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The co-development of a behaviour change intervention to improve
preconception health

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Thesis abstract

Background: The intrauterine environment can influence the future health of the child and their likelihood of developing obesity. Behaviour change interventions conducted during pregnancy have limited effectiveness to improve health outcomes during and after pregnancy. The aim of this thesis was to co-develop a behaviour change intervention to improve health behaviours before conception.

Methods: Four studies were conducted. Study one reviewed preconception health behaviour recommendations, examining consistency across Scotland, the UK, Europe and western international countries. Study two was a secondary analysis of survey data examining engagement in multiple health behaviours among preconception women in Scotland. The third study was a qualitative systematic review exploring preconception knowledge, beliefs and behaviours among people of reproductive age. Findings from these studies, alongside input from Patient and Public Involvement (PPI), informed the development of a theory-based intervention. The intervention, based on the information-motivation-behavioural skills model, was piloted in study four.

Findings and conclusions: Preconception guidelines within Scotland were similar to comparable countries, with key behaviours such as folic acid, weight management, alcohol and smoking cessation addressed in all. In Scotland, there was a lack of engagement in health promoting behaviours, particularly among those not planning a pregnancy and those living in areas of socio-economic disadvantage. Findings from the systematic review indicated a lack of understanding of preconception health across the preconception population. These findings led to the prioritisation of raising awareness as the first step to behaviour change and, with PPI input, a theory-based awareness raising intervention video was developed. The pilot study evidenced the video's acceptability and effectiveness at increasing knowledge. Future research could further develop the video by considering feasibility and implementation in primary care settings such as community pharmacy.

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Declaration

I declare that, except in cases whereby reference is made to contributions by others, this thesis consists of my own work and was written by me.

This thesis has not been submitted for any other degree at the University of Stirling or at any other institution.

Table of contents

Thesis abstract

Acknowledgements

Dissemination

Declaration

List of tables

List of figures

List of acronyms and abbreviations

CHAPTER 1 INTRODUCTION

1.1 Brief introduction to the problem

1.1.1 Child health and its association with maternal health

1.1.2 Parental body composition and behaviours influence on birth outcomes and child health

1.2 Defining preconception

1.2.1 Defining preconception as a population

1.2.2 Defining preconception as a period of time

1.3 Intervention efforts

1.4 Evidence of successful behaviour change interventions before conception

1.5 Looking forward: key priorities for intervention before conception

1.6 Incorporating PPI into the development of preconception health behaviour change interventions

1.6.1 Defining PPI

1.6.2 Evidence of how PPI has been used in the development of behaviour change interventions

1.6.3 PPI within the context of preconception

1.7 Thesis overview

1.7.1 Aims of the thesis

1.7.2 Overview of the thesis structure

CHAPTER 2 A NARRATIVE OVERVIEW OF SCOTTISH PRECONCEPTION ADVICE AND GUIDELINES COMPARED TO THE UK, EUROPEAN AND WESTERN INTERNATIONAL COUNTRIES

2.1 Introduction

2.1.1 Aims

2.2 Methods

2.2.1 Design

2.2.2 Information sources

2.2.3 Selection criteria

2.3 Results

2.3.1 Objective 1: Identify current guidelines in Scotland and the UK

2.3.2 Objective 2: Are Scottish guidelines consistent with UK, European and Western International guidelines?

2.3.3 Objective 3: Establish whether guidelines are behaviourally specific

2.4 Discussion

2.4.1 Progression of guidelines

2.4.2 Variation of specificity of guidance

2.4.3 Inclusion of men and partners

2.4.4 Limitations

2.4.5 Conclusions

CHAPTER 3 A SECONDARY ANALYSIS OF THE SCOTTISH MATERNAL AND INFANT NUTRITION SURVEY (2017)

3.1 Introduction

3.1.1 Pregnancy planning and behaviour change before conception

3.1.2 Sociodemographic factors

3.1.3 Multiple health behaviours

3.1.4 Aims and objectives

3.2 Methods

3.2.1 Participants

3.2.2 Survey packs

3.2.3 Questionnaire

3.2.4 Data analysis

3.2.5 Generating variables for behavioural and psychological planning

3.3 Results

3.3.1 Demographic information

3.3.2 Research question 1: What is the association between socio-economic status and engagement in multiple behaviour change prior to conception?

3.3.3 Research question 2: Is pregnancy planning associated with engagement in multiple health behaviours prior to pregnancy?

3.3.4 Research question 3: Are different categories of pregnancy planning associated with the performance of multiple health behaviours prior to conception?

3.3.5 Research question 4: How do psychological and behavioural pregnancy planning aspects relate to multiple behaviour change?

3.4 Discussion

3.4.1 Principal findings

3.4.2 The association between socio-economic status and engagement in multiple behaviour change prior to conception

3.4.3 The association between pregnancy planning and engagement in multiple behaviour change before conception

3.4.4 The association between individual LMUP items and engagement in multiple health behaviours before conception

3.4.5 The associations between behavioural and psychological planning with multiple behaviour change

3.4.6 Strengths and weaknesses

3.4.7 Conclusions

CHAPTER 4 PRECONCEPTION KNOWLEDGE, BELIEFS AND BEHAVIOURS AMONG PEOPLE OF REPRODUCTIVE AGE: A SYSTEMATIC REVIEW OF QUALITATIVE STUDIES

4.1 Introduction

4.2 Methods

4.2.1 Inclusion criteria

4.2.2 Search strategy

4.2.3 Screening and data extraction

4.2.4 Quality appraisal

4.2.5 Analysis and synthesis

4.3 Results

4.3.1 Search results and study selection

4.3.2 Study characteristics and quality appraisal

4.3.3 Synthesis

4.3.4 Gender roles and responsibilities

4.3.5 Cultural factors

4.3.6 Limited knowledge

4.3.7 Information seeking

4.2.8 Pregnancy planning stage

4.3.9 Behaviour specific barriers and facilitators

4.4 Discussion

4.4.1 Principal findings

4.4.2 Integration with existing literature

4.4.3 Implications and future research

4.4.4 Strengths and limitations

4.4.5 Conclusions

CHAPTER 5 PATIENT AND PUBLIC INVOLVEMENT

5.1 Introduction

5.1.1 Definition of patient and public involvement used and links to comparable studies

5.1.2 Theoretical rationale and influences

5.1.3 Aims

5.2 Methods

5.2.1 Design

5.2.2 People involved

5.2.3 Stages of involvement and nature of involvement at each stage

5.2.4 Measurement of PPI impact

5.3 Results

5.3.1 Outcomes and impact of PPI

5.3.2 Context of PPI

5.3.3 Process of PPI

5.4 Discussion

5.4.1 Outcomes

5.4.2 Impacts

5.4.3 Definition

5.4.4 Context

5.4.5 Process

5.4.6 Conclusions

CHAPTER 6: DEVELOPMENT OF THE INTERVENTION

6.1 Background of the intervention

6.1.1 Relevant experience of the research team

6.1.2 Timeline of intervention development

6.2 The intervention

6.2.1 Video aims

6.2.2 Alternative intervention formats which were considered

6.2.3 Choosing a video based intervention

6.2.4 Future implementation of the preconception health promotion video

6.2.5 Potential for wide dissemination at low cost

6.2.6 Incorporation into structured informational websites and educational tools

6.2.7 Opportunities within primary care settings

6.3 Format of delivery

6.3.1 Justification of video

6.3.2 Addressing limitations of other video based interventions

6.4 Theoretical Model

6.5 Target population

6.5.1 Primary target population

6.5.2 Secondary target population

6.6 Target behaviours

6.6.1 Preparation for pregnancy

6.6.2 Evidence from chapter 2 – Narrative review of preconception policy and guidelines

6.6.3 Evidence from chapter 3 – Secondary Analysis of the Scottish Maternal and Infant Nutrition Survey 2017

6.6.4 Evidence from chapter 4 – Qualitative systematic review exploring the preconception knowledge, beliefs, and health behaviours among people of reproductive age

6.6.5 Conclusions

CHAPTER 7 THE EFFECTIVENESS AND ACCEPTABILITY OF AN EDUCATIONAL PRECONCEPTION HEALTH VIDEO – AN EXPERIMENTAL SURVEY STUDY

7.1 Introduction

7.1.1 MRC guidance for developing and evaluating complex interventions

7.1.2 Acceptability

7.1.3 Aims

7.2 Methods

7.2.1 Study design

7.2.2 Participants and recruitment

7.2.3 Measures

7.2.4 Procedure

7.2.5 Analysis

7.2.6 Coding

7.2.7 Ethical approval

7.3 Results

7.3.1 Participant demographics

7.3.2 Research aim 1: Assess whether the intervention can improve knowledge, motivation and perceived behavioural skills

7.3.3 Research aim 2: Assess the acceptability of the intervention for providing information about health before conception

7.4 Discussion

7.4.1 Statement of findings

7.4.2 Integration with the literature

7.4.3 Future Research

7.4.4 Strengths and weaknesses

7.4.5 Conclusions

CHAPTER 8: DISCUSSION

8.1 Summary of thesis findings

8.1.1 Objective 1: Develop an understanding of preconception health and care by reviewing recommendations and guidelines about preconception care, examine knowledge and beliefs about preconception health and examine behaviours performed prior to conception

8.1.2 Objective 2: Develop an evidence and theory based multiple behaviour change intervention to optimise health of people planning a pregnancy

