8	Barhammar (2017)[1]	Postnatal women	N = 6; age = 22-28; nulliparous & multiparous	Postnatal	Postnatal	Inclusion: Women who had previously been pregnant
9	Bauld et al. (2017)[1]	Pregnant smokers	N = 41; age = 16-42 (M = 26); parity not reported	Antenatal & postnatal	12-29 weeks pregnant	Inclusion: Aged ≥ 16 years, English speaking, Referred to NHS obstetrics services at study area A or B, 6–15 weeks' gestation at maternity booking, self-reported smoker at maternity booking

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
10	Bennett et al. (2013) [1]	Physically active pregnant women	N = 9; age = 25-41; nulliparous only	Antenatal	10-35 & 31-39 weeks pregnant	Inclusion: Women expecting their first child, physically active previous to becoming pregnant; remained active (or attempted to remain active) after becoming pregnant, English-speaking
11	Bennett (1999)	African American, pregnant smokers	N = 6; age = 18-43; nulliparous & multiparous	Antenatal	Average = 20 weeks pregnant	Inclusion: African American women, >18 years old, currently pregnant, regular smokers immediately before/during at least part of their pregnancy
12	Bottorff et al. (2006) [1]	Postnatal women who quit/reduced smoking during pregnancy	N = 28; age = 20-49 (average = 30); nulliparous & multiparous	Postnatal	2-4 weeks & 3-6 months postnatal	Inclusion: First-time mothers as well as those who had experience with tobacco reduction from previous pregnancies
13	Brahic et al. (2015) [1]	Pregnant women	N = 64; age = 16-41 (average = 28.9); nulliparous & multiparous	Antenatal	All trimesters	Not reported
14	Bull et al. (2007) [1]	Pregnant women	N = 7; age = 19-42; nulliparous & multiparous	Antenatal	Pregnant	Inclusion: Pregnant women or parents of at least one child <5 years old
15	Chana & Haith-Cooper (2019) [1]	Pregnant women	N = 12; age = 22-36, nulliparous & multiparous	Antenatal	26-29 weeks pregnant	Inclusion: >16 years old, ongoing, low-risk pregnancy, good understanding of written/verbal English Exclusion: Women with medical conditions
16	Cioffi et al. (2010)	Pregnant women	N = 19; age = 18-40 (median = 35); nulliparous & multiparous	Antenatal	1-30+ weeks pregnant	Inclusion: English speaking, >18 years old, no physical impairments, no pre-existing conditions that would inhibit physical activity
17	Clarke & Gross (2004) [1]	Pregnant women	N = 57; age = 15.7- 38.2 (M = 26.3, SD = 5.2); nulliparous only	Antenatal	16-38 weeks pregnant	Inclusion: Women who conceived naturally, no more than one previous miscarriage, no pre-existing condition which might be exacerbated by pregnancy
18	Crawford-Williams et al. (2015) [1]	Pregnant/postnatal women	N = 17; age = 23-40; parity not reported	Antenatal & postnatal	13-38 weeks pregnant; 4-20 weeks postnatal	Not reported

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
19	Darroch & Giles (2016) [1]	Pregnant/postnatal Aboriginal women	N = 25; age = 16-39; multiparous only	Antenatal & postnatal	Pregnant; <2 years postnatal	Not reported
20	Deighton-Smith (2014) [1]	Pregnant women	N = 9; age = 24-35 (M = 30.11, SD = 1.30); nulliparous only	Antenatal	12-38 weeks pregnant	Inclusion: Nulliparous women, >18 years old
21	Devine et al. (2000)	Pregnant women	N = 36; age = 18-41; nulliparous & multiparous	Antenatal	Mid-pregnancy; 6 & 12 weeks postnatal	Not reported
22	Dominguez (2016)	Pregnant, Mexican-born Latina women who immigrated to the US <5 years ago	N = 10; age = >18 (m=31); multiparous only	Antenatal	Average = 7 months pregnant	Inclusion: >18 years old, immigrated to the US <5 years ago, self-reported their ethnicity as Latina, born in Mexico, pregnant, undergone a pregnancy in Mexico, planned to keep the baby, planned to remain in the Watsonville area during the study period, no active history of substance use or psychiatric illness, no restrictions in terms in diet/nutrition or exercise, no critical medical conditions
23	Dormer (2019)	Postnatal women	N = 5; age = 24-36 (Mean = 31.6, SD = 5.1); nulliparous & multiparous	Postnatal	2 weeks - 6 months postnatal	Inclusion: Fluently English, healthy pregnancy with no known complications, >30 weeks pregnant or have given birth within the last 6 months, >18 years old, had been physically active during pregnancy on average at least once per week or more throughout pregnancy for at least 12 weeks, participated in any informal or unstructured physical activity, no known health contraindications Exclusion: A communication disability that would limit participation in an interview such as a speech and/or hearing impairment
24	Edvardsson et al. (2011) [1]	Postnatal women	N = 12; age = 25-35; nulliparous only	Antenatal & postnatal	18 months postnatal (some of these women were also pregnant again)	Inclusion: First-time mothers/fathers (independent of relationship status) of an 18-month-old child
25	Ekelin et al. (2018)	Pregnant, non-exercising women	N = 16; age = 23-41; nulliparous & multiparous	Antenatal	First & third trimesters	Inclusion: Swedish- or English-speaking non-exercising women, >18 years old Exclusion: Women with conditions that contra-indicated exercise, women diagnosed with gestational diabetes

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
26	Evans et al. (2016)[1]	Pregnant women	N = 12; age = 24-38; nulliparous & multiparous	Antenatal & postnatal	Second & third trimesters; 4-6 months postnatal	Not reported
27	Fergie et al. (2019)	Pregnant women who smoke/ recently quit smoking	N = 11; age = 19-40; parity not reported	Antenatal	7-38 weeks pregnant	Inclusion: ≥18 years old, appropriate command of spoken English, ability to give informed consent, pregnant and currently smoking or recent quitter who smoked during pregnancy
28	Findley et al. (2020)	Pregnant/postnatal women	N = 16; age = >18; nulliparous only	Antenatal & postnatal	14-38 weeks pregnant; 3-13 weeks postnatal	Inclusion: 18– 40 years old, lived in England, spoke fluent English
29	Ford (2013)	Postnatal women	N = 21; age = 20-44; nulliparous & multiparous	Postnatal	<2 years postnatal	Not reported
30	Gaudet (2018)	Pregnant/postnatal women	N = 8; age = 23-35 (M = 28.5 ± 4.2); nulliparous only	Antenatal & postnatal	14-40 weeks pregnant; <6 months postnatal	Inclusion: >15 weeks pregnant with first child, normal pregnancy (no complications, no multiple pregnancy), live in Quebec, understand/speak French well Exclusion: Women with a condition or diagnosis relating to their physical or mental health if that could limit their understanding or participation in the study, experience of problems relating to their pregnancy, women who had already experienced a first pregnancy
31	Gibson et al. (2020)	Pregnant women	N = 28; age = >18; parity not reported	Antenatal	8-39 weeks pregnant	Inclusion: ≥18 years old, able to speak/write in English
32	Goodrich et al. (2013)[1]	Overweight/obese pregnant women	N = 33; age = 18-39 (average = 25.9); nulliparous & multiparous	Antenatal & postnatal	8-23 weeks & 24–36 weeks pregnant; 6-12 weeks postnatal	Inclusion: 18–39 years old, African American, pre-pregnancy BMI of 25–40 kg/m2, able to speak/read English, started prenatal care <16 weeks gestation, singleton pregnancy, not affected by any medical or physical conditions that prohibit exercise or regular physical activity
33	Gouilhers et al. (2019)[1]	Pregnant women	N = 30; age = 23-37; parity not reported	Antenatal	21-39 weeks pregnant	Exclusion: Couples where the woman never drank alcohol before pregnancy, couples where the woman had been diagnosed with problematic consumption of alcohol, pregnancies with medical complications

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
34	Grant et al. (2020) [3]	Low-income pregnant women	N = 10; age = 24-34; nulliparous & multiparous	Antenatal	6-29 weeks pregnant	Inclusion: Resident in areas of the highest quintile of deprivation according to the Welsh IMD, claiming means tested benefits, planning to remain resident in south Wales in order to complete the scheduled data production
35	Grant et al. (2019) [3]	Low-income pregnant women	N = 10; age = 24-34 (median = 29); nulliparous & multiparous	Antenatal	6-29 weeks pregnant	Not reported
36	Greenhill (2019) [1]	Pregnant women	N = 11; age = 23-36; parity not reported	Antenatal	Second & third trimester	Inclusion: English-speaking, primigravid women living in the U.S, >18 years old, provide a phone number, agree to participate in a semi-structured phone interview, in a relationship with a partner who lived in the same household
37	Griffiths (2019) [1]	Women who smoked during pregnancy	N = 8; age = >18; parity not reported	Antenatal	M = 24.5 weeks pregnant	Inclusion: Pregnant/recently pregnant, a smoker/recent ex-smoker (smoked <6 months ago and to have smoked during pregnancy), >18 years old, able to give informed consent, fluent in spoken English
38	Groth & Morrison-Beedy (2013)	Low-income, pregnant, African American women	N = 26; age = 18-39; nulliparous & multiparous	Antenatal	10-40 weeks pregnant	Inclusion: >18 years old, pregnant, self-identify as African American
39	Hammer & Inglin (2014)	Pregnant women	N = 50; age = 24-41; nulliparous & multiparous	Antenatal	16-28 weeks pregnant	Inclusion: Women having a normal pregnancy Exclusion: Women having high-risk pregnancies or exhibiting any pathology
40	Haslam & Draper (2001) [1]	Pregnant smokers	N = 40; age = 15-35; parity not reported	Antenatal	Pregnant	Not reported
41	Hassall (2016) [1]	Pregnant women who exercise regularly	N = 10; age = 27-46 (average = 34); nulliparous & multiparous	Antenatal & postnatal	Second & third trimester; 6-8 weeks postnatal	Inclusion: >16 years old, usually exercise regularly Exclusion: Women without the capacity to give informed consent, women with any contraindication to exercising in pregnancy

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
42	Hoffmeister (2016)	Pregnant women	N = 13; age = 20-38 (average = 30); nulliparous & multiparous	Antenatal	Pregnant	Inclusion: Existence of a current pregnancy and Portuguese nationality Exclusion: Existence of a high-risk pregnancy
43	Hyman & Dussault (2000)	Pregnant Southeast Asian women	N = 17; age = 26-37; parity not reported	Antenatal	Pregnant	Not reported
44a	Ingall (2011) (chapter 3)	Pregnant/postnatal women who smoked during pregnancy	N = 10; age = 18-40; nulliparous & multiparous	Antenatal & postnatal	Pregnant; <2 months postnatal	Not reported
44b	Ingall (2011) (chapter 4)	Pregnant/postnatal women who attempted to quit smoking	N = 10; age = 25-45; nulliparous & multiparous	Antenatal & postnatal	Pregnant; <2 months postnatal	Inclusion: Women who made attempts to abstain from nicotine smoking for more than one day
45	Jennings-Hobbs (2017) [1]	Pregnant smokers	N = 5; age = 18-33; nulliparous only	Antenatal	10-32 weeks pregnant	Inclusion: Pregnant, nulliparous, smoking when they became pregnant, in an intimate relationship Exclusion: Non-English-speaking women
46	Johnson et al. (2019)	Young women who smoked during pregnancy	N = 5; age = 18-20; parity not reported	Antenatal & postnatal	Pregnant; <1 year postnatal	Inclusion: 18-20 years old, pregnant/given birth <1 year ago, smoked tobacco at some point during pregnancy
47	Jones et al. (2012) [1]	Pregnant women	N = 12; age = >18 (average = 29); nulliparous & multiparous	Antenatal	Pregnant	Not reported
48	Kessler & Alversion (2017) [2]	Low-income pregnant smokers	N = 18; age = >18; parity not reported	Antenatal	4-40 weeks pregnant	Inclusion: ≥18 years old, current smoker, prenatal patient at the clinic, ability to read and communicate in English, ability to give informed consent
49	Koshy et al. (2010) [1]	Pregnant women who smoked/ recently quit smoking	N = 24; age = 15-40; nulliparous & multiparous	Antenatal	Pregnant	Not reported
50	Kreku (2015)	Pregnant women	N = 12; age = 18-40; nulliparous & multiparous	Antenatal	37-39 weeks pregnant	Not reported

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
51	Laing (2015)	Pregnant women	N = 20; age = 20-37; nulliparous & multiparous	Antenatal	Pregnant	Inclusion: Women attending routine antenatal care, booked <14 weeks gestation Exclusion: Women experiencing known pregnancy complications, <18 years old, reporting no alcohol consumption prior to pregnancy, a history of illicit substance use and/or alcohol dependence
52	Lee et al. (2018) [1, 2]	Pregnant women	N = 19; age 19-41; nulliparous & multiparous	Antenatal	All trimesters	Inclusion: Singleton pregnancy, English language proficiency Exclusion: Women with higher order pregnancies
53	Lee (2016)	Pregnant/postnatal Central American immigrant women	N = 30; age = 18-45; parity not reported	Antenatal & postnatal	>28 weeks pregnant; 3-6 months postnatal	Inclusion: 18-45 years old, tested for GDM, >28 weeks gestation, no health or lifestyle factors that would make participation a burden
54	Lee et al. (2011) [1]	Pregnant women	N = 58; age = 20-40 (average = 31.21, SD =3.92); nulliparous & multiparous	Antenatal	Average = 28.74 weeks pregnant	Not reported
55	Leiferman et al. (2011)	Pregnant women of low socioeconomic status	N = 25; age = 18-46; nulliparous & multiparous	Antenatal	17-40 weeks pregnant	Inclusion: Pregnant, English-speaking, 18-46 years old, in second/third trimester, recipients of Medicaid Exclusion: Participants experiencing high-risk pregnancy or were advised not to exercise
56	Marshall et al. (2019) [1]	Young pregnant women	N = 43; age = 16-24; parity not reported	Antenatal	Pregnant	Not reported
57	Modi (2008) [1]	Women who smoked during a past pregnancy	N = 18; age = 17-37; parity not reported	Postnatal	4-56 months postnatal	Not reported
58	Morris et al. (2020) [1]	Postnatal women	N = 17; age = 23-40 (average = 33); nulliparous & multiparous	Postnatal	<7 months postnatal	Inclusion: Women who participated in the intervention arm of the Southampton PRegnancy Intervention for the Next Generation (SPRING) trial

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
59	Morrison et al. (2020) [1,2]	Young pregnant women	N = 54; age = 16-24; parity not reported	Antenatal	Third trimester (+1 postnatal participant)	Inclusion: Youth with singleton pregnancies, 14-24 years old, access to a cell phone with texting capabilities, ability to speak/read English
60	Mostyn Williams (1998)	Postnatal women who smoked during pregnancy	N = 10; age = 19-37; nulliparous only	Postnatal	<3 weeks postnatal	Inclusion: First full-term pregnancy of >37 weeks gestation, no recognised medical or obstetric complication in pregnancy, normal vaginal delivery, smoked throughout pregnancy, consented to take part
61	Murray et al. (2014)	Pregnant women who smoked/ recently quit smoking	N = 8; age = 20-31 (M = 23.8, SD = 3.9); nulliparous & multiparous	Antenatal	12-33 weeks pregnant	Inclusion: Pregnant emancipated minors or woman, >19 years old, smoked/quit smoking during pregnancy
62	Nash (2015) [4]	Pregnant women	N = 38; age 21-43; parity not reported	Antenatal & postnatal	10-20 weeks pregnant; 8-10 weeks postnatal	Not reported
63	Nash (2011) [1,4]	Pregnant women	N = 38; age 21-43; parity not reported	Antenatal & postnatal	10-20 weeks pregnant; 8-10 weeks postnatal	Not reported
64	Nguyen et al. (2012)	Postnatal women who quit smoking during pregnancy	N = 24; age 18-36; parity not reported	Postnatal	Postnatal	Inclusion: Verbally consented to be screened, spoke English, recently gave birth to a healthy infant, >18 years old, no scheduling conflict, smoked in the past but quit smoking since becoming pregnant
65	Nichter et al. (2007)	Low-income pregnant smokers	N = 53; age = 18-43 (M = 25); nulliparous & multiparous	Antenatal	Mean = 19.3 weeks pregnant	Inclusion: Low-income women, <28 weeks pregnant, had been smoking at the time they learned of their pregnancy
66	O'Brien et al (2017) [1]	Pregnant women with a BMI >25kg/m2	N = 22; age = >18 (M = 32.3, SD = 4.5); nulliparous & multiparous	Antenatal	34 weeks pregnant	Inclusion: 18-45 years old, singleton pregnancy, early pregnancy BMI of between 25.0 kg/m2 - 39.9 kg/m2, no history of diabetes or other relevant medical disorders
67	Padmanabhan et al. (2015) [1]	Pregnant women	N = 19; age = 19-38; nulliparous & multiparous	Antenatal	Third trimester	Inclusion: >16 years old, singleton pregnancy, able to read/write in English
68	Petrov Fieril et al. (2014)	Pregnant women who perform regular resistance training	N = 17; age = >25; nulliparous & multiparous	Antenatal	15-35 weeks pregnant	Inclusion: Single pregnancy, ongoing, regular highly repetitive resistance training (once or twice a week for 5 weeks or longer), absence of medical or obstetric diseases, ability to speak Swedish

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
69	Pledger (2015)	Postnatal women who accessed an NHS stop smoking service during pregnancy	N = 6; age = 18-35; parity not reported	Antenatal	<9 months postnatal	Inclusion: Women referred to the NHS stop smoking service whilst pregnant (July 2012-13); ability to speak English fluently, >18 years old, had an initial assessment with an NHS stop smoking advisor Exclusion: Accessed mental health services within the preceding 12 months
70	Pletsch & Thornton Kratz (2004)	Pregnant ex-smokers	N = 15; age = >18 (M = 24, SD = 5.7); nulliparous & multiparous	Antenatal & postnatal	Early pregnancy & 36 weeks pregnant; 3 months postnatal	Inclusion: >18 years old, speak English, stopped smoking by first prenatal visit
71	Raymond et al. (2009)	Pregnant women	N = 20; age = 23-40 (Median = 33); nulliparous & multiparous	Antenatal	12-14 weeks pregnant	Not reported
72	Reyes et al. (2013)[1]	Low-income, overweight/obese, pregnant African American women	N = 21; age: 18-37 (M = 23.8 ± 5.0); nulliparous & multiparous	Antenatal	All trimesters	Inclusion: Mothers who self-identified as African American, ≥ 18 years old, received Medicaid
73	Scholin et al. (2018)[1]	Postnatal women	N = 33; age = 24-40; nulliparous & multiparous	Postnatal	<18 months postnatal	Not reported
74a	Smith (2017) (chapter 6)	Overweight pregnant/postnatal women	N = 7; age = >18; nulliparous & multiparous	Antenatal & postnatal	Pregnant; <1 year postnatal	Inclusion: >18 years old, singleton pregnancy/within one year postpartum, 1st/2nd pregnancy, BMI 25-29kg/m2
74b	Smith (2017)[1] (chapter 7)	Overweight pregnant/postnatal women	N = 18; age = >18; nulliparous & multiparous	Antenatal & postnatal	28-40 weeks pregnant; 1-2 days postnatal	Inclusion: >18 years old, singleton pregnancy/within 6 weeks postpartum, fluent in English, BMI 18.5-24.9 Kg/m2 (for G1), BMI 25-29.9 Kg/m2 (for G2), BMI ≥30kg/m2 (for G3)
75	Stricher (2018)	Women who smoked during pregnancy	N = 53; age = 20-41 (average = 28); nulliparous & multiparous	Antenatal & postnatal	Pregnant; <2 years postnatal	Inclusion: >18 years old, pregnant/had given birth <2 years ago, smoked during pregnancy, spoke Finnish
76	Subramanian et al. (2020)	Active pregnant/postnatal women	N = 19; age = 25-36; parity not reported	Antenatal & postnatal	Mean = 26.8 weeks pregnant; 5 months postnatal	Inclusion: Pregnant/postpartum (< 1 year), active during pregnancy/were already active before pregnancy

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
77	Szwajcer et al. (2007) [1]	Pregnant women	N = 48; age = 21-39; nulliparous & multiparous	Antenatal	All trimesters (nulliparous women) & first trimester (multiparous women)	Not reported
78	Thornton et al. (2006) [1]	Pregnant/postnatal Latino women	N = 10; age = 21-36 (M = 27.1); nulliparous & multiparous	Antenatal & postnatal	Pregnant; 6-12 weeks postnatal	Inclusion: Spanish-speaking Latino pregnant/post-partum community residents, ≥ 18 years old
79	Tod (2003)	Pregnant smokers	N = 11; age = 19-38; nulliparous & multiparous	Antenatal	Pregnant	Inclusion: >16 years old, able to give informed consent, able to participate during the study period, smoked during their pregnancy
80	Tombor (2015) [1]	Pregnant smokers	N = 8; age = 17-30; parity not reported	Antenatal	11-36 weeks pregnant	Inclusion: Women >16 years old, smoked cigarettes daily/occasionally, interested in stopping smoking
81	Tovar et al. (2010) [1]	Pregnant Puerto Rican and Dominican women	N = 29; age = 18-40; parity not reported	Antenatal	11-28 weeks pregnant	Inclusion: 18–40 years old, singleton pregnancy, >11 weeks and <28 weeks gestation, self-identified as Puerto Rican/Dominican, no diagnosis of chronic diseases
82	Trevorrow (2016)	Pregnant women	N = 5; age = 27-40; nulliparous & multiparous	Antenatal	Pregnant	Not reported
83	Tweheyo (2016) [1]	Pregnant women	N = 10; age = 22-35; nulliparous & multiparous	Antenatal & postnatal	<24 weeks pregnant; <4 weeks postnatal	Inclusion: 20-40 years old
84	van Mulken et al. (2016)	Pregnant women	N = 30; age = >18; nulliparous & multiparous	Antenatal	All trimesters	Inclusion: ≥18 years old, not highly dependent on medical care, at the end of the first trimester/ between 13–19 weeks gestation, able to understand/speak/read English
85	Warren (2013) [1]	Overweight/obese pregnant women	N = 15; age = 20-37 (M = 27); nulliparous only	Antenatal & postnatal	14-18 weeks pregnant; 7-11 weeks postnatal	Inclusion: <16 weeks gestation at recruitment, 18-40 years old, low risk of pregnancy complications and therefore assigned to midwife led care Exclusion: Lack of fluency in English, assigned to consultant led care, history of eating disorders, pre-existing health conditions

ID	Study	Population of interest	Participants	Pregnancy phase	Gestational age	Inclusion/exclusion criteria
86	Waterson (1992)	Postnatal women	N = 60; age = 20-44; nulliparous only	Postnatal	~ 20 months postnatal	Inclusion: Women who delivered normal singleton infants, first-time mothers Exclusion: Cases where there was clinical concern over the health of the infant, <18 years old, non-drinkers, members of ethic minority groups
87	Weir et al. (2010) [1]	Overweight/obese pregnant women	N = 14; age = >16; nulliparous & multiparous	Antenatal	Third trimester	Inclusion: Woman booking with a normal, singleton pregnancy, a measured BMI at booking of ≥25 kg/m2, adequate verbal/written English, >16 years old
88	Whitaker et al. (2016) [1]	African American/White pregnant women	N = 30; age = 18-41; nulliparous & multiparous	Antenatal	20-30 weeks pregnant	Inclusion: African American/White women, 20–30 weeks gestation, singleton pregnancy, pre-pregnancy BMI of 18.5–45.0 kg/m2, 18–44 years old, initiated antenatal care ≤16 weeks gestation
89	Wigginton & Lee (2013)	Postnatal women who smoked during pregnancy	N = 11; age = 20-35; parity not reported	Antenatal & postnatal	<2 years postnatal (1 women pregnant again)	Not reported

NB. Details reported relate only to pregnant or postnatal women in any given sample, where distinguishable

[1] Data for some participants has been excluded based on the eligibility criteria

[2] Reporting qualitative phase of the study only

[3, 4] More than one paper report data from this sample

S10. CASP quality assessment

ID	Study	1. Was there a clear statement of the aims of the research?	2. Is qualitative methodology appropriate?	3. Was the research design appropriate to address the aims of the research?	4. Was the recruitment strategy appropriate to the aims of the research?	5. Was the data collected in a way that addressed the research issue?	6. Has the relationship between researcher and participants been adequately considered?	7. Have ethical issues been taken into account?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?
							CASP criteria			
1	Agberotimi (2013)	Y	Y	Y	N	Can't tell	Can't tell	Y	Can't tell	N
2a	Allen-Walker (chapter 4) (2016)	Y	Y	Y	Y	Y	Y	Y	Y	Y
2b	Allen-Walker (chapter 5) (2016)	Y	Y	Y	Y	Y	Y	Y	Y	N
3	Andersson & Ernstsson (2017)	Y	Y	Y	Can't tell	Y	Can't tell	Y	Y	N
4	Ashwin et al. (2012)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Can't tell	N
5	Atkinson et al. (2016)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Y	Y
6	Audet et al. (2006)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Y	N
7	Barbour (1990)	Y	Y	Y	Y	Y	Can't tell	Can't tell	Can't tell	N
8	Barhammar (2017)	Y	Y	Y	N	Y	Y	Y	Can't tell	Y
9	Bauld et al. (2017)	Y	Y	Y	Y	Y	Can't tell	Y	Y	N
10	Bennett et al. (2013)	Y	Y	Y	Y	Y	Y	Y	Y	Y
11	Bennett (1999)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Y	Y
12	Bottorff et al. (2006)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Y	N
13	Brahic et al. (2015)	Y	Y	Y	Y	Can't tell	Can't tell	Can't tell	Can't tell	Y
14	Bull et al. (2007)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Can't tell	N
15	Chana & Haith-Cooper (2019)	Y	Y	Can't tell	Can't tell	Y	Can't tell	Y	Y	Y
16	Cioffi et al. (2010)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
17	Clarke & Gross (2004)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Can't tell	N