8.2 A comparison of the thesis findings with the wider literature

8.2.1 Identification of specific groups at risk of not engaging in health promoting behaviours

8.2.2 Limited knowledge and awareness of preconception health and its importance

8.2.3 The role of pregnancy and receptivity to health information

8.2.4 The acceptability of an informational video to promote preconception health

8.2.5 The effectiveness of an informational video to improve knowledge of preconception

8.3 Implications of the thesis findings

8.3.1 Targeting specific populations using appropriate methods

8.3.2 The importance of a public health approach alongside more tailored individual approaches to develop interventions

8.3.3 The potential dissemination and use of the preconception health promotion video developed as part of this thesis

8.4 Thesis strengths and limitations

8.4.1 Objective 1 Develop an understanding of preconception health and care by reviewing recommendations and guidelines about preconception care, examine knowledge and beliefs about preconception health and examine behaviours performed prior to conception

8.4.2 Objective 2: Develop an evidence and theory based multiple behaviour change intervention to optimise health of people planning a pregnancy

8.5 A reflection on the use of Patient and Public Involvement (PPI) in the development of the intervention

8.6 Recommendations

8.7 Conclusions

REFERENCES

APPENDIX 1: RECOMMENDATIONS FROM REVIEW DOCUMENTS

APPENDIX 2: ANTENATAL SURVEY

APPENDIX 3: SEARCH STRATEGY (ALL DATABASES) AND RESULTS

APPENDIX 4: CASP SCORING TABLES

APPENDIX 5: SCRIPT FOR VIDEO

APPENDIX 6: STORYBOARD

APPENDIX 7: ANIMATED VIDEO FRAMES

APPENDIX 8: ETHICAL APPROVAL

APPENDIX 9: SURVEY ADVERTISEMENT

APPENDIX 10: PILOT STUDY SURVEY

LIST OF TABLES

Table	Title	Page number
2.1	Overview of the type of documents included for review	37
2.2	Summary of behavioural guidance included in each set of guidelines	39
2.3	Summary of recommendations for maternal/paternal age and inter-pregnancy intervals	42
2.4	Summary of recommendations for a healthy weight	43
2.5	Summary of recommendations for physical activity	45
2.6	Summary of dietary recommendations	46
2.7	Summary of recommendations for folic acid supplementation	48
2.8	Summary of recommendations for vitamin D supplementation	49
2.9	Summary of recommendations for management of chronic disease	50
2.10	Summary of recommendations for immunisations	51
2.11	Summary of recommendations for managing current medications	52
2.12	Summary of recommendations for testing and treating sexually transmitted infections	53
2.13	Summary of recommendations for abuse	54
2.14	Summary of recommendations for smoking	55
2.15	Summary of recommendations for illicit drug use	56
2.16	Summary of recommendations for alcohol consumption	57
2.17	Summary of recommendations for caffeine intake	59
2.18	Summary of recommendations for cervical screening	59
2.19	Summary of recommendations for avoiding infection and transmission of Zika Virus	60
2.20	Summary of recommendations for exposure to hazardous/radioactive substances	61
2.21	Summary of recommendations for managing mental health	62
2.22	Summary of recommendations for oral and dental hygiene	63

3.1	Items used to generate a composite score for multiple behaviour change	75
3.2	ANOVA comparisons of multiple behaviour change across SIMD quintiles	80
3.3	Number of people within each LMUP category	81
3.4	Summary of the means and standard deviations for engagement in multiple behaviour change across each LMUP group for individual LMUP items	82
4.1	Characteristics of primary studies included analysis	96
4.2	Developed themes including associated subthemes and descriptions	98
6.1	Timeline of intervention development activities	132
6.2	Description and justification of intervention aims	134
7.1	Original and adapted definitions of TFA constructs	156
7.2	Mean likert scale responses regarding the acceptability of the preconception health promotion video	162

LIST OF FIGURES

Figure	Title	Page number
3.1	Generation of behavioural and psychological planning components	77
3.2	Number of participants within each SIMD quintile	78
3.3	Percentage of participants who chose whether or not to engage in the target behaviours before conception	79
3.4	Mean score for engagement in multiple behaviour change across SIMD quintiles	80
3.5	Mean score for engagement in multiple behaviour change across LMUP groups	81
3.6	The composite score for engagement in multiple behaviour change across the LMUP bands for each question	83
3.7	The composite score for engagement in multiple behaviour change for behavioural and psychological planning	84
4.1	PRISMA flow diagram of literature search from initial search	94
4.2	Behaviour change organising framework including developed themes	101
5.1	Stages of PPI	116
5.2	Advertisement used to recruit women to the PPI group	119
5.3	Roadmap of PPI process	122
6.1	The Information-Motivation-Behavioural Skills Model of health behaviour	143
6.2	Four preconception population perspectives	145
7.1	Flow diagram of the two intervention conditions and their respective survey routes	158
7.2	Participants plans for parenthood	160
7.3	Mean Likert scores for each IMB construct for the video and no video group	161

LIST OF ACRONYMS AND ABBREVIATIONS

AG: Aileen Grant

BMI: Body mass index

CASP: Critical Appraisal Skills Programme

COM-B: Capability, Opportunity, Motivation, Behaviour

FASD: Foetal Alcohol Spectrum Disorder

FoD: Format of Delivery

HCP: Health care professional

HW: Hannah Welshman

IMB: Information-Motivation-Behavioural-Skills

LGA: Large for gestational age

NHS: National Health Service

PCC: Preconception care

PPI: Patient and Public Involvement

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SC: Sinéad Currie

SD: Stephan Dombrowski

TDF: Theoretical Domains Framework

VS: Vivien Swanson

CHAPTER 1: INTRODUCTION

This PhD thesis presents the systematic development of an evidence-based behaviour change intervention to improve knowledge of the importance of optimising health before conception among people of reproductive age. This chapter will introduce the research problem and outline key priorities for intervention with the preconception population including the use of Patient and Public Involvement (PPI) before describing the aims of the thesis and the chapters included. This chapter will begin by presenting the background and justification of the thesis, providing an overview of the literature surrounding preconception health promotion and will present the structure the thesis will take.

1.1 Brief introduction to the problem

1.1.1 Child health and its association with maternal health

Rates of overweight and obesity among children in the UK are increasing, with greater numbers of children living with health conditions directly related to obesity and poor diet. Medical costs for health conditions directly associated with obesity, along with consequent disruption to productivity as a result, reached estimated costs of £60 million in the UK in 2018 (Davies, Mytton, & Pawson, 2019). This is particularly relevant within areas of economic disadvantage. In an independent report, the UK Chief Medical Officer stated that current projections estimate by 2030, 1 in 3 children living in socioeconomically disadvantaged areas will be obese (Davies, Mytton, & Pawson, 2019). Socioeconomic disadvantage is measured according to a person's socio-economic status (SES) which is defined as the measurement of economic and social status (Baker, 2014) which can influence accessibility of health services and habit formation regarding health promoting behaviours.

In Scotland, rates of overweight and obesity are high with 34% of children being overweight by the age of 10. Children who are overweight in the early primary school period are likely to remain so and the percentage of children maintaining an unhealthy weight status is even greater when they have obesity, with 79% of children with obesity at age 6 remaining so throughout primary school (Bradshaw, 2018). Similarly to the rest of the UK, the rates of overweight and obesity are greater in areas of socio-economic disadvantage. The obesity crisis and health inequalities associated with it within the UK have been commented on by the World Health Organisation who termed it as preventable (Buse, Wilding, Bryant, Halford, & Ralston, 2022).

A systematic review and meta-analysis reported that children and adolescents with obesity are five times more likely to have obesity in adulthood than those without obesity in childhood (Simmonds, Llewellyn, Owen, & Woolacott, 2016). Health risks associated with obesity during childhood and adolescence are cardiovascular disease, type 2 diabetes and cancer (Weihrauch-Blüher, Schwarz, & Klusmann, 2019). The rise of childhood obesity has been termed a global health problem with obesity associated illnesses previously only observed in adult populations now becoming increasingly prevalent among children, namely type 2 diabetes (Burke, 2006; Verduci, Di Profio, Fiore, & Zuccotti, 2022).

Excess weight gain can occur in utero and during early childhood and is associated with foetal exposure to gestational weight gain and gestational diabetes (Rhee, Phelan, & McCaffery, 2012). A meta-analysis explored the effects of gestational weight gain and maternal obesity on overweight and obesity across childhood (Yu et al., 2013). Findings indicated that maternal weight before conception and gestational weight gain were associated with greater infant fat development, with weight status before conception being the stronger predictor for child obesity. The authors called for health interventions to target maternal overweight and obesity before conception.

1.1.2 Parental body composition and behaviours influence on birth outcomes and child health

The association between maternal body composition and obesity in childhood was reported in a meta-analysis and suggests that there may be complex interactions between the intra-uterine environment, health behaviours within families after birth and longer term social, psychological and environmental factors (Heslehurst et al., 2019). Body composition was measured using body mass index (BMI) which incorporates weight to height measured in kg/m^2 (Hubbard, 2000). Increasing maternal BMI was associated with greater risk of obesity in offspring, particularly when the mothers BMI is categorised as obese ($>30\text{kg}/\text{m}^2$). Maternal obesity increased the chances of their offspring living with obesity by 264%, whilst maternal BMI which would be categorised as overweight ($>25\text{kg}/\text{m}^2$) was associated with an increase in the child's likelihood of living with obesity by 89% (Heslehurst et al., 2019). Optimising maternal BMI as means to reduce childhood obesity has been suggested as a viable preventative measure. Maternal obesity during pregnancy is associated with increased risk of pre-eclampsia, gestational diabetes, and excess maternal weight gain (Creanga, Catalano, & Bateman, 2022). Gestational weight gain is recommended to be limited to 5-9kg for women with obesity by the Institute of Medicine, however in a systematic review

exploring gestational weight gain in women with obesity, this amount was exceeded in included studies by 47-72% of women (Faucher & Barger, 2015). Gestational weight gain is associated with higher birthweight, which in turn has adverse effects on birth outcomes, with greater risk of caesarean delivery at birth. Whilst being associated with higher birthweight, maternal obesity has been found to be a predictor of obesity in early childhood. A retrospective cohort study conducted in the USA with 8494 pre-school children from low-income families found that by age four, one in four children whose mothers had obesity in the first trimester of pregnancy had obesity themselves. This was compared to one in ten children who had obesity by age four when their mothers were within a healthy BMI in the first trimester of pregnancy (Whitaker, 2004). These findings were supported by a meta-analysis which found an association between pre-pregnancy maternal obesity and obesity among offspring during childhood (Yu et al., 2013). The authors called for intervention before and during pregnancy to address maternal weight.

Additionally, the influence of the biological father's health should be considered. A systematic review and meta-analysis exploring the effects of paternal body composition on conception, pregnancy complications, birth and childhood health outcomes found that paternal BMI did have independent effects on conception and child health outcomes (Campbell & McPherson, 2019). They found that infertility was greater among men with a BMI categorised as overweight or obese, however effects of paternal BMI on pregnancy complications were varied. Two included studies considered infant birth weight and size however they were measured differently between studies. One study found that increased paternal BMI was associated with greater risk of macrosomia (Yang et al., 2015) whereas the second study measuring birth size found that increased paternal BMI was associated with greater risk of small for gestational age infants (SGA) (McCowan et al., 2011). Whilst having opposite outcomes, findings from both studies mirrored those from animal studies in which greater paternal BMI increased the likelihood of macrosomia and SGA (Fullston et al., 2013; Ng et al., 2010). These findings suggest that paternal health can influence the health of the developing foetus and attention should be paid to optimising the health of both biological parents before conception.

If continued into pregnancy, behaviours such as smoking, alcohol consumption and unhealthy eating can increase the risk of adverse maternal and foetal health outcomes. Maternal obesity, associated with an unhealthy diet, can increase the risk of developing gestational diabetes and pre-eclampsia (Begum, Sachchithanatham & Somsubhra, 2010). Behaviours such as

smoking are associated with foetal growth restriction if engaged in during any trimester of pregnancy (Lewandowska, Wieckowska, Sztorc & Sajdak, 2020) and alcohol consumption during pregnancy is associated with preterm birth and Foetal Alcohol Spectrum Disorder (FASD) (McQuire, Daniel, Hurt, Kemp & Parajothy, 2019). Smoking cigarettes can cause both short and long term health problems for women, with research suggesting that there is a dose-response relationship between prenatal smoking and sudden infant death syndrome (Anderson et al., 2019). Additionally, for men, engaging in smoking, alcohol consumption and illicit drug use has been associated with infertility due to the damaging effects on spermatogenesis (Sansone et al., 2018). Therefore, whilst the risks associated with overweight and obesity have been acknowledged, it is important to also consider engagement in multiple risk behaviours which may be continued into pregnancy and influence foetal development and maternal health outcomes.

1.2 Defining preconception

In 1976, one of the first preconception clinics was introduced in Edinburgh with the purpose of supporting women with diabetes who were reliant on insulin due to their being at greater risk of adverse pregnancy outcomes (Haddad, 1985). Since then, there has been mounting evidence that intervening in the preconception period can improve health outcomes for women with or without pre-existing conditions such as diabetes. The concept of preconception health, however, lacks a clear definition. This section will explore how preconception has been defined in terms of the population, but also biologically as a period of time preceding conception.

1.2.1 Defining preconception as a population

To conceptualise the preconception population, a model of preconception action phases was developed which considers a person's lifespan from childhood to people who have experience of pregnancy (Barker et al., 2018). The model includes four stages based on an individual's goal to become a parent, beginning with children and adolescents who are not yet biologically capable of pregnancy however intervention efforts for this population should focus on adopting health promoting behaviours and providing education as to why health before conception is important. The next stage includes adults with no immediate intention to become pregnant despite being physically able to achieve pregnancy. The third stage which follows includes adults with the intention to become pregnant who may be more receptive to health information which is focused on improving health before conception. The final stage includes adults who have previous experience of pregnancy and for whom, improving health

behaviours before conception is described as reactivating previous health behaviours from their past pre-pregnancy experiences (Barker et al., 2018)

This life stage model allowed for the needs and priorities of different groups within the preconception population to be identified. A working definition of preconception has since been developed and is considered in the context of a population with three specific attributes: being of reproductive age, man or woman and the woman or partner not currently being pregnant (Hill, Hall, Skouteris & Currie, 2020). From these attributes, four perspectives were developed from which to consider preconception. These are life course, public health, potential and intentional. This working definition follows on from the model of preconception action phases through which different populations can be considered based on their life stage and priorities (Barker et al., 2018). The four preconception perspectives will be defined in the following paragraph.

In the broadest sense, preconception can be considered from a life course perspective (Hill et al., 2020). This group includes those who do not possess all of the previously mentioned defining attributes of the preconception population, for example young adolescents. The public health perspective is more focused whereby individuals in this group possess the three defining attributes for preconception but are not yet sexually active. The potential preconception perspective refers to individuals who possess the three defining attributes but who are also sexually active regardless of their use of effective contraception. Lastly, the intentional preconception perspective involves individuals who possess the defining attributes but also have the intention to conceive or are beginning to plan a pregnancy. These four perspectives from which the preconception population can be considered is illustrated below in figure 1.1.

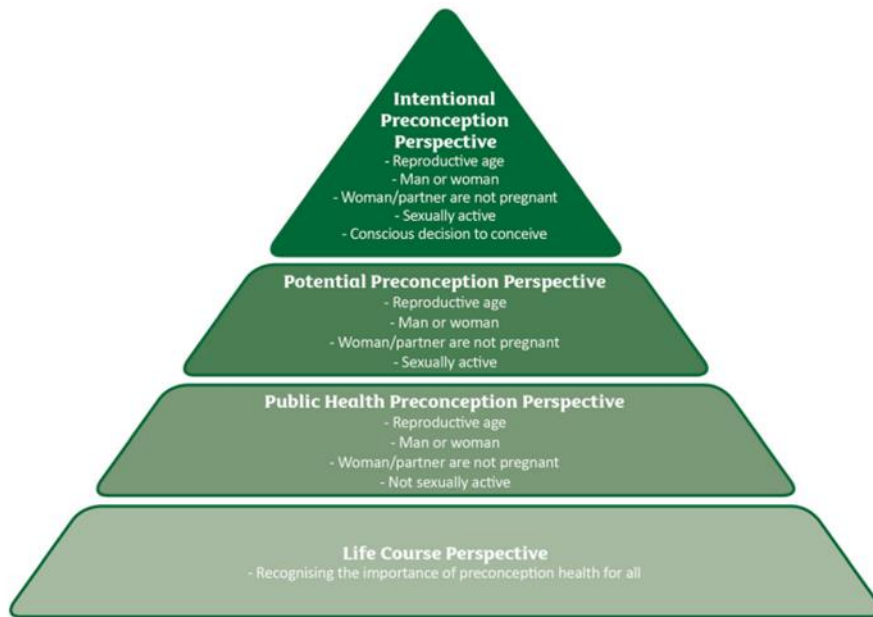


Figure 1.1 Four preconception population perspectives (Hill et al., 2020)

Barker et al. (2018) suggest that each stage is based on the person's life course and is centred on their intentions regarding pregnancy planning. This differs from the four preconception perspectives presented in figure 1.1 which uses three defining attributes centring around the biological ability to conceive (Hill et al., 2020).

Inconsistencies in the definition of the preconception period have been recognised as a factor acting as barriers to improving preconception health (Anakwe, Xian, BeLue, & Xaverius, 2022). It is important to ensure that a clear definition of the preconception population is available to ensure that people in need of health promotion are being targeted within appropriate interventions. This allows researchers to identify and address modifiable preconception health risks in specific populations. This is particularly important as whilst different groups within the preconception population vary regarding pregnancy intentions, differences can lie within those groups e.g. through gender differences. A cross sectional survey study conducted in Canada found that for smoking, limited physical activity and unhealthy eating, men had a higher prevalence of engaging in these behaviours (Dennis et al., 2022). Authors stated the importance of identifying groups who are at risk of engaging in damaging health behaviours. By clearly defining the preconception population, each group can be studied in greater detail to identify at risk groups and opportunities for intervention.