ID	Study	1. Was there a clear statement of the aims of the research?	2. Is qualitative methodology appropriate?	3. Was the research design appropriate to address the aims of the research?	4. Was the recruitment strategy appropriate to the aims of the research?	5. Was the data collected in a way that addressed the research issue?	6. Has the relationship between researcher and participants been adequately considered?	7. Have ethical issues been taken into account?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?
							CASP criteria			
18	Crawford-Williams et al. (2015)	Y	Y	Y	Y	Y	Y	Y	Y	Y
19	Darroch & Giles (2016)	Y	Y	Y	Y	Can't tell	Y	Y	Y	Y
20	Deighton-Smith (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y
21	Devine et al. (2000)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
22	Dominguez (2016)	Y	Y	Y	Y	Y	Y	Y	Y	Y
23	Dormer (2019)	Y	Y	Y	Y	Y	Y	Y	Y	Y
24	Edvardsson et al. (2011)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Y	Y
25	Ekelin et al. (2018)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Y	Y
26	Evans et al. (2016)	Y	Y	Y	Y	Y	Can't tell	Can't tell	Y	Y
27	Fergie et al. (2019)	Y	Y	Can't tell	Y	Y	Y	Y	Y	Y
28	Findley et al. (2020)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
29	Ford (2013)	Y	Y	Y	Y	Y	Y	Y	Y	N
30	Gaudet (2018)	Y	Y	Y	Y	Y	Can't tell	Y	Can't tell	N
31	Gibson et al. (2020)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Y	Y
32	Goodrich et al. (2013)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Y	N
33	Gouilhers et al. (2019)	Y	Y	Y	Can't tell	Can't tell	Can't tell	Y	Y	N
34	Grant et al. (2020)	Y	Y	Y	Y	Y	Y	Y	Y	Y
35	Grant et al. (2019)	Y	Y	Y	Y	Y	Y	Y	Y	N
36	Greenhill (2019)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Y	Y
37	Griffiths (2019)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
38	Groth & Morrison-Beedy (2013)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y

ID	Study	1. Was there a clear statement of the aims of the research?	2. Is qualitative methodology appropriate?	3. Was the research design appropriate to address the aims of the research?	4. Was the recruitment strategy appropriate to the aims of the research?	5. Was the data collected in a way that addressed the research issue?	6. Has the relationship between researcher and participants been adequately considered?	7. Have ethical issues been taken into account?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?
							CASP criteria			
39	Hammer & Inglin (2014)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Can't tell	N
40	Haslam & Draper (2001)	Y	Y	Can't tell	Y	Y	Can't tell	Can't tell	Can't tell	N
41	Hassall (2016)	Y	Y	Y	Y	Y	Y	Y	Y	N
42	Hoffmeister (2016)	Y	Y	Y	Can't tell	Y	Can't tell	Y	Can't tell	Y
43	Hyman & Dussault (2000)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Can't tell	N
44a	Ingall (chapter 3) (2011)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Y	Y
44b	Ingall (chapter 4) (2011)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
45	Jennings-Hobbs (2017)	Y	Y	Y	Y	Y	Y	Y	Y	Y
46	Johnson et al. (2019)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Can't tell	N
47	Jones et al. (2012)	Y	Y	Can't tell	Y	Y	Can't tell	Can't tell	Can't tell	N
48	Kessler & Alversion (2017)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Can't tell	Y
49	Koshy et al. (2010)	Y	Y	Can't tell	Can't tell	Y	N	Y	Y	Y
50	Kreku (2015)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
51	Laing (2015)	Y	Y	Y	Y	Y	Y	Y	Y	Y
52	Lee et al. (2018)	Y	Y	Y	Can't tell	Can't tell	Can't tell	Y	Y	Y
53	Lee (2016)	Y	Y	Can't tell	Y	Y	Can't tell	Can't tell	Can't tell	Y
54	Lee et al. (2011)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
55	Leiferman et al. (2011)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Y	N
56	Marshall et al. (2019)	Y	Y	Y	Can't tell	Y	N	Y	Y	Y
57	Modi (2008)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
58	Morris et al. (2020)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y

ID	Study	1. Was there a clear statement of the aims of the research?	2. Is qualitative methodology appropriate?	3. Was the research design appropriate to address the aims of the research?	4. Was the recruitment strategy appropriate to the aims of the research?	5. Was the data collected in a way that addressed the research issue?	6. Has the relationship between researcher and participants been adequately considered?	7. Have ethical issues been taken into account?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?
						CASP criteria				
59	Morrison et al. (2020)	Y	Y	Y	Y	Y	Can't tell	Y	Y	N
60	Mostyn Williams (1998)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Can't tell	Y
61	Murray et al. (2014)	Y	Y	Y	Y	Can't tell	Can't tell	Y	Y	Y
62	Nash (2015)	N	Y	Can't tell	Can't tell	Can't tell	Can't tell	Can't tell	Y	N
63	Nash (2011)	N	Y	Can't tell	Can't tell	Can't tell	Y	Y	Can't tell	N
64	Nguyen et al. (2012)	Y	Y	Can't tell	Y	Can't tell	Can't tell	Y	Y	Y
65	Nichter et al. (2007)	Y	Y	Can't tell	Y	Y	Y	Y	Y	Y
66	O'Brien et al (2017)	Y	Y	Can't tell	Y	Y	Y	Y	Can't tell	Y
67	Padmanabhan et al. (2015)	Y	Y	Y	Y	Y	Can't tell	Y	Y	N
68	Petrov Fieril et al. (2014)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
69	Pledger (2015)	Y	Y	Y	Y	Y	Can't tell	Y	Can't tell	N
70	Pletsch & Thornton Kratz (2004)	Y	Y	Can't tell	Can't tell	Y	Can't tell	Y	Y	Y
71	Raymond et al. (2009)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
72	Reyes et al. (2013)	Y	Y	Y	Y	Y	Y	Y	Y	Y
73	Scholin et al. (2018)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Y	Y
74a	Smith (chapter 6) (2017)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
74b	Smith (chapter 7) (2017)	Y	Y	Y	Y	Y	Can't tell	Y	Y	N
75	Stricher (2018)	Y	Y	Y	Y	Y	N	Y	Y	N
76	Subramanian et al. (2020)	Y	Y	Y	Y	Y	Can't tell	Y	Y	N
77	Szwajcer et al. (2007)	Y	Y	Can't tell	Y	Y	Can't tell	Can't tell	Y	Y
78	Thornton et al. (2006)	Y	Y	Can't tell	Y	Y	Can't tell	Y	Y	Y

ID	Study	1. Was there a clear statement of the aims of the research?	2. Is qualitative methodology appropriate?	3. Was the research design appropriate to address the aims of the research?	4. Was the recruitment strategy appropriate to the aims of the research?	5. Was the data collected in a way that addressed the research issue?	6. Has the relationship between researcher and participants been adequately considered?	7. Have ethical issues been taken into account?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?
							CASP criteria			
79	Tod (2003)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
80	Tombor (2015)	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y
81	Tovar et al. (2010)	Y	Y	Y	Y	Y	Can't tell	Y	Y	N
82	Trevorrow (2016)	Y	Y	Y	Can't tell	Y	Y	Y	Y	Y
83	Tweheyo (2016)	Y	Y	Y	Y	Can't tell	Y	Y	Y	Y
84	van Mulken et al. (2016)	Y	Y	Y	Y	Y	Y	Y	Y	Y
85	Warren (2013)	Y	Y	Y	Y	Y	Y	Y	Y	Y
86	Waterson (1992)	Y	Y	Y	Can't tell	Y	Can't tell	Can't tell	Can't tell	N
87	Weir et al. (2010)	Y	Y	Y	Can't tell	Y	Can't tell	Y	Y	Y
88	Whitaker et al. (2016)	Y	Y	Y	Y	Y	Can't tell	Can't tell	Y	N
89	Wigginton & Lee (2013)	Y	Y	Can't tell	Y	Y	Y	Y	Y	Y

S11. Barriers and facilitators to behaviour change identified within the analysis

Themes		Sub-themes	Influencing factors	Healthy eating		Physical activity		Smoking cessation		Alcohol reduction	
				B	F	B	F	B	F	B	F
1. A time to think about 'me'	1.1.	A desire to self-indulge	Desire to indulge self	✓			✓	✓		✓	
			Physical need/addiction	-	-		✓	✓		✓	
			Relaxation/reduced guilt towards behaviour	✓		-	-	-	-	-	-
	1.2.	A desire to retain ownership over body & behaviour	Resistance towards advice/guidance	✓		✓	✓	✓		✓	
			Desire to exercise personal choice	✓		✓	✓	✓		✓	
			Listening to their body or intuition	✓		✓	✓	-	-	✓	
			Desire to manage weight/bodily changes		✓		✓	✓		-	-
	1.3.	A desire for good health	Pregnancy symptoms/physical limitations	✓	✓	✓	✓		✓		✓
			Perceived benefits to self		✓		✓	✓	✓	✓	✓
			Desire for an uncomplicated pregnancy/birth		✓		✓	-	-	-	-
			Concern about own health		✓	✓			✓		✓
			Perceived benefits to future health		✓		✓		✓	-	-
			Mental health/emotions/motivation	✓		✓	✓	✓	✓	✓	✓
2. Adopting the 'good mother' role	2.1.	Driven by the health of the baby	Guilt		✓	-	-	✓	✓		✓
			Visceral reminders of baby		✓	✓			✓		✓
			Concern about risk to baby		✓	✓		✓	✓	✓	✓
			Desire for a healthy pregnancy/baby		✓	✓	✓		✓		✓
			Sense of responsibility		✓	✓			✓		✓
			Positive reinforcement/reassurance	✓			✓	✓	✓	✓	
	2.2.	Driven by roles & expectations	Desire to be a good mother		✓		✓		✓	✓	✓
			Societal pressures/expectations		✓	✓		✓	✓		✓
			Concealment of behaviour	-	-	-	-	✓		✓	
			Desire to challenge the pregnant norm	-	-		✓	-	-	✓	
			Disconnection to pregnancy	-	-	-	-	✓		-	-

Themes		Sub-themes	Influencing factors	Healthy eating		Physical activity		Smoking cessation		Alcohol reduction	
				B	F	B	F	B	F	B	F
	2.3.	Driven by pre-pregnancy attitudes & behaviours	Fear of losing pre-pregnancy identity	✓			✓	✓		✓	
			Pre-pregnancy habits and behaviours	✓	✓	✓	✓	✓		✓	✓
			Established beliefs/intentions	-	-	✓			✓		✓
			Experiencing pregnancy for the first time	-	-	✓		-	-		✓
			Experience of a previous pregnancy		✓		✓	✓		✓	
			Poor health outcomes in prior pregnancy	-	-	-	-		✓		✓
			Prior healthy pregnancy despite unhealthy behaviours	-	-	-	-	✓		✓	
			Prior pregnancy difficulties	-	-	✓			✓		✓
3. Beyond mother & baby	3.1.	Practical & environmental influences	Environment	✓		✓		✓	✓	✓	
			Availability/convenience	✓	✓	-	-	✓		-	-
			Transportation	-	-	✓	✓	-	-	-	-
			Weather	✓		✓	✓	-	-	-	-
			Accessibility of services	-	-	✓	✓	✓	✓	-	-
			Financial cost	✓		✓			✓		✓
			Time constraints	✓		✓		✓		-	-
			Competing priorities	✓		✓		-	-	-	-
			Social disadvantage/deprivation	✓		-	-	✓		✓	
	3.2.	Social influences	Social support/influence of others	✓	✓	✓	✓	✓	✓	✓	✓
			Partner support	✓	✓	✓	✓	✓	✓	✓	✓
			Social nature of behaviour	✓			✓	✓		✓	
			Social comparisons	✓			✓	✓		✓	
			Reflecting on the experiences of others		✓		✓	✓	✓	✓	✓
	3.3.	Knowledge, understanding, & advice	Knowledge and understanding	✓	✓	✓	✓	✓	✓	✓	✓
			Perceived hierarchy of behaviours		✓	-	-	✓		✓	✓
			Effective professional communication/guidance		✓		✓		✓		✓
			Positive relationship with healthcare providers		✓	-	-		✓	-	-
			Insufficiency of professional advice/guidance	✓		✓		✓		✓	

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Themes	Sub-themes	Influencing factors	Healthy eating		Physical activity		Smoking cessation		Alcohol reduction	
			B	F	B	F	B	F	B	F
		Alternative sources of information		✓	✓	✓	✓	✓	✓	✓
		Cultural beliefs	-	-	✓	✓	-	-	-	-

B = Barrier; F = Facilitator

NB: Where factors were identified as influencing a behaviour in an unspecified direction, this has not been reported in the table.

Appendix D: Registered PROSPERO protocol for study one

UNIVERSITY *of York*
Centre for Reviews and Dissemination

Systematic review

1. * Review title.

Give the working title of the review, for example the one used for obtaining funding. Ideally the title should state succinctly the interventions or exposures being reviewed and the associated health or social problems. Where appropriate, the title should use the PI(E)COS structure to contain information on the Participants, Intervention (or Exposure) and Comparison groups, the Outcomes to be measured and Study designs to be included.

Identifying factors affecting health behaviour change during pregnancy: a thematic synthesis

2. Original language title.

For reviews in languages other than English, this field should be used to enter the title in the language of the review. This will be displayed together with the English language title.

3. * Anticipated or actual start date.

Give the date when the systematic review commenced, or is expected to commence.

11/12/2018

4. * Anticipated completion date.

Give the date by which the review is expected to be completed.

11/12/2019

5. * Stage of review at time of this submission.

Indicate the stage of progress of the review by ticking the relevant Started and Completed boxes. Additional information may be added in the free text box provided.
Please note: Reviews that have progressed beyond the point of completing data extraction at the time of initial registration are not eligible for inclusion in PROSPERO. Should evidence of incorrect status and/or completion date being supplied at the time of submission come to light, the content of the PROSPERO record will be removed leaving only the title and named contact details and a statement that inaccuracies in the stage of the review date had been identified.
This field should be updated when any amendments are made to a published record and on completion and publication of the review. If this field was pre-populated from the initial screening questions then you are not able to edit it until the record is published.

The review has not yet started: No

Review stage	Started	Completed
Preliminary searches	Yes	No
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Provide any other relevant information about the stage of the review here (e.g. Funded proposal, protocol not yet finalised).

6. * Named contact.

The named contact acts as the guarantor for the accuracy of the information presented in the register record.

Lauren Rockliffe

Email salutation (e.g. "Dr Smith" or "Joanne") for correspondence:

Ms Rockliffe

7. * Named contact email.

Give the electronic mail address of the named contact.

lauren.rockliffe@postgrad.manchester.ac.uk

8. Named contact address

Give the full postal address for the named contact.

Manchester Centre for Health Psychology, Division of Psychology and Mental Health, School of Health

Sciences, Faculty of Biology, Medicine and Health, University of Manchester, Oxford Road, Manchester M13

9PL UK

9. Named contact phone number.

Give the telephone number for the named contact, including international dialling code.

10. * Organisational affiliation of the review.

Full title of the organisational affiliations for this review and website address if available. This field may be completed as 'None' if the review is not affiliated to any organisation.

University of Manchester

Organisation web address:

https://www.manchester.ac.uk/

11. * Review team members and their organisational affiliations.

Give the title, first name, last name and the organisational affiliations of each member of the review team. Affiliation refers to groups or organisations to which review team members belong.

Ms Lauren Rockliffe. University of Manchester
Dr Sarah Peters. University of Manchester
Dr Debbie M Smith. Leeds Trinity University
Professor Alex Heazell. University of Manchester

12. * Funding sources/sponsors.

Give details of the individuals, organizations, groups or other legal entities who take responsibility for initiating, managing, sponsoring and/or financing the review. Include any unique identification numbers assigned to the review by the individuals or bodies listed.

Lauren Rockliffe is funded by a full doctoral training studentship from the Medical Research Council at the

University of Manchester

13. * Conflicts of interest.

List any conditions that could lead to actual or perceived undue influence on judgements concerning the main topic investigated in the review.

None

14. Collaborators.

Give the name and affiliation of any individuals or organisations who are working on the review but who are not listed as review team members.

15. * Review question.

State the question(s) to be addressed by the review, clearly and precisely. Review questions may be specific or broad. It may be appropriate to break very broad questions down into a series of related more specific questions. Questions may be framed or refined using PI(E)COS where relevant.

The objectives of this review are to 1) identify factors affecting health behaviour change during pregnancy

and 2) assess to what extent these factors are accounted for in the COM-B model (Michie et al., 2011) and

McBride et al.'s (2003) model of teachable moments.

16. * Searches.

Give details of the sources to be searched, search dates (from and to), and any restrictions (e.g. language or publication period). The full search strategy is not required, but may be supplied as a link or attachment.

The following databases will be searched:

- MEDLINE (Ovid)

- PsycINFO (Ovid)

- Cumulative Index to Nursing and Allied Health Literature-Plus (CINAHL-P) (EBSCOhost)

- Maternity & Infant Care Database (MIDIRS) (Ovid)

Reference lists of included articles will be searched for other relevant articles, and forward and backwards

searching of key papers will be conducted. Literature of key authors and grey literature will also be searched.

There will be no restriction on language, country or publication date. The search terms used will include key words and subject headings, according to the databases used. Subject headings will not be exploded and key word searches will only be performed on titles and abstracts.

17. URL to search strategy.

Give a link to a published pdf/word document detailing either the search strategy or an example of a search strategy for a specific database if available (including the keywords that will be used in the search strategies), or upload your search strategy.Do NOT provide links to your search results.

Alternatively, upload your search strategy to CRD in pdf format. Please note that by doing so you are consenting to the file being made publicly accessible.

Do not make this file publicly available until the review is complete

18. * Condition or domain being studied.

Give a short description of the disease, condition or healthcare domain being studied. This could include health and wellbeing outcomes.

Women's experiences and perceptions of pregnancy-related health behaviour change.

19. * Participants/population.

Give summary criteria for the participants or populations being studied by the review. The preferred format includes details of both inclusion and exclusion criteria.

Inclusion criteria:

Studies containing qualitative data about women's experiences or perceptions of pregnancy-related health behaviour change during the antenatal period

-Health behaviours of interest are smoking, alcohol use, diet or physical activity only

- Studies may include other participant types (e.g. partners, health professionals) but women must be distinguishable in the results

- Studies may present findings related to the antenatal and postnatal period, as long as the data relating to the antenatal period is distinguishable

- Health behaviours and intentions for health behaviour change can relate to the antenatal or postnatal period (i.e. a participant in the antenatal period may discuss planning to start exercising once they have had their baby)

- Intervention studies are eligible if they also contain qualitative data relating to health behaviour change

Exclusion criteria:

Studies conducted in low- or middle-income countries

Studies reporting on the content or delivery of interventions

Studies focusing on women on specialist care pathways for a medical diagnosis including physical and mental health conditions (e.g. gestational diabetes, psychosis)

Studies focusing on women who have experienced previous pregnancy complications (e.g., small for

gestational age [SGA]) or pregnancy was a result of assisted reproductive technology

Studies focusing on pregnancy-specific behaviours

Letters

Conference abstracts

Book chapters

Reviews

Commentaries

Protocols

20. * Intervention(s), exposure(s).

Give full and clear descriptions or definitions of the nature of the interventions or the exposures to be reviewed.

Not applicable.

21. * Comparator(s)/control.

Where relevant, give details of the alternatives against which the main subject/topic of the review will be compared (e.g. another intervention or a non-exposed control group). The preferred format includes details of both inclusion and exclusion criteria.

Not applicable.

22. * Types of study to be included.

Give details of the types of study (study designs) eligible for inclusion in the review. If there are no restrictions on the types of study design eligible for inclusion, or certain study types are excluded, this should be stated. The preferred format includes details of both inclusion and exclusion criteria.

Primary research studies reporting qualitative findings (qualitative or mixed methods).

23. Context.

Give summary details of the setting and other relevant characteristics which help define the inclusion or exclusion criteria.

Studies conducted with women during pregnancy, or in the postnatal period, that focus on their experience

or perception of health behaviour change during pregnancy.

24. * Main outcome(s).

Give the pre-specified main (most important) outcomes of the review, including details of how the outcome is defined and measured and when these measurement are made, if these are part of the review inclusion criteria.

To identify factors affecting health behaviour change during pregnancy

Timing and effect measures

Not applicable

25. * Additional outcome(s).

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List the pre-specified additional outcomes of the review, with a similar level of detail to that required for main outcomes. Where there are no additional outcomes please state 'None' or 'Not applicable' as appropriate to the review

To assess to what extent identified factors are accounted for in the COM-B model (Michie et al., 2011) and

McBride et al.'s (2003) model of teachable moments

Timing and effect measures
Not applicable

26. * Data extraction (selection and coding).

Give the procedure for selecting studies for the review and extracting data, including the number of researchers involved and how discrepancies will be resolved. List the data to be extracted.

After applying the search strategy to all selected databases, all results will be downloaded and any

duplications will be removed. Titles and abstracts will be screened for all retrieved studies. All uncertain

articles will be included for full-text review. Full texts of all remaining articles will be obtained and each study

read in full and assessed for inclusion; one researcher will assess all articles and a second will assess 10%

of the articles. Any discrepancies will be resolved by discussion. Where this is not possible, a third reviewer

will be called upon for a decision. Authors will be contacted for missing data, where necessary.

Data will be extracted and used to populated a pre-designed data extraction table. The following information

will be recorded:

- Article characteristics (ID, title, authors, year, country)

- Study aim/objective

- Participant characteristics (number, age, setting, nulliparous/multiparous)

- Dates research conducted

- Timeframe of research (i.e. during the antenatal/postnatal period)

- Study type (qualitative/mixed methods)

- Data collection method

- Analysis method

- Results data (findings including author interpretations).

27. * Risk of bias (quality) assessment.

State whether and how risk of bias will be assessed (including the number of researchers involved and how discrepancies will be resolved), how the quality of individual studies will be assessed, and whether and how this will influence the planned synthesis.

Study quality will be assessed by two researchers using the CASP qualitative checklist (Critical Appraisal

Skills Programme, 2018). Inter-rater reliability will be calculated and reported. Any discrepancies will be

resolved by discussion and where this is not possible, a third reviewer will be called upon for a decision.

Studies scoring between 9-10 will be rated as high-quality, those scoring between 7.5-9 as moderate-quality,

and those less than 7.5 as low-quality (as suggested by Butler, Hall & Copnell, 2016). No papers will be

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excluded based on quality.

28. * Strategy for data synthesis.

Give the planned general approach to synthesis, e.g. whether aggregate or individual participant data will be used and whether a quantitative or narrative (descriptive) synthesis is planned. It is acceptable to state that a quantitative synthesis will be used if the included studies are sufficiently homogenous.

The extracted data will be analysed using thematic synthesis (Thomas & Harden, 2008). The following steps

will be followed:

1) Line-by-line coding of the extracted data

2) Organisation of the initial codes to create descriptive themes

3) Organisation of the descriptive themes to create higher-order analytical themes

All findings will be reported adhering to the PRISMA statement guidelines (Moher, Liberati, Tetzlaff, Altmas &

PRISMA Group, 2009) and ENTREQ statement guidelines (Tong, Flemming, McInnes, Oliver & Craig, 2012).

29. * Analysis of subgroups or subsets.

Give details of any plans for the separate presentation, exploration or analysis of different types of participants (e.g. by age, disease status, ethnicity, socioeconomic status, presence or absence or co-morbidities); different types of intervention (e.g. drug dose, presence or absence of particular components of intervention); different settings (e.g. country, acute or primary care sector, professional or family care); or different types of study (e.g. randomised or non-randomised).

Not applicable.

30. * Type and method of review.

Select the type of review and the review method from the lists below. Select the health area(s) of interest for your review.

Type of review
Cost effectiveness
No

Diagnostic
No

Epidemiologic
No

Individual patient data (IPD) meta-analysis
No

Intervention
No

Meta-analysis
No

Methodology
No

Narrative synthesis
No

Network meta-analysis
No

Pre-clinical
No

Prevention
No

Prognostic
No

Prospective meta-analysis (PMA)
No

Review of reviews
No

Service delivery
No

Synthesis of qualitative studies
Yes

Systematic review
Yes

Other
No

Health area of the review

Alcohol/substance misuse/abuse
No

Blood and immune system
No

Cancer
No

Cardiovascular
No

Care of the elderly
No

Child health
No

Complementary therapies
No

Crime and justice
No

Dental
No

Digestive system
No

Ear, nose and throat
No

Education
No

Endocrine and metabolic disorders
No

Eye disorders
No

General interest
No

Genetics
No

Health inequalities/health equity
No

Infections and infestations
No

International development
No

Mental health and behavioural conditions
No

Musculoskeletal
No

Neurological
No

Nursing
No

Obstetrics and gynaecology
No

Oral health
No

Palliative care
No

Perioperative care
No

Physiotherapy
No

Pregnancy and childbirth
Yes

Public health (including social determinants of health)
No

Rehabilitation
No

Respiratory disorders
No

Service delivery
No

Skin disorders
No

Social care
No

Surgery
No

Tropical Medicine
No

Urological
No

Wounds, injuries and accidents
No

Violence and abuse
No

31. Language.

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Select each language individually to add it to the list below, use the bin icon to remove any added in error.
English

There is not an English language summary

32. Country.

Select the country in which the review is being carried out from the drop down list. For multi-national collaborations select all the countries involved.