1.2.2 Defining preconception as a period of time

Whilst identifying appropriate population groups for preconception health promotion is important to identify at risk groups, conception itself is a biological event and preconception should also be considered from this perspective. Preconception can be defined biologically as the period of time beginning 14 weeks prior to conception due to follicular development in the ovaries becoming most active at this time (Hoek, Steegers-Theunissen, Sinclair, & Schoenmakers, 2020). However, when considering exposure to risk factors which may influence the uterine environment, the preconception period can be considered to have critical periods and sensitive periods (Stephenson et al., 2018). The critical period is defined as beginning up to three months preceding conception (Stephenson et al., 2018). Uterine exposure to an accumulation of behavioural risk factors during this time can result in permanent damage to developing foetus (Ben-Shlomo & Kuh, 2002). Nutrition, smoking and alcohol consumption are examples of behavioural factors which have an immediate effect on the uterine environment (Steegers-Theunissen, Twigt, Pestinger, & Sinclair, 2013). Therefore, optimising health during the critical period is important to reduce health risks associated with poor diet, smoking and alcohol consumption.

A sensitive period was described using the example of adolescence whereby habits are formed regarding health behaviours such as eating behaviours, alcohol consumption and smoking. Health risks associated with unhealthy behaviours engaged in during this time are important to target as health risks may accumulate over the lifespan when habits are formed early. The habits formed in this sensitive period can influence health behaviours in adulthood which then directly influence the uterine environment. The accumulation effect of the risks from health behaviours such as alcohol consumption and insufficient folic acid intake can increase the risk of adverse health outcomes for the developing foetus both during pregnancy and later in life (Timmermans et al., 2011).

The sensitive period provides an opportunity to improve engagement in health promoting behaviours whilst reducing engagement in behaviours which are linked to adverse pregnancy outcomes and may have intergenerational effects on the individual's future child. Health behaviours can take time to change and due to this early intervention is key to ensure that people can optimise their health before the critical period where the risk factors associated with behaviours such as an unhealthy diet, alcohol consumption and smoking can have a direct effect on spermatogenesis and the uterine environment (Peral-Sanchez, Hojeij, Ojeda, Steegers-Theunissen, & Willaime-Morawek, 2021; Sansone et al., 2018). The preconception

period should therefore be recognised as a period of time which goes beyond the immediate biological factors that influence the uterine environment in the immediate weeks preceding conception. This supports the inclusion of people within the preconception population who may not be actively planning to conceive in health interventions before conception.

In light of evidence which suggests that certain groups may be at greater risk of experiencing adverse health outcomes during pregnancy due to engaging in unhealthy behaviours, this thesis will consider preconception from a population perspective. This will allow the identification of an appropriate target population who could benefit from a behaviour change intervention which is tailored to their needs and preferences.

1.3 Intervention efforts

Considering the impact of parental obesity on child health outcomes introduced in section 1.1.2, behaviour change interventions have been carried out during pregnancy with the aim of improving health outcomes for mothers and their infants. In an effort to prevent childhood obesity, considerable research has been carried out during pregnancy in what has been termed a teachable moment (Phelan, 2010). A systematic review examining the effect of increasing physical activity among overweight and obese pregnant women found that intervening during pregnancy could reduce gestational weight gain and lowered the risks of developing gestational diabetes (Du, Ouyang, Nie, Huang, & Redding, 2019). Whilst noting some benefits of intervening during pregnancy, there were no significant differences between those who increased physical activity and those who did not for rates of caesarean section delivery, infant birthweight and risk of preterm birth. The authors of the systematic review urged caution however when interpreting their findings due to the small sample size of the 13 included papers in their analysis.

A more recent systematic review and meta-analysis with a larger sample size of 20 studies explored the effects of behaviour change interventions during pregnancy on long term obesity related outcomes in offspring (Raab et al., 2021). Findings showed that BMI for offspring from 12 months until three years and older did not differ significantly between those whose mothers took part in a behaviour change intervention during pregnancy and those whose mothers did not. Authors suggested a possible explanation that the effects of the intervention were insufficient to change the intra-uterine environment. Findings indicated no significant difference between intervention and control groups for gestational weight gain, however

authors noted that poor intervention adherence may be a factor influencing intervention outcomes.

Research suggests varied success for behaviour change interventions during pregnancy depending on intervention outcomes. Pregnancy may still be an opportune teachable moment regarding engagement in health promoting behaviours however the timing of behaviour change interventions should depend on the desired health outcomes. Examples include interventions focusing on diet and physical activity during pregnancy, the UPBEAT trial conducted in the UK (Flynn et al., 2016) and the LIMIT trial in Australia (Dodd et al., 2014). Whilst both trials reported improvements in eating behaviours, neither resulted in any significant reduction of obstetric conditions such as gestational diabetes, pre-eclampsia and large for gestational age (LGA) infants. Although, some risk reduction for obstetric conditions was observed for other behaviours such as cigarette smoking. Therefore, with regards to changing behaviour, pregnancy may be an opportune time when motivation to optimise health is greater, however for people at risk of adverse health outcomes due to health status before pregnancy, intervening in pregnancy may be too late to reduce risk. For example, when the effects of smoking cessation during pregnancy were studied, it was found that smoking during any trimester of pregnancy was associated with foetal growth restriction despite cessation. Yet when smoking cessation occurred before conception, no restriction in foetal growth was observed (Blatt, Moore, Chen, Van Hook, & DeFranco, 2015). This suggests that for certain health behaviours, intervention before pregnancy is required to improve health outcomes. In light of this evidence, it is important to consider the behaviours of women before conception with the aim of understanding what factors influence engagement in specific health promoting behaviour.

The limitations of behaviour change interventions during pregnancy to improve foetal health outcomes has been discussed in the literature, where attention has shifted to the period of time before conception. Intervening in the preconception period has been recommended as part of a Lancet series involving experts in topics such as health psychology, medicine, nutrition, and epidemiology which provides a clear call to action for intervention in the preconception period. The Lancet series advises that behaviour change interventions conducted during pregnancy alone are not enough to prevent adverse outcomes and intervention is required before conception (Stephenson et al., 2018). They explore intervention strategies before conception and consider the preconception period across the lifespan (Barker et al., 2018). This is relevant for the development of behaviour change

interventions as health behaviour changes can take time to implement into a person's life. Allowing time for people to improve their health and allow positive health outcomes must therefore precede the critical foetal development period in the first trimester of pregnancy, when people discover they are pregnant and make behavioural changes.

1.4 Evidence of successful behaviour change intervention before conception

Evidence presented in sections 1.2 and 1.3 suggest that behaviour change interventions should be conducted before conception to improve pregnancy and birth outcomes. This section will explore examples of behaviour change interventions which have been delivered before conception.

Regarding the general population, there is limited evidence of preconception health interventions being delivered to examine their effectiveness at changing behaviour and reducing risks to health. A scoping review explored what behaviour change interventions have been delivered to the preconception population, what behaviours have been addressed along with how these are delivered and the effectiveness of the intervention (Hemsing, Greaves & Poole, 2017). The authors reported that interventions ranged from brief advice to in depth counselling and tended to be aimed towards women who were considered high risk of adverse maternal and foetal health outcomes. This included women with an existing chronic illness or those at risk of alcohol exposed pregnancies. Regarding outcomes, the majority of interventions reported improvements in some of their outcome measures, commonly being improved knowledge. Suggestions for future research to contribute to the literature on preconception health were to explore men and women's preference for the delivery of preconception health information, find appropriate methods of engaging partners and ensure that interventions are not stigmatising to women.

One study which was identified in the systematic review described above was effective at supporting women in improving their health before conception. Since the scoping review was published, the study has been developed further and tested in a larger randomised controlled trial (Jack et al., 2020). Authors explored the effects of using an online conversational agent to deliver preconception health information and found a 16% increase in women taking action to address risks to health before conception when compared to a control group (Jack et al., 2020). The study included women identifying as Black and African American and between the ages of 18 and 34 in the USA. The conversational agent, "Gabby", screened each participant through an online risk assessment which considered emotional and mental health,

vaccinations, nutrition and activity, reproductive health and family planning. After being assessed for risks, the women could select which ones they wished to address, and they received advice on how to take action to reduce these health risks over a 12 month period. The control group received a letter outlining preconception health risks and encouraging them to visit a health professional to discuss them. When measured at six months, findings showed that women in the intervention group had taken action to reduce 50% of their identified risks compared with 43% of women in the control group. This study suggests that online methods of delivering preconception health information may be beneficial to support people planning a pregnancy to optimise their health. It must be noted that this study has a specific target population and inclusion criteria for this study was based on racial disparities in health in the U.S.A resulting in Black and African American women being at greater risk of adverse pregnancy and birth outcomes.

Whilst there has been some development since the scoping review (Hemsing, Greaves, & Poole, 2017), there is limited evidence of preconception health behaviour change interventions. A recent systematic review exploring interventions delivered from before conception until age 20 found limited evidence of interventions of behaviour change interventions targeting the preconception population (Vaivada et al., 2022). The authors stated that intervention before conception is required to ensure that modifiable risk behaviours engaged in by parents can be modified to improve child health outcomes.

1.5 Looking forward: key priorities for intervention before conception

Thus far, the problem of obesity in childhood, its associated risks to health and potential causes have been discussed. Intervening to improve engagement in health promoting behaviours during pregnancy has limited success whereby behaviours may be changed, however it may be too late to prevent health risks associated with unhealthy behaviours when they are engaged in after conception once foetal development has begun. To reduce health risks during pregnancy and after birth, the preconception period is the most important time to intervene to ensure the intra-uterine environment can support healthy foetal development. However, as this area of research is still in its infancy, there are questions to ask in order to develop effective behaviour change interventions to support people planning a pregnancy.