England

33. Other registration details.

Give the name of any organisation where the systematic review title or protocol is registered (such as with The Campbell Collaboration, or The Joanna Briggs Institute) together with any unique identification number assigned. (N.B. Registration details for Cochrane protocols will be automatically entered). If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here. If none, leave blank.

34. Reference and/or URL for published protocol.

Give the citation and link for the published protocol, if there is one

Give the link to the published protocol.

Alternatively, upload your published protocol to CRD in pdf format. Please note that by doing so you are consenting to the file being made publicly accessible.

No I do not make this file publicly available until the review is complete

Please note that the information required in the PROSPERO registration form must be completed in full even if access to a protocol is given.

35. Dissemination plans.

Give brief details of plans for communicating essential messages from the review to the appropriate audiences.

The review will be submitted for publication in a peer-reviewed journal and the results will be presented at

relevant conferences.

Do you intend to publish the review on completion?
Yes

36. Keywords.

Give words or phrases that best describe the review. Separate keywords with a semicolon or new line. Keywords will help users find the review in the Register (the words do not appear in the public record but are included in searches). Be as specific and precise as possible. Avoid acronyms and abbreviations unless these are in wide use.

Qualitative; Systematic Review; Pregnancy; Health Behaviour Change

37. Details of any existing review of the same topic by the same authors.

Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible.

38. * Current review status.

Review status should be updated when the review is completed and when it is published. For newregistrations the review must be Ongoing.
Please provide anticipated publication date

Review_Ongoing

39. Any additional information.

Provide any other information the review team feel is relevant to the registration of the review.

40. Details of final report/publication(s).

This field should be left empty until details of the completed review are available.

Give the link to the published review.

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Appendix E: Recruitment leaflet for study three

Appendix F: Online recruitment poster for study three

Appendix G: Online recruitment adverts for study three

Facebook advert
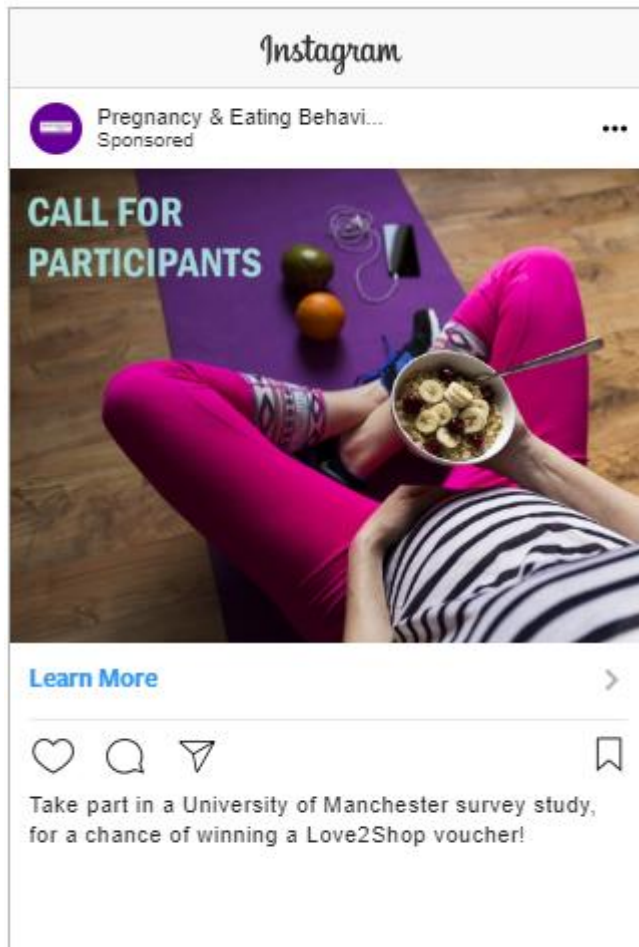
Facebook post

Are you 12-16 weeks pregnant & receiving maternity care in the UK? If so, researchers from the University of Manchester would like to invite you to take part in a new study looking at pregnancy & eating behaviour, as part of a PhD project! You could win a Love2Shop voucher! To take part visit https://is.gd/survey_one. Please share!

[Post will be accompanied by *Online Recruitment Poster v2. 11.11.19*]

Instagram advert

Instagram post

Are you…

- 12-16 weeks pregnant?
- Receiving maternity care in the UK?
- Over the age of 18?

If so, we want to hear from you!

Researchers at the University of Manchester are looking for women to take part in an online survey study to help understand what factors might affect women's eating behaviour during pregnancy, as part of a PhD project.

Participation involves completing four short and simple online surveys; three during your pregnancy and one after your baby is born.

For each of the four surveys you complete, you will be entered into a prize draw to win a Love2Shop voucher.

For further details and to take part please visit https://is.gd/survey_one.

We are recruiting until October 2020, so if you're not yet 12-16 weeks pregnant, you can still take part once you are!

For any questions please get in touch! [contact details provided in profile]

#preg #preggo #preggers #pregnant #pregnancy #pregnancydiary #mumtobe #mumtobe2020 #bump #babywatch #bumppic #babyannouncement #pregnancylife #12weeks #13weeks #14weeks #15weeks #16weeks #pregnancydiet #firsttrimester #secondtrimester

Online forum recruitment advert

Are you between 12-16 weeks pregnant and receiving maternity care in the UK?

If so, researchers at the University of Manchester would like to invite you to take part in an online survey study to help understand what factors might affect women's eating behaviour during pregnancy, as part of a PhD project.

Participation involves completing **four short online surveys;** three during your pregnancy and one once your baby is born.

For each of the four surveys you complete, you will be entered into a **prize draw to win a Love2Shop voucher.**

For further details and to take part please visit https://is.gd/survey_one

We are recruiting until October 2020, so if you're not yet 12-16 weeks pregnant, you can still take part once you are!

For more information please contact Lauren Rockliffe (Lead Researcher) at lauren.rockliffe@postgrad.manchester.ac.uk.

University recruitment advert

Pregnancy and eating behaviour study – win a Love2Shop voucher!

Are you between 12-16 weeks pregnant and receiving maternity care in the UK?

If so, researchers at the University of Manchester would like to invite you to take part in an online survey study to help understand what factors might affect women's eating behaviour during pregnancy, as part of a PhD study.

Participation involves completing four short online surveys; three during your pregnancy and one once your baby is born.

For each of the four surveys you complete, you will be entered into a prize draw to win a Love2Shop voucher.

For further details and to take part please visit https://is.gd/survey_one

We are recruiting until October 2020, so if you're not yet 12-16 weeks pregnant, you can still take part once you are!

For more information, please contact Lauren Rockliffe (Lead Researcher) at lauren.rockliffe@postgrad.manchester.ac.uk.

Twitter recruitment post

Are you 12-16 weeks pregnant & receiving maternity care in the UK? If so, researchers from UoM invite you to take part in a PhD #researchstudy looking at #pregnancy & #eating! You could win a Love2Shop voucher! To take part visit https://is.gd/survey_one #firsttrimester

[Post will be accompanied by *Online Recruitment Poster v2. 11.11.19*]

Appendix H: Consent form for study three

P-EAT
Pregnancy & Eating Behaviour

MRC | Medical Research Council

MANCHESTER 1824
The University of Manchester

Consent Form

Study Title: Pregnancy and Eating Behaviour (P-EAT)
IRAS ID: 264741
Lead Researcher: Lauren Rockliffe

If you are happy to participate, please complete and sign the consent form below.

Please initial box

1. I confirm that I have read the information sheet dated 11.11.19, version 2, for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my personal data (e.g. postcode, ethnicity) will be collected as part of this study.

3. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason and without detriment to myself. I understand that it will not be possible to remove my data from the project once it has been anonymised and forms part of the data set. I agree to take part on this basis.

4. I understand that data collected during the study may be looked at by individuals from The University of Manchester (UoM) or regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data.

5. I agree that any data collected may be published anonymously in academic reports or journals.

6. I agree that the researchers may retain my contact details in order to provide me with a summary of the findings for this study (optional).

7. I agree that the researchers may retain my contact details in order to contact me about taking part in future research (optional).

8. I agree that any anonymised data collected may be shared with researchers at UoM or at other institutions.

9. I agree to take part in the above study.

Data Protection

The personal information we collect and use to conduct this research will be processed in accordance with data protection law as explained in the Participant Information Sheet and the Privacy Notice for Research Participants (http://documents.manchester.ac.uk/display.aspx?DocID=37095).

_____   _____   _____
Name of participant   Date   Signature

_____   _____   _____
Name of person taking consent   Date   Signature

Consent Form v2. 11.11.19

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Appendix I: Participant information sheet for study three

P-EAT
Pregnancy & Eating Behaviour

MRC | Medical Research Council

MANCHESTER 1824
The University of Manchester

Participant Information Sheet

IRAS number: 264741

You are being invited to take part in a research study about pregnancy and eating behaviour, which is part of a PhD research project being conducted at the University of Manchester (UoM). Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please get in touch if there is anything that is unclear or if you would like more information.

What is this study about?
The aim of this study is to find out whether different factors (e.g. emotions) affect the decisions women make about what they eat while they are pregnant. We plan to do this by asking women to complete a survey at four different times; three times during their pregnancy and once after their baby is born.

By collecting information throughout the pregnancy, we hope to be able to see changes in what women eat, that we can link to different factors. Once we have a better understanding about what affects women's decisions about what they eat, we will be better able to support women in making healthy changes during pregnancy.

Why have I been invited to take part in this study?
We are inviting women to take part if they are (or will shortly be) between 12–16 weeks pregnant.

If you are not yet at 12-16 weeks, you can still take part once you reach that point in your pregnancy. People can take part in the study up until the end of October 2020.

Approximately 340 other women will take part in this study. Participants are being recruited from a range of different settings (e.g. hospitals, community clinics, online).

Who is eligible to take part?
Women are eligible to participate in this study if they are:
- between 12-16 weeks pregnant
- over the age of 18
- receiving maternity care in the UK
- carrying one baby (i.e. not twins)

What would taking part involve?
If you agree to take part, you will need to complete the enclosed survey and return it to us using the freepost envelope provided. Over the following nine months you will receive three more surveys; two during the rest of your pregnancy and one shortly after your baby is born. The survey should take no longer than 15 minutes to complete. For each survey you don't respond to, you can expect to receive a reminder two weeks later (unless you opt out).

The survey covers a range of subjects including telling us about yourself, your medical/pregnancy history, psychological factors, and your eating behaviour. The content of all of the surveys will be fairly similar, but the first survey will be the longest.

Once you have completed the survey, you can return it to us using the freepost envelope enclosed, along with the consent form.

When can I expect to receive the surveys?
The next survey will be sent to you when you are around 20-24 weeks pregnant. The third survey will be sent when you are around 36-40 weeks pregnant, and the final survey will be sent around 6-12 weeks after you have your baby.

Paper Participant Information Sheet v2 11.11.19

Participant Information Sheet

IRAS number: 264741

Will I be compensated for taking part?

As a thank you for taking part, participants will be entered into a prize draw to win a £50 Love2Shop voucher for each of the four surveys they complete. There will be a total of four winners.

Do I have to take part?

If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself. However, it will not be possible to remove your data from the project once it has been anonymised as we will not be able to identify your specific data. This does not affect your data protection rights. If you decide not to take part you do not need to do anything further.

What are the possible benefits of taking part?

There are no guaranteed benefits from taking part in this study. However, your participation will contribute to research and may help to improve the support given to pregnant women in the future. You may find taking part in this research enjoyable and interesting.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or serious risks of taking part in this study, but some questions are of a sensitive nature, which may be upsetting for some people. You can opt-out of the study at any time (by contacting lauren.rockliffe@postgrad.manchester.ac.uk), but unless you do so, you will continue to receive the follow-up surveys and reminder emails.

The consent process

Before completing the survey you will need to read the enclosed consent form. If you agree to the points on the consent form, you will need to put your initials in the boxes and sign the form. **Please return this, along with the survey, using the freepost envelope enclosed.**

Will the outcomes of the research be published?

The findings from this study will be published in a PhD thesis, in academic journals and presented at academic conferences.

Who will conduct the research?

This study will be conducted by Lauren Rockliffe. Lauren is a PhD student at UoM. She works in the Division of Psychology and Mental health, within the School of Health Sciences.

What information will you collect about me?

In order to participate in this research project we will need to collect information that could identify you, called "personal identifiable information". Specifically we will need to collect:

- Your email address
- Your telephone number
- Your home address
- Your ethnicity
- Your postcode
- Some medical information

Under what legal basis are you collecting this information?

We are collecting and storing this personal identifiable information in accordance with data protection law which protect your rights. These state that we must have a legal basis (specific reason) for collecting your data. For this study, the specific reason is that it is "a public interest task" and "a process necessary for research purposes".

What are my rights in relation to the information you will collect about me?

You have a number of rights under data protection law regarding your personal information. For example you can request a copy of the information we hold about you, by contacting us directly.

If you would like to know more about your different rights or the way we use your personal information to ensure we follow the law, please consult our Privacy Notice at http://documents.manchester.ac.uk/display.aspx?DocID=37095.

Will my participation in the study be confidential and my personal identifiable information be protected?

In accordance with data protection law, UoM is the Data Controller for this project. This means that we are responsible for making sure your personal information is kept secure, confidential, and used only in the way you have been told it will be used. All researchers are trained with this in mind, and your data will be looked after in the following way:

Your participation in this study will be kept confidential and only the study team at UoM will have access to your personal information. You will be asked to create a unique ID number on completion of the first survey, which will be known only to the research team. Any identifiable information will be kept separately from your survey responses and will be held for a maximum of 1 year after the study has finished. This includes contact details retained to re-contact you about taking part in future research, or to provide you with a summary of the study findings, if you consent to this. Anonymised research data will be held for a maximum of 10 years before being destroyed.

Please also note that individuals from UoM or regulatory authorities may need to look at the data collected for this study to make sure the project is being carried out as planned. This may involve looking at identifiable data. All individuals involved in auditing and monitoring the study will have a strict duty of confidentiality to you as a research participant.

Who is organising and funding this study?

UoM are sponsoring the study and the Medical Research Council (MRC) are funding it.

Who has reviewed this study?

This study was reviewed by the Health Research Authority (HRA) and the North West - Preston Research Ethics Committee (REC) (IRAS ID: 264741; REC Reference: 19/NW/0674).

How can I withdraw from the study?

If you no longer wish to take part, you can withdraw at any time by clicking on the opt-out link at the bottom of each email or survey. Alternatively, you can contact Lauren (Research Lead) directly at lauren.rockliffe@postgrad.manchester.ac.uk.

Contact details

For further information about the study please contact: **Dr Sarah Peters (Chief Investigator, UoM) at sarah.peters@manchester.ac.uk, or on 0161 2752558 or Lauren Rockliffe (Research Lead, UoM) at lauren.rockliffe@postgrad.manchester.ac.uk.**

Alternatively you can contact us at The Centre for Health Psychology, University of Manchester, Coupland 1 Building, Oxford Road, Manchester, M13 9PL.

What if I have a complaint?

If you wish to make a complaint please contact either Dr Sarah Peters or Lauren Rockliffe, using the above contact details.

Paper Participant Information Sheet v2 11.11.19

If you wish to make a formal complaint to someone independent of the research team or if you are not satisfied with the response you have gained from the researchers in the first instance then please contact:

The Research Governance and Integrity Officer, Research Office, Christie Building, The University of Manchester, Oxford Road, Manchester, M13 9PL, by emailing: research.complaints@manchester.ac.uk or by telephoning 0161 275 2674.

If you wish to contact us about your data protection rights, please email dataprotection@manchester.ac.uk or write to The Information Governance Office, Christie Building, The University of Manchester, Oxford Road, M13 9PL at the University and we will guide you through the process of exercising your rights.

You also have a right to complain to the Information Commissioner's Office about complaints relating to your personal identifiable information. You can contact them on 0303 123 1113, or for more information please visit https://ico.org.uk/make-a-complaint/.

Further information
The Patient Advisory and Liaison Service (PALS) offers confidential advice, support and information on health-related matters. They can be contacted on 0161 604 5897 or at PALS@pat.nhs.uk.

Thank you for taking the time to read this information sheet.

Appendix J: T1 survey for study three

P-EAT
Pregnancy & Eating Behaviour

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TODAY'S DATE: _____

We would like to take some details so that we can create an individual participant ID code for you.

Please enter the first three letters of your mother's maiden name (e.g. if her name was Smith, enter SMI)

_____

Please enter the number of the month you were born (e.g. 12 for December)

_____

Please enter the first letter of your middle name (if none put X)

_____

If you meet the eligibility criteria, after completing this survey, you will receive a further three surveys; one around 20-24 weeks, one around 36-40 weeks, and a final one around 6-12 weeks after your baby is born.

We would like to send the future surveys to you via email, or by post if you don't have internet access, but you can also receive them by text if you wish. Your details will only be used for this purpose, unless you provide consent for us to contact you for other purposes.

Please provide your email address

_____

Please provide your mobile phone number

_____

Please provide your home address

_____

_____

_____

Please could you tell us where you heard about this research

	Please tick one
Arrowe Park Hospital	☐
Blackpool Victoria Hospital	☐
Countess of Chester Hospital	☐
Leighton Hospital	☐
Liverpool Women's Hospital	☐
Ormskirk General Hospital	☐
Royal Preston Hospital	☐
St Mary's Hospital	☐
Warrington Hospital	☐
Whiston Hospital	☐
Wythenshawe Hospital	☐
Other	☐
I'm not sure	☐

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First, we would like to ask you some questions about yourself

1. How old are you? _____

2. When is your estimated due date? _____

3. How many pregnancies have you had (not including this one)? _____

4. How many children have you had? _____

5. Before this pregnancy did you experience any of the following? (Please tick all that apply)

☐ Difficulty becoming pregnant   ☐ Assisted pregnancy (e.g. IVF)

6. Please indicate how many of the following events you have experienced

Miscarriages _____   Stillbirth or the loss of a baby after birth _____

7. Who is providing your professional maternity care?

☐ NHS
☐ Private healthcare provider
☐ Mixture of both (i.e. NHS + private provider)
☐ Not sure

8. Where in the UK are you receiving maternity care?

☐ England
☐ Scotland
☐ Wales
☐ Northern Ireland

9. Are you having a multiple pregnancy? (e.g. twins or triplets)

☐ Yes   ☐ No   ☐ Not sure

10. Were any complications or concerns raised during your last scan?

☐ Yes   ☐ No   ☐ Not sure

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11. Do you have any medical conditions that mean you have to change your diet?

☐ Yes ☐ No ☐ Not sure

11.1. If yes, please state what condition and if anything is being done to treat or control the condition

_____

_____

12. Have you altered your diet in the last month, due to religious reasons? (e.g. Ramadan, Lent)

☐ Yes ☐ No

12. 1. If yes, how have you changed your diet?

_____

_____

13. What is your ethnicity?

Asian / Asian British	Black / African / Caribbean / Black British	Mixed / Multiple ethnic groups	White	Other ethnic group
Indian ☐	African ☐	White & Black Caribbean ☐	English / Welsh / Scottish / Northern Irish / British ☐	Arab ☐
Pakistani ☐	Caribbean ☐	White & Black African ☐	Irish ☐	Any other ethnic group, please describe ☐
Bangladeshi ☐	Any other Black / African / Caribbean background, please describe ☐	White & Asian ☐	Gypsy or Irish Traveller ☐	_____
Chinese ☐		Any other Mixed / Multiple ethnic background, please describe ☐	Any other White background, please describe ☐	
Any other Asian background, please describe ☐ _____	_____	_____	_____	

14. What is your height? _____

(please specify the unit of measurement e.g. feet & inches, or cm)

15. What is your current weight? _____

(please specify the unit of measurement e.g. stones & pounds, or Kg)

16. What is your relationship status?

- [ ] Single (never married or never in a civil partnership)
- [ ] In a relationship
- [ ] Married (including those in civil partnerships)
- [ ] Separated (but still legally married or in a civil partnership)
- [ ] Divorced (including formerly in a civil partnership which is now legally dissolved)
- [ ] Widowed (including surviving partner from a civil partnership)
- [ ] Other (please specify) _____

17. What is your employment status?

- [ ] Employee: full-time
- [ ] Employee: part-time
- [ ] Self-employed: full-time
- [ ] Self-employed: part-time
- [ ] Student: full-time
- [ ] Student: part-time
- [ ] Unemployed
- [ ] Other (please specify) _____

17.1. If you are employed, what is your job?

_____

18. What is your postcode? _____

19. What is the highest level of qualification you have achieved?

- [ ] Postgraduate education level qualification (e.g. Masters or Doctoral qualification or equivalent)
- [ ] Higher education level qualification (e.g. Bachelor's degree or equivalent)
- [ ] Further education level qualification (e.g. A Levels/National Vocational Qualification (NVQ) Higher National Diploma or equivalent)
- [ ] High School qualification (GCSEs/O Levels or equivalent)
- [ ] No formal qualifications
- [ ] Other (please specify) _____

20. In the last 12 hours, for how long have you felt nauseated or sick to your stomach?

- [ ] Not at all
- [ ] 1 hour or less
- [ ] 2 to 3 hours
- [ ] 4 to 6 hours
- [ ] More than 6 hours

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21. In the last 12 hours, have you vomited or thrown up...

- ☐ 7 or more times
- ☐ 5 to 6
- ☐ 3 to 4
- ☐ 1 to 2
- ☐ I did not throw up

22. In the last 12 hours, how many times have you had retching or dry heaves without bringing anything up?

- ☐ No time
- ☐ 1 to 2
- ☐ 3 to 4
- ☐ 5 to 6
- ☐ 7 or more

We would now like to ask you some questions about how you feel about yourself and your pregnancy. Some of these questions may be difficult to answer, but please be as honest as you can, and remember that all the answers you provide are confidential.

23. Please indicate on a scale of 1 to 7 how strongly your agree or disagree with each of the following statements.

	Strongly disagree 1	2	3	Neither agree nor disagree 4	5	6	Strongly agree 7
I am concerned that being pregnant poses a risk to my health	☐	☐	☐	☐	☐	☐	☐
I am concerned about my health after the baby arrives	☐	☐	☐	☐	☐	☐	☐
I am concerned there is a risk to my unborn baby	☐	☐	☐	☐	☐	☐	☐
I am concerned that the birth may pose a risk to my baby	☐	☐	☐	☐	☐	☐	☐

24. Please indicate on a scale of 1 to 5 how worried you feel...

	Not at all worried 1	Slightly worried 2	Somewhat worried 3	Worried 4	Very worried 5
...about your health during your pregnancy	☐	☐	☐	☐	☐
...about your baby's health during your pregnancy	☐	☐	☐	☐	☐

25. This scale consists of a number of words that describe different feelings and emotions. Please read each item and then select the appropriate answer. Please indicate on a scale of 1 to 5 to what extent you have felt this way in the past few weeks.

	Very slightly or not at all 1	A little 2	Moderately 3	Quite a bit 4	Extremely 5
Interested	☐	☐	☐	☐	☐
Distressed	☐	☐	☐	☐	☐
Excited	☐	☐	☐	☐	☐
Upset	☐	☐	☐	☐	☐
Strong	☐	☐	☐	☐	☐
Guilty	☐	☐	☐	☐	☐
Scared	☐	☐	☐	☐	☐
Hostile	☐	☐	☐	☐	☐
Enthusiastic	☐	☐	☐	☐	☐
Proud	☐	☐	☐	☐	☐
Irritable	☐	☐	☐	☐	☐
Alert	☐	☐	☐	☐	☐
Ashamed	☐	☐	☐	☐	☐
Inspired	☐	☐	☐	☐	☐
Nervous	☐	☐	☐	☐	☐
Determined	☐	☐	☐	☐	☐
Attentive	☐	☐	☐	☐	☐
Jittery	☐	☐	☐	☐	☐
Active	☐	☐	☐	☐	☐
Afraid	☐	☐	☐	☐	☐

26. Please indicate on a scale of 1 to 7, where 1 is you feel negative about becoming a mother (either for the first time, or becoming a mother again) and 7 is you feel positive about becoming a mother, what number best describes how you feel about yourself becoming a mother

☐	☐	☐	☐	☐	☐	☐
1 (negative)	2	3	4	5	6	7 (positive)

27. Please select the statement that best reflects how you feel about yourself since you found out you were pregnant

☐ I feel better about myself

☐ I feel worse about myself

☐ There has been no change in how I feel about myself

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28. Please indicate on a scale of 1 to 7 how strongly you agree or disagree with the following statement: *"most people important to me think I will be a good mother"*

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
(strongly disagree)			(neither agree nor disagree)			(strongly agree)

Finally, we would like to ask you some questions about your eating habits.