Firstly, it is important that key health behaviours are identified for inclusion in the development of a behaviour change intervention. As mentioned in section 1.4, there is limited evidence of behaviour change interventions being delivered to the general population and

little is understood regarding what health behaviours are recommended for people planning a pregnancy, how these behaviours are engaged in and how they are prioritised by people who, whilst categorised as being preconception, are at different stages of life with different priorities.

Secondly, the definitions of preconception discussed in section 1.2.1 cover a large proportion of the general population who will have different values and priorities depending on their stage of life. It is important to note that these different life stages and varying priorities are in turn, independent from psycho-social factors such as socio-economic status which is a risk factor for low engagement in health promoting behaviours. Any behaviour change intervention which considers the needs of a specific subgroup of the preconception population should also consider how factors like socio-economic status may influence a person's ability to engage in certain health promoting behaviours and interact with health services. This should be considered when developing health behaviour change interventions to prevent the widening of health inequalities. Therefore, it can be seen that research is needed to identify who health behaviour change interventions should target, how interventions should be delivered to different subpopulations and to what extent these subpopulations have the knowledge and the motivation to optimise their health before conception.

1.6 Incorporating PPI into the development of preconception health behaviour change interventions

1.6.1 Defining PPI

Patient and Public Involvement (PPI) is defined as research that is done with members of the public rather than for them (INVOLVE, 2012). Involving key stakeholders in research is recommended in Medical Research Council (MRC) framework as a core element of the intervention development process (Skivington et al., 2021). These key stakeholders are identified as people who are the target population for the intervention, who may be involved in its delivery or who may be affected by the intervention. Involving people in the development of a preconception health behaviour change intervention is important to increase the likelihood that the intervention will feel relevant to the target population and appeal to them. Co-production is encompassed within PPI however it includes a greater degree of involvement from contributors and involves a shared power between contributors.

The framework for co-production and prototyping provides guidance and a structure which can be used to aid researchers when involving key stakeholders in the development of an intervention (Hawkins et al., 2017). It involves three stages; 1) evidence review and stakeholder consultation, 2) co-production and 3) prototyping. These three stages, when followed, can assist researchers in translating evidence from literature into practice by considering the knowledge and opinions of key stakeholders. This thesis presents the development of an intervention with contribution from people within the target population, the process of which will be outlined in detail in later chapters and this involvement will be referred to as PPI throughout.

1.6.2 Evidence of how PPI has been used in the development of behaviour change interventions

There is limited evidence of PPI being used within the context of preconception research, due to preconception health research being in its infancy. The preconception population has multiple sub groups within who are at different life stages and have different priorities regarding pregnancy planning. Hence, this broad population may be challenging when recruiting from groups for whom, improving health for pregnancy is not a priority.

A study conducted in the UK aiming to test whether taking probiotic capsules are effective at preventing preterm birth used a PPI group involving women from ethnic minority groups who are less likely to become involved in clinical trials (Rayment, Lanlehin, McCourt, & Husain, 2017). Whilst this study was developing an intervention to be carried out among pregnant women, it is relevant due to the people included in the PPI group being from a hard to reach group who may not be as motivated to take part. The authors commented on the difficulties they anticipated in recruitment of this PPI group and set out strategies to increase the likelihood of women agreeing to join the group and engage in discussions. These included visiting children's groups at times when mothers would regularly meet to ensure that women were not being asked to give additional time to engage in the project. Another method to involve women in discussions was to attend baby drop in groups where women had an established routine of attending at specific times and were in an environment in which they felt familiar. These strategies allowed researchers to ensure that women involved in the PPI group felt comfortable and did not have to give additional time which may be a barrier to involvement. This study is relevant for the preconception context whereby different groups

within the preconception population who are not actively planning a pregnancy may be less inclined to become involved in a preconception research project.

1.6.3 PPI within the context of preconception

Due to the different groups within the preconception population who will have varying priorities regarding pregnancy planning, it is important to ensure that interventions developed to support behaviour change are relevant to the people they are being delivered to. A method of ensuring behaviour change interventions meet the needs of their target population is by using PPI in their development. This allows researchers to ensure the perspective of the target population is considered. PPI may be used to identify barriers to recruitment, improve acceptability of interventions by ensuring they are relevant to the target population and to include the varied perspectives of the target population (Rayment, Lanlehin, McCourt, & Husain, 2017). Using PPI within preconception health behaviour change intervention development has the potential to address some of the key recommendations outlined in section 1.4. These are to ensure that developed interventions are empowering for women rather than stigmatising, partners are engaged appropriately, and that information is provided in a way that is deemed acceptable.

1.7 Thesis overview

1.7.1 Aims of the thesis

This thesis aims to develop a co-designed behaviour change intervention to improve the health behaviours of people planning a pregnancy. This will be achieved by exploring what information is available regarding pregnancy preparation, what behaviours are engaged in before pregnancy and the frequency of which this occurs, along with exploring the beliefs and motivations of the preconception population.

The thesis has two objectives:

1. To develop an understanding of preconception health and care by reviewing recommendations and guidelines about preconception care, examine knowledge and beliefs about preconception health and examine behaviours performed prior to conception.
2. To co-develop an evidence and theory based multiple behaviour change intervention to optimise health of people before pregnancy

1.7.2 Overview of the thesis structure

To achieve the aims outlined above, a mixed method approach was taken which is presented across 8 chapters, as detailed below.

Chapter 2: a narrative overview of Scottish and UK preconception guidelines considered in a European and Western International Context. This chapter contributes to objective 1.

Chapter 3: a secondary analysis of the Scottish Maternal and Infant Nutrition Survey (2017) which contributed to objective 1 and informed decisions made when addressing objective 2.

Chapter 4: a qualitative systematic review of the literature exploring knowledge, beliefs, and behaviours of people before conception. This chapter addressed objectives 1 and 2.

Chapter 5: the process of using Patient and Public Involvement in the development of the behaviour change intervention, contributing to objective 2.

Chapter 6: the systematic development of a behaviour change intervention and contributes to objective 2.

Chapter 7: a pilot study exploring the impact of a health behaviour change intervention among people of reproductive age and contributes to objective 2.

Chapter 8: thesis discussion.

CHAPTER 2: A NARRATIVE OVERVIEW OF SCOTTISH PRECONCEPTION ADVICE AND GUIDELINES COMPARED TO THE UK, EUROPEAN AND WESTERN INTERNATIONAL COUNTRIES

Chapter 1 introduced the topic of preconception and outlined how specific health behaviours, which are engaged in before conception, can influence the health of a mother and baby both during and after pregnancy. This chapter outlines what guidance is available regarding preconception health behaviours in Scotland and the UK. For context, these are considered alongside recommendations from a selection of European and western international countries.

2.1 Introduction

The period before conception is a critical time to optimise health and improve pregnancy outcomes (Stephenson et al., 2018). As introduced in chapter one, the time before conception can be considered in terms of a sensitive period, where habits are formed regarding engagement in health promoting behaviours, and a critical period. The critical period includes the months before conception and the uterine environment in this time can be influenced by behaviours such as diet and folic acid supplementation (Steegers-Theunissen, Twigt, Pestinger, & Sinclair, 2013). Research suggests that the intrauterine environment can influence foetal development and health in later life (Ben-Shlomo & Kuh, 2002). Scientific literature has stressed the importance of making health behaviour improvements prior to conception to improve health outcomes during pregnancy and after birth.

Clinical guidelines can benefit health professional by providing recommendations and ensuring that professional practice is not outdated (Moore & Dukes, 2019). A method of ensuring recommendations from scientific literature are translated into practice is through the development of clinical guidelines. Assuming clinical guidelines are up to date, relevant and implemented properly, there is scope to reduce the number of people being treated for preventable conditions (Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999). However, access to health information by the public does not always translate into behaviour change. There are a number of factors which might explain this lack of action including; poor quality evidence, novel skills being required to implement recommended behaviours, guidelines lacking cultural sensitivity and not aligning with the target population's existing values, and vague descriptions of how to engage in the target behaviour (Haines, Kuruvilla, & Borchert, 2004). Therefore, to ensure that guidelines can be implemented effectively, it is imperative

that they are analysed for coherence, cultural sensitivity and that they illustrate clearly the correct procedures required to engage in the target behaviour.

In response to the problem of improving the implementation of health guidelines, the importance of how guidelines are worded and the implications of behavioural recommendations being precise, an examination was conducted by Michie and Johnston (2004). They comment on how guidelines often appear to be written to deliver general guidance rather than to provide advice regarding specific actions which are required to engage in a specific behaviour. The authors continue to comment that specifying how to engage in target behaviours within published guidelines serves two important purposes. Firstly, the receiver of the guidelines has clarity regarding the actions required which increases the likelihood of guidelines being translated into practice. Secondly, it allows healthcare professionals to identify factors which precede or follow the attempted application of guidelines. As preconception care is important to protect against adverse maternal and foetal outcomes, it is imperative that guidelines for health professionals are clearly written and behaviourally specific, outlining who is responsible for implementation, when guidelines should be implemented along with where and how this should be done. Therefore, it is important to review the consistency and specificity of health guidelines available for the preconception population if they are to be effectively communicated by health professionals and translated into practice by members of the general public.