29. Please select the statement that is most accurate for you

☐ Since I became pregnant, my diet is healthier than before I was pregnant

☐ Since I became pregnant, my diet is about the same as before I was pregnant

☐ Since I became pregnant, my diet is less healthy than before I was pregnant

30. Please indicate on a scale of 1 to 7 how strongly you agree or disagree with the following statements.

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
I find it easy to eat healthily	☐	☐	☐	☐	☐	☐	☐
I am able to prepare healthy meals	☐	☐	☐	☐	☐	☐	☐
I know how to prepare healthy meals	☐	☐	☐	☐	☐	☐	☐
It is easy for me to eat healthily at home and at work	☐	☐	☐	☐	☐	☐	☐
Most of the time, I feel that I really want to eat healthily	☐	☐	☐	☐	☐	☐	☐
I understand most of the advice I have received about my diet during pregnancy	☐	☐	☐	☐	☐	☐	☐
There are many benefits to me eating healthily	☐	☐	☐	☐	☐	☐	☐
Most other pregnant women I know eat healthily	☐	☐	☐	☐	☐	☐	☐
I eat healthily often without having to try	☐	☐	☐	☐	☐	☐	☐
I like to try new healthy recipes and different foods	☐	☐	☐	☐	☐	☐	☐
I associate eating healthily with good times in my life	☐	☐	☐	☐	☐	☐	☐
I associate eating healthily with bad times in my life	☐	☐	☐	☐	☐	☐	☐
Eating healthily can make me feel happy	☐	☐	☐	☐	☐	☐	☐
Eating healthily can make me feel sad	☐	☐	☐	☐	☐	☐	☐
I would be willing to keep a record of how healthily I eat every week	☐	☐	☐	☐	☐	☐	☐
I feel good about myself when I eat healthily	☐	☐	☐	☐	☐	☐	☐
I have healthy eating goals that I want to achieve	☐	☐	☐	☐	☐	☐	☐
I have a plan for how my healthy eating will be	☐	☐	☐	☐	☐	☐	☐

31. The following questions ask about some foods and drinks you might have during a 'typical' week, over the past month or so. Do not be concerned if some things you eat or drink are not mentioned.

Please tick how often you eat at least ONE portion of the following foods & drinks: (a portion includes: a handful of grapes, an orange, a serving of carrots, a side salad, a slice of bread, a glass of fizzy drink). (Please answer every line).

	Rarely or never	Less than 1 a week	Once a week	2-3 times a week	4-6 times a week	1-2 times a day	3-4 times a day	5+ a day
Fruit (tinned/fresh)	☐	☐	☐	☐	☐	☐	☐	☐
Fruit juice (not cordial or squash)	☐	☐	☐	☐	☐	☐	☐	☐
Salad (not garnish added to sandwiches)	☐	☐	☐	☐	☐	☐	☐	☐
Vegetables (tinned/frozen/fresh but not potatoes)	☐	☐	☐	☐	☐	☐	☐	☐
Chips/fried potatoes	☐	☐	☐	☐	☐	☐	☐	☐
Beans or pulses like baked beans, chick peas, dahl	☐	☐	☐	☐	☐	☐	☐	☐
Fibre-rich breakfast cereal, like Weetabix, Fruit 'n Fibre, Porridge, Muesli	☐	☐	☐	☐	☐	☐	☐	☐
Wholemeal bread or chapattis	☐	☐	☐	☐	☐	☐	☐	☐
Cheese/yogurt	☐	☐	☐	☐	☐	☐	☐	☐
Crisps/savoury snacks	☐	☐	☐	☐	☐	☐	☐	☐
Sweet biscuits, cakes, chocolate, sweets	☐	☐	☐	☐	☐	☐	☐	☐
Ice cream/cream	☐	☐	☐	☐	☐	☐	☐	☐
Non-alcoholic fizzy drinks/pop (not sugar free or diet)	☐	☐	☐	☐	☐	☐	☐	☐

	Rarely or never	Less than 1 a week	Once a week	2-3 times a week	4-6 times a week	7 + times a week
Beef, Lamb, Pork, Ham - steaks, roasts, joints, mince or chops	☐	☐	☐	☐	☐	☐
Chicken or Turkey – steaks, roasts, joints, mince or portions (not in batter or breadcrumbs)	☐	☐	☐	☐	☐	☐
Sausages, bacon, corned beef, meat pies/pasties, burgers	☐	☐	☐	☐	☐	☐
Chicken/turkey nuggets/twizzlers, turkey burgers, chicken pies, or in batter or breadcrumbs	☐	☐	☐	☐	☐	☐
White fish in batter or breadcrumbs – like 'fish and chips'	☐	☐	☐	☐	☐	☐
White fish not in batter or breadcrumbs	☐	☐	☐	☐	☐	☐
Oily fish – like herrings, sardines, salmon, trout, mackerel, fresh tuna (not tinned tuna)	☐	☐	☐	☐	☐	☐

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Thank you for taking the time to complete this survey, your participation is greatly appreciated.

As a thank you for taking part, you will be entered into a prize draw to win a £50 Love2Shop voucher. The winner will be selected once recruitment is complete, and will be notified by email.

If you DO NOT want to be entered into the prize draw, please tick below.

☐   I do not want to be entered into the prize draw

Please note that we will contact you to complete a further three surveys over the next eight months. A reminder will automatically be sent to you if a survey has not been completed.

We very much hope you will take part in the follow-up surveys. However, there is no obligation to do so, and if for any reason you no longer wish to take part, please tick below. You will still be entered into the prize draw for the survey you have completed.

☐   I no longer wish to take part in the follow-up surveys

For any questions, please contact Lauren Rockliffe (Lead Researcher) at lauren.rockliffe@postgrad.manchester.ac.uk.

If for any reason you have found completing this survey upsetting or you have any concerns about what has been covered please consider doing one of the following things:
- You could talk to a family member or close friend about your concerns.
- You could talk to your GP or to the Samaritans on 116 123.
- If you are feeling extremely concerned or as though you need help urgently you could contact your out-of-hours GP or visit your local A&E department.

For further information on mental well-being during pregnancy please visit:
https://www.tommys.org/pregnancy-information/im-pregnant/mental-wellbeing/tips-improving-mental-wellbeing-pregnancy

Appendix K: Health Research Authority ethical approval for study three

Dr Sarah Peters
Manchester Centre for Health Psychology
University of Manchester, Oxford Road
Manchester
M13 9PL

21 November 2019

Dear Dr Peters

**HRA and Health and Care
Research Wales (HCRW)
Approval Letter**

Study title: **Exploring the extent to which models of 'teachable moments' explain eating behaviour in pregnancy: A longitudinal prospective study**
IRAS project ID: **264741**
Protocol number: **N/A**
REC reference: **19/NW/0674**
Sponsor **University of Manchester**

I am pleased to confirm that **HRA and Health and Care Research Wales (HCRW) Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?
HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report (including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see IRAS Help for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?
HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to obtain local agreement in accordance with their procedures.

What are my notification responsibilities during the study?

The standard conditions document "*After Ethical Review – guidance for sponsors and investigators*", issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:
- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?
Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is **264741**. Please quote this on all correspondence.

Yours sincerely,

Michael Pate
Approvals specialist

Email: hra.approval@nhs.net

Copy to: *Ms Lynne Macrae*

Appendix L: North West – Preston Research Ethics Committee approval for study three

NHS

Health Research Authority

North West - Preston Research Ethics Committee
Barlow House
3rd Floor
4 Minshull Street
Manchester
M1 3DZ

Please note: This is an acknowledgement letter from the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

21 November 2019

Ms Lauren Rockliffe
Manchester Centre for Health Psychology
University of Manchester, Oxford Road
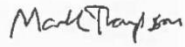Manchester
M13 9PL

Dear Ms Rockliffe

Study title: Exploring the extent to which models of 'teachable moments' explain eating behaviour in pregnancy: A longitudinal prospective study

REC reference: 19/NW/0674
Protocol number: N/A
IRAS project ID: 264741

Thank you for your letter of 14th November 2019. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 04 November 2019

Documents received

The documents received were as follows:

Yours sincerely

Mark Thompson
Mark Thompson
Approvals Officer

E-mail: nrescommittee.northwest-preston@nhs.net

Copy to: *Ms Lauren Rockliffe*
                Ms Elizabeth Mainwaring, Manchester University NHS Foundation Trust

Appendix M: Supplementary material for study three

Table S1. Severity of sickness/nausea across time-points

	n	M (SD)	No symptoms n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	Missing n (%)
T1	514	5.3 (2.4)	150 (29.1%)	225 (43.6%)	134 (26%)	5 (1)	2 (0.4%)
T2	304	3.7 (1.5)	204 (66.9%)	87 (28.5%)	12 (3.9%)	1 (0.3%)	1 (0.3%)
T3	210	3.7 (1.4)	126 (60%)	78 (37.1%)	4 (1.9%)	2 (1%)	-

Appendix O: Online recruitment adverts for study four

Facebook advert

Facebook post

Have you recently had a baby?

Researchers at the University of Manchester are looking to speak to women in the UK, who had a baby less than 6 months ago, as part of an interview study about pregnancy and eating behaviour.

Interviews will be conducted via zoom, at a time that is convenient for you.

For more information, or to take part, please contact Lauren at
PEATinterviewstudy@manchester.ac.uk

[Post will be accompanied by *Online Recruitment Poster v2. 24.11.2020*]

Online forum post

Call for participants! Pregnancy and eating behaviour interview study

Have you recently had a baby?

Researchers at the University of Manchester are looking to speak to women in the UK, who had a baby less than 6 months ago, as part of an interview study about pregnancy and eating behaviour.

Interviews will be conducted using zoom, at a time that is convenient for you.

For more information, or to take part, please contact Lauren at
PEATinterviewstudy@manchester.ac.uk

Twitter post

Have you recently had a baby? Researchers at UoM are looking for women who had a baby <6 months ago to participate in a study about #pregnancy and eating (UK only). For more info or to take part please email Lauren at
PEATinterviewstudy@manchester.ac.uk #fourthtrimester #newmum

[Post will be accompanied by *Online Recruitment Poster v2. 24.11.2020*]

Appendix P: Participant information sheet for study four

Pregnancy & Eating Behaviour Interview Study

MANCHESTER 1824
The University of Manchester

Participant Information Sheet

You are being invited to take part in a research study about pregnancy and eating behaviour, which is part of a PhD research project being conducted at the University of Manchester. Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please get in touch if there is anything that is unclear or if you would like more information.

This participant information sheet should be read in conjunction with The University privacy notice

What is the purpose of the research?
The purpose of this research is to understand what might affect women's eating behaviour throughout their pregnancy. We plan to do this by conducting online interviews with women in the UK, to better understand their experiences.

Who is eligible to take part?
Women are eligible to take part in this study if they:
- Had a baby less than 6 months ago
- Are over the age of 18
- Had their baby in the UK
- Had a single pregnancy
- Were not advised to change their diet during their pregnancy

Approximately 25 women will take part in this study.

What would I be asked to do if I took part?
If you would like to be involved, you will be invited to take part in an interview. The interview will take place over Zoom, which is an online video-conferencing app that you can use either online or on your phone. You can have your video switched on or off (use audio-only) depending on which option you feel most comfortable with, and it will be audio-recorded. The interview will last around 1 hour and will take place at a time that is convenient for you. The questions asked will be related to your eating during your pregnancy and about any changes that might have occurred.

Who will conduct the research?
This study will be conducted by Lauren Rockliffe. Lauren is a PhD student at the University of Manchester. She works in the Division of Psychology and Mental health, within the School of Health Sciences.

What are the possible disadvantages and risks of taking part?
There are no disadvantages or serious risks of taking part in this study, but the interview will focus on eating during pregnancy, which may be a sensitive topic for some people. However, you do not have to answer any questions that you do not want to and can stop the interview at any point.

What are the possible benefits of taking part?
There are no guaranteed benefits from taking part in this study. However, your participation will contribute to research and may help to improve the support given to pregnant women in the future. You may find taking part in this research enjoyable and interesting.

Will I be compensated for taking part?
As a thank you for taking part, participants will be entered into a prize draw to win a £100 Love2Shop voucher.

What will happen to my personal information?
In order to undertake the research project we will need to collect the following personal information about you:

- Your age
- Your baby's date of birth
- Number of children
- Limited medical/pregnancy history
- Level of education
- Postcode
- Ethnicity
- Relationship status
- Employment status
- Height and weight

Participant Information Sheet v2. 06.10.2020

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Only the research team will have access to this information. We are collecting and storing this personal information in accordance with the General Data Protection Regulation (GDPR) and Data Protection Act 2018 which legislates to protect your personal information. The legal basis upon which we are using your personal information is "public interest task" and "for research purposes" if sensitive information is collected. For more information about the way we process your personal information and comply with data protection law please see our Privacy Notice for Research Participants. The University of Manchester, as Data Controller for this project, takes responsibility for the protection of the personal information that this study is collecting about you. In order to comply with the legal obligations to protect your personal data the University has safeguards in place such as policies and procedures. All researchers are appropriately trained, and your data will be looked after in the following way:

- Only the study team at the University of Manchester will have access to your personal identifiable information, that is data which could identify you, but they will anonymise it as soon as practical.

- Any identifiable information that we need to keep on record (for example, if you consent to be contacted with a summary of study findings, or are happy to be re-contacted about future research) will be kept separately from the audio-recordings and will be held for a maximum of 1 year after the study has finished. Anonymised data and your consent form will be held for a maximum of 10 years before being destroyed.

- All research data and personal identifiable information will be stored on a secure University server.

Your participation in this research will be recorded in Zoom and your personal data will be processed by Zoom. This may mean that your personal data is transferred to a country outside of the European Economic Area, some of which have not yet been determined by the European Commission to have an adequate level of data protection. Appropriate legal mechanisms to ensure these transfers are compliant with the UK General Data Protection Regulation are in place. The recordings will be removed from the above third-party platform and stored on University of Manchester managed file storage as soon as possible following the completion of data collection.