A systematic review of preconception care policy, guidelines, and recommendations in six European states was conducted by Shaw et al. (2015) to identify the existence of guidelines and explore the quality and consistency of them. All guidelines in their review included advice for women with chronic illnesses however there was limited information available for women who did not have an illness and for men. Findings also indicated heterogeneity between European guidelines for women regarding behaviours like alcohol consumption and micronutrient supplementation. The review authors called for further research to develop evidence-based guidelines and recommendations for health in the preconception period which includes both women and men.

This chapter will present an updated review of recommendations and guidelines with a focus on those existing within Scotland and the UK. Given the importance of engagement in health promoting behaviours before conception introduced in chapter 1, it is important to identify the available behavioural recommendations and consider their specificity and consistency

with guidelines throughout Europe and western international countries. Comparing guidelines within Scotland and the UK to those within a European and western international context allows inferences to be made regarding the comprehensiveness of guidelines in relation to other developed countries.

Within the context of this PhD thesis, it is important to consider what advice is available regarding preconception health and behaviour. By conducting an overview of recommendations, information can be gathered regarding which health behaviours receive attention and which have been neglected. Where guidelines are present, their specificity and clarity for health professionals can be investigated. The information gathered can be considered to identify important behaviours to be included in the development of a behaviour change intervention.

2.1.1 Aims

This narrative overview aims to identify preconception guidelines within Scotland and compare them with the UK and a sample of European and International guidelines.

The objectives of the narrative overview are:

- To identify the current guidelines for preconception health and care in Scotland and the UK
- To consider whether Scottish Guidelines are consistent with recommendations in the UK, European and other western developed countries.
- To establish the extent to which guidelines are behaviourally specific.

2.2 Methods

2.2.1 Design

A narrative overview of current preconception guidelines and recommendations carried out in accordance with guidelines (Green, Johnson, & Adams, 2006). This involved providing a synthesis of available evidence and collating many sources of information to form one readable document from which inferences and conclusions could be made.

2.2.2 Information Sources

Electronic searches were carried out in November and December 2019 in Google search using the terms: pre-conception; preconception; preconception care; pre-pregnancy; pregnancy planning; sexual health AND policy; guidelines; recommendations.

Webpages for all Scottish Health boards and the NHS UK webpage were searched in November 2019 using the terms: preconception, preconception care, pre-pregnancy, pregnancy planning and sexual health. All relevant information which contained any guidance on health behaviours specifically before conception was included. The searches were carried out again in November 2022 and no documents had been updated.

Each information source was reviewed and any guidance on preconception health was extracted and presented in table format for each behaviour.

2.2.3 Selection Criteria

The inclusion criteria for guidelines and recommendations included any guidance that specifically addressed preconception care for women and/or partners. This information could be aimed towards couples planning a pregnancy or health professionals delivering preconception care and advice.

Exclusion criteria included documents not published in English and guidelines specifically targeted towards women with chronic illnesses, for example diabetes whereby patients receive routine care including illness specific preconception advice. Documents which exclusively targeted collective measures were excluded to ensure a focus on health for the individual. Collective measures include recommendations for the general public to improve health before conception, but are not always designed to target this population e.g. recommendations for cigarette packaging with pregnancy or specific warnings to the iodisation of salt.

Health behaviours included in the review were led by the guidelines and the inclusion or exclusion of particular behaviours was no pre-determined. The analysis conducted within this chapter examines each set of guidelines in their entirety.

2.3 Results

The electronic search identified multiple information sources which provided preconception advice and guidance. NHS Scotland health board websites were searched and four health boards were found to have included advice on preconception health and care. These four NHS boards were Dumfries and Galloway, Forth Valley, Greater Glasgow and Clyde, and Lanarkshire. Electronic searches using the specified search terms revealed guidelines from the National Institute for Health and Care Excellence (NICE) in the UK along with national guidelines from Germany, The Netherlands and Canada along with regional guidelines from the Queensland Government of Australia.

All health guidelines and recommendations included advice for individual behaviour change for the general population. Some recommendations included sections which were targeted at collective public health measures and individuals with specific chronic health conditions. These are illustrated in table 2.1 but are not discussed in this section in adherence with the previously stated exclusion criteria. An overview of the type of document, target audience and type of preconception care is outlined below in table 2.1

2.1 Overview of the type of documents included for review

Information Sources	Country of origin	Type of document	Who is the information aimed towards?	Type of preconception care
NHS Dumfries & Galloway	Scotland	“Toolkit”	Health Care Professionals (HCPs)	General Individual
NHS Forth Valley	Scotland	Webpage information	General Public	General Individual
NHS Greater Glasgow & Clyde	Scotland	National report	General Public and HCPs	General Individual &

Information Sources	Country of origin	Type of document	Who is the information aimed towards?	Type of preconception care
				Collective Measures
NHS Lanarkshire	Scotland	Webpage information	General Public	General Individual
NHS UK	United Kingdom	Webpage information	General Public	General Individual
NICE Guidelines	United Kingdom	National Guidelines	HCPs	General Individual & Specialised Individual
Healthy Start – Young Family Network (Germany)	Germany	National Guidelines	HCPs	General Individual & Specialised Individual
Health Council of the Netherlands	Netherlands	National Guidelines	HCPs	General Individual & Specialised Individual
Public Health Agency of Canada	Canadian	National Guidelines	HCPs	General Individual & Specialised Individual
Queensland Government of Australia	Australia	Regional Guidelines	HCPs	General Individual & Specialised Individual

Table 2.2 Summary of behavioural guidance included in each set of guidelines

	NHS Dumfries and Galloway	NHS Forth Valley	NHS Greater Glasgow & Clyde	NHS Lanarkshire	NHS UK	NICE Guidelines	Germany	Netherlands	Canada	Australia
Maternal/ paternal age	✓					✓		✓	✓	
Interpregnancy intervals	✓					✓			✓	
Weight	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Physical activity	✓		✓		✓		✓		✓	✓
Diet	✓		✓	✓	✓	✓	✓	✓	✓	✓
Folic acid	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Micronutrient supplementation	✓	✓	✓		✓		✓	✓	✓	✓
Chronic disease management	✓		✓		✓			✓	✓	
Immunisations	✓		✓	✓	✓	✓	✓	✓	✓	
Medication										✓
Sexually Transmitted Infections (STIs)	✓		✓	✓				✓	✓	
Abuse	✓		✓						✓	

Smoking	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Illicit drugs	✓		✓	✓		✓		✓	✓	✓
Alcohol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Caffeine		✓					✓			
Cervical Screening	✓	✓	✓			✓				
Hazardous/radioactive substances								✓	✓	
Mental Health	✓		✓	✓				✓	✓	
Dental/oral hygiene							✓		✓	

2.3.1 Objective 1: Identify current guidelines in Scotland and the UK

Within Scotland, preconception guidelines were included on four NHS health board websites that are accessible to the public and address individual behaviour change. Within the UK, the NHS UK website included preconception health recommendations which address individual behaviour, and NICE guidelines targeted individual behaviour change but differed from the previously mentioned recommendations by being aimed at health professionals providing preconception care.

Regarding included behaviours, all guidelines within Scotland and the UK included advice on folic acid supplementation, weight management, avoiding alcohol and smoking cessation. NHS boards on average included a similar number of behavioural recommendations (mean=11) compared to NICE guidelines (n=10). The guidelines which included the most behavioural recommendations were Dumfries and Galloway (n=16) and Greater Glasgow and Clyde (n=14).

There were no clear differences between UK guidelines and those in Scotland regarding the advice provided in each behavioural recommendation. Differences between guidelines within Scotland and the UK occurred in terms of the number of behaviours included in respective guidelines and how specific that guidance was. Differences in specificity of guidance are examined in detail in section 2.3.3.

2.3.2 Objective 2: Are Scottish guidelines consistent with UK, European and western international guidelines?

Findings from objective 1 showed that guidelines differed regarding who they were aimed towards. Information on NHS websites across Scottish health boards and NHS UK was aimed at the general public. NHS Dumfries and Galloway along with NICE guidelines included advice for health professionals. Of the included European and Western International guidelines, all guidance was aimed towards health care practitioners caring for preconception patients.

Regarding the inclusion of behavioural recommendations, there was consistency regarding the inclusion of guidance for folic acid, weight management, alcohol and smoking within Scottish and UK guidelines. Guidance for each of these mentioned behaviours was also included across recommendations from included European and Western International countries.

In terms of the range of included behaviours, Scottish health boards included similar numbers of behaviours in comparison with European and Western International counterparts. Canada produced guidelines for the most number of health behaviours (n=18) and was the only nation to include guidance on seeking advice regarding medication. Behavioural advice addressing exposure to hazardous or radioactive substances was included by Canada and the Netherlands but not in any Scottish or UK recommendations. In contrast, guidance on abusive relationships was only included by two Scottish health boards and one other nation, Canada. Whilst Scottish guidance stated that abusive relationships should be stopped, Canadian guidance offered greater detail for health professionals to discuss how these relationships can be ended and what support is available to the patient.

In addition to the inclusion of specific behaviours, variation between recommendations occurred regarding who advice was for. All of the included recommendations included preconception women by default however inclusion of men and partners varied between recommendations and behaviours. NHS Glasgow and Clyde did not specifically address men or partners in any of their behavioural recommendations. Of those recommendations who included men and partners the most common behaviours addressed were smoking and sexually transmitted infections. Aside from behaviours which are only applicable to women (folic acid supplementation and cervical screening), men and partners were not specifically mentioned in guidance regarding mental health, exposure to hazardous/radioactive substances, caffeine, medication and physical activity by any set of recommendations.

2.3.3 Objective 3: Establish whether guidelines are behaviourally specific

As stated under objective 2, differences in guidelines were found regarding the level of detail for each behavioural recommendation. The remainder of this results section will explore each of the included behaviours and compare the detail of behaviourally specific advice included.

Maternal/Paternal Age and Interpregnancy Intervals (completed pregnancies)

Table 2.3 Summary of recommendations for maternal/paternal age and inter-pregnancy intervals

Country/Region	Recommendations and guidelines		
	Maternal /Paternal Age (years)	Interpregnancy intervals	Who is this recommendation for?
NHS Dumfries & Galloway	35	18 months	Women
NICE Guidelines	35	18-59 months	Women
Health Council of the Netherlands	40	n/a	Women and partners
Public Health Agency of Canada	35	18-24 months	Women

Four sets of guidelines included ages at which a person is considered to be of advanced maternal/paternal age and recommended interpregnancy intervals. Three of which included women only and stated age 35. This differed for the Netherlands who included women and their partners and included a more advanced age of 40. Of the guidelines including information regarding inter-pregnancy intervals all stated 18 months as the minimum recommended time to wait before becoming pregnant again, however a range was provided by NICE guidelines and the Public Health Agency of Canada which provided a different upper limit of 59 and 24 months respectively.

Weight

Table 2.4 Summary of recommendations for a healthy weight

Country/Region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	BMI between 18.5-30kg/m ²	Women
NHS Forth Valley	BMI of between 18.5-25kg/m ²	Women
NHS Greater Glasgow & Clyde	Advised to follow a nutritious diet to achieve and maintain a healthy weight (not specified)	Women
NHS Lanarkshire	maintain a healthy weight (not specified)	Women and men
NHS UK Website	Highlights risks of overweight and suggests consulting GP about weight before conception	Women
NICE Guidelines	BMI between 18.5-24.9 kg/m ² Specific risks and advice for both over/underweight provided.	Women
Germany Healthy Start	Weight should be consistent with national/international guidelines	Women
Health Council of the Netherlands	BMI between 20-25kg/m ²	Women
Public Health Agency of Canada	BMI between 18.5-24.9 kg/m ² .	Women
Australia – Queensland Government	A BMI between 18.5-24.9 kg/m ² . Additional information is provided for specific ethnicities (appendix 1)	Women

Achieving a healthy weight and maintaining it was recommended by all included guidelines, with variation in how this advice is presented. Six sets of guidelines provided advice regarding a target BMI range. With the exception of NHS Dumfries and Galloway which provided a BMI range which was inclusive of healthy and overweight, 18.5-30 kg/m², all other recommended BMI ranges included the healthy BMI range of 18.5-24.9 kg/m². Additional information was provided by The Queensland Government guidelines which considered cultural and ethnic differences regarding weight and specific advice was provided for HCPs regarding these specific groups (appendix 1). The remaining four guidelines which did not explicitly state a recommended BMI range recommended a “healthy weight” and the NHS website suggested consultation with a general practitioner to discuss weight when preparing for pregnancy.

All of the guidelines were targeted towards women only with the exception of NHS Lanarkshire which included partners in weight recommendations.

Physical Activity

Table 2.5 Summary of recommendations for physical activity

Country/region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	Advise to start regular physical activity before becoming pregnant	Women
NHS Glasgow & Clyde	Advise to start regular physical activity before becoming pregnant	Women
NHS UK website	NHS advice is to walk often, with information on the website regarding suitable activities and strength programmes	Women
Germany – The Healthy Start – Young Family Network	At least 30 minutes of moderate physical activity 5 days a week	Women
Public Health Agency of Canada	150 minutes per week of moderate to vigorous physical activity	Women

Country/region	Recommendations and guidelines	Who is this recommendation for?
Australia – Queensland Government	Muscle strengthening activity 2 days each week along with 2.5-5 hours of moderate intensity PA each week or 1.25-2.5 hours vigorous intensity PA each week.	Women

Six of the information sources provided advice regarding physical activity (PA). Three information sources (Germany, Canada & Queensland) referenced national physical activity guidelines and specific activities were suggested by NHS UK only, however intensity and duration of physical activity was not specified. German and Canadian guidelines both suggested 150 minutes of physical activity weekly, which was in line with UK guidelines for the general population (UK Government, 2019). All advice regarding physical activity targeted women only and did not explicitly mention men or partners.

Diet

Table 2.6 Summary of dietary recommendations

Country/region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	Recommended food groups specified	Women
NHS Greater Glasgow & Clyde	Advise a nutritious diet (no specific detail)	Women
NHS Lanarkshire	Advise a nutritious diet (no specific detail)	Women and men
NHS UK Website	Balanced diet including vitamin C, D, calcium and iron. Those with coeliac disease, a vegan or vegetarian diet should consult their GP.	Women
NICE Guidelines	Balanced diet recommended with specified food groups (appendix 1)	Women

Country/region	Recommendations and guidelines	Who is this recommendation for?
Germany Healthy Start	Balanced and varied diet based on general recommendations for adults with specified food groups (appendix 1)	Women
Health Council of the Netherlands	A varied diet is advised, avoiding liver products to ensure there is no vitamin A excess in the diet	Women
Public Health Agency of Canada	A balanced diet is recommended with specific food groups specified. Ethnic, socioeconomic and cultural factors are addressed (see appendix 1)	Women
Australia – Queensland Government	Advises a balanced diet in line with national guidelines with specified food groups	Women

Nine of the information sources included dietary advice. Three health boards within NHS Scotland provided preconception dietary advice which was consistent with that from NHS UK and NICE Guidelines (2017).

Whilst NHS Greater Glasgow and Clyde and NHS Lanarkshire advised adopting a nutritious diet prior to pregnancy, more specific detail was provided by NHS Dumfries and Galloway, suggesting a diet rich in fruits, vegetables and wholegrains. Consultation with a GP was advised by NHS UK for those following a vegan/vegetarian diet and those with coeliac disease. Behaviourally specific advice was provided by NICE, German, Canadian and Queensland guidelines. These recommendations differed however regarding specificity, with the most detailed recommendations provided by the Queensland Government of Australia (see appendix 1).

Dietary advice provided by Scottish health boards is consistent with recommendations from the Netherlands, Germany and further afield in Canada and Australia. Some additional details were provided by the Health Council of the Netherlands whereby a diet excluding liver products to ensure safe intake of vitamin A is suggested. The Germany Healthy Start

Network also advised the use of iodised salt and a diet including fish to ensure adequate iodine intake. Canadian guidelines included dietary advice acknowledging cultural differences and issues such as food insecurity which HCPs should consider.

Country/Region	Recommendations and guidelines
NHS Dumfries & Galloway	400mcg daily, 3 months before conception until 13 weeks pregnant
NHS Forth Valley	400mcg daily once contraception is stopped
NHS Greater Glasgow & Clyde	Dosage not specified, recommended to consult GP
NHS Lanarkshire	400mcg daily, 3 months before conception until 12 weeks pregnant
NHS UK Website	400mcg folic acid daily, from one month before conception until 12 weeks pregnant. Higher dosages (5mg) required for women deemed high risk for NTDs
NICE Guidelines	400mcg daily, from one month before conception until 12 weeks pregnant. Higher dosages (5mg) required for women deemed high risk for NTDs
Germany Healthy Start	400mcg daily, from one month before conception until 12 weeks pregnant. Higher dosages (5mg) required for women deemed high risk for NTDs
Health Council of the Netherlands	400mcg folic acid daily, beginning 4 weeks prior to conception until 8 weeks pregnant.
Public Health Agency of Canada	400mcg folic acid daily starting 3 months before conception
Australia – Queensland Government	400mcg folic acid daily, beginning 12 weeks before conception and to be continued until 12 weeks pregnant.

Folic acid

Table 2.7 Summary of recommendations for folic acid supplementation

All information sources provided advice regarding folic acid supplementation. Recommended folic acid dosage was consistent across recommendations. All Scottish health boards, except Greater Glasgow and Clyde in which time was not specified, provided differing timeframes from when supplementation should begin. Recommended timeframes to commence folic acid supplementation varied between one and three months prior to conception with the exception of NHS Forth Valley which recommended supplementation once contraception was stopped. Additional detail was provided by NHS UK, NICE guidelines and Germany Healthy Start guidelines which provided information regarding dosage requirements for those who had been deemed higher risk of neural tube defects.

Micronutrient Supplementation

Table 2.8 Summary of recommendations for vitamin D supplementation

Country/region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	Vitamin D	Women
NHS Forth Valley	Vitamin D	Women
NHS Greater Glasgow & Clyde	Vitamin D	Women
NHS UK Website	Vitamin D with recommendation to avoid multivitamins including vitamin A	Women
Germany Healthy Start	Vitamin D Iron supplements only recommended to be taken after a medical diagnosis of an iron deficiency	Women
Health Council of the Netherlands	Vitamin D	Women

Country/region	Recommendations and guidelines	Who is this recommendation for?
Public Health Agency of Canada	Calcium Iron	Women
Canada	Vitamin D	
Australia – Queensland Government	Iodine supplementation of 150mcg daily	Women

Eight information sources provided micronutrient supplementation guidance. All guidelines except those from the Queensland Government recommended vitamin D supplementation. There was consistency between advice regarding vitamin D supplementation alongside the inclusion of calcium and iron by the Public Health Agency of Canada and cautioning against supplementing with vitamin A from the NHS UK. Iodine supplementation was recommended within Queensland guidelines and iodised salt is suggested within German micronutrient advice (appendix 1). Whilst neither set of guidelines specified an ideal timeframe for supplementation, the Queensland guidelines specified dosage in a daily supplementation of 150 mcg.