You have a number of rights under data protection law regarding your personal information. For example, you can request a copy of the information we hold about you, including audio recordings. This is known as a Subject Access Request. If you would like to know more about your different rights, please consult our privacy notice for research and if you wish to contact us about your data protection rights, please email dataprotection@manchester.ac.uk or write to The Information Governance Office, Christie Building, University of Manchester, Oxford Road, M13 9PL. at the University and we will guide you through the process of exercising your rights. You also have a right to complain to the Information Commissioner's Office, Tel 0303 123 1113.

Will my participation in the study be confidential?
Your participation in the study will be kept confidential to the study team and those with access to your personal information as listed above.

Audio-recordings of the interviews will be transcribed by a University-approved transcription company and/or a University employee. Audio-recordings transferred outside of the University, for this purpose, will be done so using a secure online transfer process. All identifiable information will be removed from the interview transcripts and the audio-recordings will be destroyed after this point (no longer than one month after the interview has taken place). Direct quotes may be used in the write-up of the study but will be used in such a way so as not to reveal the identity of the individuals.

Please note that individuals from the University of Manchester or regulatory authorities may need to look at the data collected for this study to make sure the project is being carried out as planned. This may involve looking at identifiable data. All individuals involved in auditing and monitoring the study will have a strict duty of confidentiality to you as a research participant.

Other circumstances that may lead to disclosure of personal identifiable information may include:

- If there are concerns about your safety or the safety of others. In such an event, a member of the research team may need to contact a participant's GP, care team or family member, and this will be discussed with you.

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- If there are concerns about current or future illegal activities. In such an event, the research team are responsible for reporting such concerns to the authorities.

What happens if I do not want to take part or if I change my mind?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time without giving a reason and without detriment to yourself. You may request that your data is removed from the project up to two weeks after your interview. However, it will not be possible to remove your data after this point, as once it has been anonymised and forms part of the dataset we will not be able to identify your specific data. This does not affect your data protection rights.

All interviews need to be audio-recorded, but you are free to stop the interview at any time you choose if for any reason you become uncomfortable with the recording process.

Will my data be used for future research?

Your research data will not be shared with anyone outside of the research team and will not be used for future research.

Will the outcomes of the research be published?

The findings from this study will be published in a PhD thesis, in academic journals and presented at academic conferences. We will provide you with a copy of the findings, if you have provide consent for us to do so.

Who has reviewed the research project?

This study was reviewed by the University of Manchester, Psychology and Mental Health Divisional Ethics Panel.

What if I want to make a complaint?

Minor complaints

If you have a minor complaint then you need to contact the Chief Investigator in the first instance: **Dr Sarah Peters, sarah.peters@manchester.ac.uk, 0161 2752558.**

Formal complaints

If you wish to make a formal complaint or if you are not satisfied with the response you have gained from the researchers in the first instance, then please contact:

The Research Governance and Integrity Manager, Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, M13 9PL, by emailing: research.complaints@manchester.ac.uk, or by telephoning: 0161 275 2674.

What Do I Do Now?

If you have any queries about the study or if you are interested in taking part, please contact: **Lauren Rockliffe (Lead Researcher) at Lauren.rockliffe@postgrad.manchester.ac.uk.**

This Project Has Been Approved by the University of Manchester Psychology and Mental Health Divisional Ethics Panel [2020-9584-16317]

Appendix Q: Consent form for study four

Online Consent Form

If you are happy to participate, please tick the following statements.

Please tick

1. I confirm that I have read the information sheet dated [date], version [number], for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my personal data (e.g. age, ethnicity) will be collected as part of this study.

3. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason and without detriment to myself. I understand that I can request for my data to be removed from the project up to two weeks after the interview takes place, but that it will not be possible to remove my data from the project after this point. I agree to take part on this basis.

4. I understand that data collected during the study may be looked at by individuals from The University of Manchester (UoM) or regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data.

5. I agree that any data collected may be published anonymously in academic reports or journals.

6. I agree that the researchers may retain my contact details in order to provide me with a summary of the findings for this study [optional].

7. I agree that the researchers may retain my contact details in order to contact me about taking part in future research [optional].

8. I agree to take part in the above study.

Data Protection

The personal information we collect and use to conduct this research will be processed in accordance with data protection law as explained in the Participant Information Sheet and the Privacy Notice for Research Participants (http://documents.manchester.ac.uk/display.aspx?DocID=37095).

Please enter your name: _____

Please enter the date: _____

Online consent form v2. 06.10.2020

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Appendix R: Demographic questionnaire for study four

1. What is your age?

2. On what date did you give birth?

3. How many children do you have?

4. What is your ethnicity? (please select from the following categories)

Asian / Asian British:
- Indian
- Pakistani
- Bangladeshi
- Chinese
- Any other Asian background, please describe

Black / African / Caribbean / Black British:
- African
- Caribbean
- Any other Black / African / Caribbean background, please describe

Mixed / Multiple ethnic groups:
- White and Black Caribbean
- White and Black African
- White and Asian
- Any other Mixed / Multiple ethnic background, please describe

White:
- English / Welsh / Scottish / Northern Irish / British
- Irish
- Gypsy or Irish Traveller
- Any other White background, please describe

Other ethnic group:
- Arab
- Any other ethnic group, please describe

5. What is your relationship status?

- Single (never married or never in a civil partnership)
- In a relationship
- Married (including those in civil partnerships)
- Separated (but still legally married or in a civil partnership)
- Divorced (including formerly in a civil partnership which is now legally dissolved)
- Widowed (including surviving partner from a civil partnership)
- Other (please specify)

6. What is your employment status? If you are currently on maternity leave, please indicate your employment status prior to going on maternity leave.

- Employee: full-time
- Employee: part-time
- Self-employed: full-time
- Self-employed: part-time
- Student: full-time
- Student: part-time

     o Unemployed
     o Other (please specify)

7. If you are employed, what is your job?

8. What is your post code?

9. What is the highest level of qualification you have achieved?

- Postgraduate education level qualification (e.g. Masters or Doctoral qualification or equivalent)
- Higher education level qualification (e.g. Bachelor's degree or equivalent)
- Further education level qualification (e.g. A Levels/National Vocational Qualification (NVQ) Higher National Diploma or equivalent)
- High School qualification (GCSEs/ O Levels or equivalent)
- No formal qualifications
- Other (please specify)

10. What is your height? (please specify the unit of measurement. E.g. feet and inches, or cm)

11. What is your current weight? (please specify the unit of measurement. E.g. stones & pounds, or KG)

12. Did you have any health complications during pregnancy (e.g. gestational diabetes)?

13. Do you have any medical conditions that mean you have to change your diet?

14. Do you currently, or have you previously, suffered from an eating disorder? (please provide details).

Appendix S: Debrief sheet for study four

Pregnancy & Eating Behaviour Interview Study

MANCHESTER
1824
The University of Manchester

Participant Debrief Sheet

Thank you for taking part in the interview, your involvement is greatly appreciated. We hope that you have found it interesting and have not been affected by any of the topics discussed. However, if you have found any part of this experience to be distressing and you wish to speak to one of the researchers, please contact Lauren Rockliffe at lauren.rockliffe@postgrad.manchester.ac.uk, or on 07938312644.

Alternatively, please consider doing one of the following things:

➤ You could talk to a family member or close friend about your concerns.

➤ You could talk to your GP or to the Samaritans on 116 123.

➤ If you are feeling extremely concerned or as though you need help urgently you could contact your out-of-hours GP or visit your local A&E department.

For further information on mental health and well-being, please visit:

MIND (UK) – postnatal mental health support

https://www.mind.org.uk/information-support/types-of-mental-health-problems/postnatal-depression-and-perinatal-mental-health/self-care/#.XN17leRYboo

MIND (UK) – mental health support

https://www.mind.org.uk/

The Samaritans (UK) – general mental health support, including suicidal and other distressing thoughts

https://www.samaritans.org/

BEAT – eating disorders support

https://www.beateatingdisorders.org.uk/support-services/myself

Debrief sheet v2. 06.10.2020

Appendix T: Interview schedule for study four

Interview Schedule

Introduction

- o Introduce self
- o Purpose of the study
- o Probable length of interview
- o Audio-recorded
- o Anonymous/confidential
- o Can stop at any time/refuse to answer
- o Any questions
- o Explain focus on eating behaviour in different phases in pregnancy
- o If confirmed eating disorder, check comfort with topic

---- start recording ----

1. Thinking back to the start of your pregnancy, can you tell me a bit about your eating and any changes you made? *refer to timeline*

- o Time/event/gestation?
- o Barriers/facilitators to change?
- o Motivation (for self/baby)
- o Influence of others
- o Information received/needed
- o Practical/environmental factors

2. Thinking back to the middle of your pregnancy, can you tell me a bit about your eating and any changes you made? *refer to timeline*

- o Time/event/gestation?
- o Barriers/facilitators to change?
- o Motivation (for self/baby)
- o Influence of others
- o Information received/needed
- o Practical/environmental factors

3. Thinking back to the end of your pregnancy, can you tell me a bit about your eating and any changes you made? *refer to timeline*

- o Time/event/gestation?
- o Barriers/facilitators to change?
- o Motivation (for self/baby)
- o Influence of others
- o Information received/needed
- o Practical/environmental factors

Interview Schedule v4. 06.10.2020

End of interview

- o Any questions or comments on issues not covered in the interview
- o Reassure anonymity/confidentiality
- o Offer copy of findings once study complete
- o Thank for time

Appendix U: UoM ethical approval for study four

Psychology & Mental Health Division Panel

Division of Psychology & Mental Health
Zochonis Building G32

The University of Manchester

Manchester

M13 9PL

Email: Clare.Hamnett@manchester.ac.uk

MANCHESTER 1824

The University of Manchester

Ref: 2020-9584-16626

13/10/2020

Dear Dr Sarah Peters, Ms Lauren Rockliffe ,

Study Title: Factors influencing women's eating behaviours during pregnancy: A qualitative study

Psychology & Mental Health Division Panel

I write to thank you for submitting the final version of your documents for your project to the Committee on 08/10/2020 14:48 . I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation as submitted and approved by the Committee.

COVID-19 Important Note

Please ensure you read the information on the Research Ethics website in relation to data collection in the COVID environment as well as the guidance issued by the University in relation to face-to-face (in person) data collection both on and off campus.

A word document version of this guidance is also available.

Please see below for a table of the titles, version numbers and dates of all the final approved documents for your project:

Document Type	File Name	Date	Version
Advertisement	Online forum recruitment advert v1. 27.05.2020	27/05/2020	1
Advertisement	Online recruitment advert v1. 27.05.2020	27/05/2020	1
Advertisement	Twitter recruitment advert v1. 27.05.2020	27/05/2020	1
Data Management Plan	Data Management Plan v1. 12.08.2020	12/08/2020	1
Additional docs	Visual timeline example	12/08/2020	1
Additional docs	Interview guide v4 06.10.2020	06/10/2020	4
Consent Form	Consent form v2. 06.10.2020	06/10/2020	2
Distress Protocol/Debrief Sheet	Debrief sheet v2. 06.10.2020	06/10/2020	2
Additional docs	Distress policy v2. 06.10.2020	06/10/2020	2
Additional docs	Demographic questionnaire v2. 06.10.2020	06/10/2020	2
Advertisement	Facebook recruitment adverts v2. 06.10.2020	06/10/2020	2
Participant Information Sheet	Participant Information Sheet v2. 06.10.2020	06/10/2020	2
Additional docs	Response to ethics review	08/10/2020	1

This approval is effective for a period of five years and is on delegated authority of the University Research Ethics Committee (UREC) however please note that it is only valid for the specifications of the research project as outlined in the approved documentation set. If the project continues beyond the 5 year period or if you wish to propose any changes to the methodology or any other specifics within the project an application to seek an amendment must be submitted for review. Failure to do so could invalidate the insurance and constitute research misconduct.

You are reminded that, in accordance with University policy, any data carrying personal identifiers must be encrypted when not held on a secure university computer or kept securely as a hard copy in a location which is accessible only to those involved with the research.

For those undertaking research requiring a DBS Certificate: As you have now completed your ethical application if required a colleague at the University of Manchester will be in touch for you to undertake a DBS check. Please note that you do not have DBS approval until you have received a DBS Certificate completed by the University of Manchester, or you are an MA Teach First student who holds a DBS certificate for your current teaching role.

Reporting Requirements:

You are required to report to us the following:

1. <u>Amendments</u>: Guidance on what constitutes an amendment
2. <u>Amendments</u>: How to submit an amendment in the ERM system
3. <u>Ethics Breaches and adverse events</u>
4. <u>Data breaches</u>

We wish you every success with the research.

Yours sincerely,

Dr Jane Senior

Psychology & Mental Health Division Panel