Chronic Disease Management

Table 2.9 Summary of recommendations for management of chronic disease

Country/Region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	Advised to consult GP or specialist prior to conception to discuss pregnancy intentions	Women
NHS Greater Glasgow & Clyde	Advised to consult GP or specialist when planning pregnancy	Women
NHS UK Website	Specific guidance for asthma, diabetes, epilepsy, heart disease and congenital heart defects, mental health problems and	Women

	obesity and provides information for screening tests	
Country/region	Recommendations and guidelines	Who is this recommendation for?
Health Council of the Netherlands	Specific guidance given for diabetes and epilepsy (appendix 1)	Women
Public Health Agency of Canada	Advises that health professionals to help stabilise chronic medical conditions before conception.	Women

Five of the included information sources provided guidance on management of chronic illnesses. Three provided general guidance to discuss pregnancy intentions with a health care practitioner to manage the specific chronic health condition. The Health Council of the Netherlands provided guidance regarding diabetes and epilepsy specifically and the NHS UK website provided information regarding a range of chronic illnesses (table 2.9). The NHS UK website also recommended screening tests for couples who may be carriers of sickle cell anaemia or thalassaemia and was the only set of recommendations which provided such information.

Immunisations

Table 2.10 Summary of recommendations for immunisations

Country/Region	Recommendations and guidelines	Who are these recommendations for?
NHS Dumfries & Galloway	Measles, mumps, rubella (MMR), Human Papillomavirus (HPV), influenza, Hepatitis B, tetanus and diphtheria	Women
NHS Greater Glasgow & Clyde	Consultation with GP to ensure vaccinations are up to date is recommended	Women
NHS Lanarkshire	Rubella vaccination advised	Women

Country/region	Recommendations and guidelines	Who is this recommendation for?
NHS UK Website	MMR vaccine	Women
NICE Guidelines	Rubella, Hepatitis B and varicella	Women
Germany Healthy Start	MMR vaccine along with pertussis vaccination. Any gaps in vaccination status should be addressed.	Women
Health Council of the Netherlands Public Health Agency of Canada	Rubella vaccination recommended	Women and partners
	Hepatitis B, influenza, varicella, pertussis, tetanus, diphtheria and MMR.	Women

Eight of the reviewed documents included immunisation recommendations. These were consistent across the included guidelines with the measles, mumps and rubella (MMR) vaccine addressed in every recommendation which provided advice on specific immunisations. Whilst advice regarding specific vaccinations varied, the recommendation of a consultation with a health professional to address any gaps in vaccination history was consistent across all included guidelines. All included recommendations provided advice for women however the Health Council of the Netherlands also specifically addressed the need for partners and family members who would be around the future baby to be fully vaccinated prior to pregnancy.

Medications

Table 2.11 Summary of recommendations for managing current medications

Country/region	Recommendations and guidelines	Who is this recommendation for?
Public Health Agency of Canada	Any medications should be checked for safety of use during pregnancy with dosages adjusted if required	Women

The Public Health Agency of Canada had the only set of recommendations which directly addressed medication safety prior to conception. The Health Council of the Netherlands addressed medication in the context of chronic disease management (table 2.9) and mental health (table 2.21).

Sexually Transmitted Infections

Table 2.12 Summary of recommendations for testing and treating sexually transmitted infections

Country/Region	Recommendations and guidelines	Who are these recommendations for?
NHS Dumfries & Galloway	Testing and early treatment suggested	Not specified
NHS Greater Glasgow & Clyde	Advised to stop risking exposure to STIs	Women
NHS Lanarkshire	Advised to practice safe sex with the intention of avoiding STIs and unintended pregnancy	Women and partners
Health Council of the Netherlands	Any existing STIs should be treated before conception. For those who are HIV seropositive, medication should be discussed with the health care professional.	Women and partners

Country/region	Recommendations and guidelines	Who is this recommendation for?
Public Health Agency of Canada	STI screening should take place before conception. All patients should be advised to practice safe sex to reduce risk of STIs and unintended pregnancy	Women and partners

STIs were included within five sets of recommendations with guidance recommending the practice of protected sex and/or attending a sexual health screening test. Within NHS Scotland, testing and treatment for STIs prior to conception was recommended by Dumfries & Galloway whereas recommendations from Greater Glasgow and Clyde and Lanarkshire took a preventative approach by advising the practice of safe sex to prevent exposure to STIs.

The Health Council of the Netherlands and the Public Health Agency of Canada both provided behaviourally specific recommendations for health professionals to identify and treat pre-existing STIs. The Public Health Agency of Canada was the only set of guidelines which specifically stated that sexual health screening and the practice of protected sex should be advised.

Abuse

Table 2.13 Summary of recommendations for abuse

Country/Region	Recommendations and guidelines	Who are these recommendations for?
NHS Dumfries & Galloway	HCPs should advise that abuse can begin/worsen during pregnancy Highlight the risks of remaining in an abusive relationship.	Women
NHS Greater Glasgow & Clyde	Patients should be advised to stop any relationships which are abusive.	Women

Country/region	Recommendations and guidelines	Who is this recommendation for?
Public Health Agency of Canada	HCPs should explore the support offered by partners or family members, including any financial or housing support. Any fear of, or actual, harm (physical, psychological or financial) should be discussed.	Women

Abuse was mentioned by two health boards within NHS Scotland (Dumfries & Galloway, Greater Glasgow and Clyde) and the Public Health Agency of Canada. NHS Dumfries & Galloway advised health professionals to explain that abuse can continue and worsen during pregnancy along with highlighting the risks of remaining in an abusive relationship. Greater Glasgow and Clyde advised that women stop any relationships which are abusive. Contextual detail was provided by Canadian recommendations where health professionals should explore the support that the patient is offered from their partner or family. Guidance was provided for HCPs for cases in which physical, psychological or financial harm is suspected or being experienced by patients. Further advice was provided whereby HCPs should provide information about appropriate services when there are concerns regarding patient safety. The Public Health Agency of Canada was the only set of recommendations which provided information directly related to leaving an abusive relationship and the support required to do so.

Smoking

Table 2.14 Summary of recommendations for smoking

Country/Region	Recommendations and guidelines	Who are these recommendations for?
NHS Dumfries & Galloway	HCPs to highlight risks of smoking	Women and partners
NHS Forth Valley	Couples should be smoke free	Women and partners

Country/region	Recommendations and guidelines	Who is this recommendation for?
NHS Greater Glasgow & Clyde	Women advised to be smoke free	Women
NHS Lanarkshire	Both partners advised to stop smoking.	Women and partners
NHS UK Website	Recommended that the partner, friends and family do not smoke around the woman planning pregnancy.	Women and partners
NICE Guidelines	Smoking cessation is advised. Referral to specialist services is advised if deemed appropriate.	Women
Germany Healthy Start	Couples should be smoke free and avoid being around those who are smoking	Women and partners
Health Council of the Netherlands	Couples should be smoke free	Women and partners
Public Health Agency of Canada	Couples should be smoke free. Referrals to specialist services should be offered for those actively planning to become pregnant.	Women and partners
Australia – Queensland Government	Smoking is not recommended and women should consult HCP for advice and support	Women and partners

All sets of recommendations advised a smoke free environment. This advice was consistent across each set of recommendations and the German Healthy Start guidelines extended their advice to state that couples intending to become pregnant should also avoid being near smokers. Recommendations written for HCPs remained consistent in discouraging smoking and advised referral to specialist services where additional support is required to facilitate smoking cessation.

Illicit drugs

Table 2.15 Summary of recommendations for illicit drug use

County/region	Recommendation and guidelines	Who are these recommendations for?
NHS Dumfries & Galloway	HCPs to advise about health risks associated with illicit drug use	Women
NHS Greater Glasgow & Clyde	Use of illicit substances and legal highs to be stopped	Women
NHS Lanarkshire	Advises that no illicit drugs are safe when pregnant or planning pregnancy	Women
NICE Guidelines	Referral to specialist services should be offered to those requiring assistance to stop their use. Testing for Hepatitis B, C and HIV recommended for intravenous drug users.	Women
Health Council of the Netherlands	Advised that both parents abstain from taking any illicit drugs.	Women and partners
Public Health Agency of Canada	Women should be advised on the risks associated with illicit substance misuse and be referred to addiction services which include mental health care. Contraceptive options should be discussed when deemed appropriate	Women and partners
Australia – Queensland Government	Women should be advised to consult HCP for advice and assistance to avoid illicit drugs	Women and partners

Seven of the information sources provided guidance regarding illicit drugs.

Recommendations were consistent whereby no illicit drugs were deemed safe for use.

Guidance for HCPs ranged from advising patients of the risks involved with illicit drug use to

referral to specialist services and testing for hepatitis B, C and HIV among intravenous drug users.

Illicit substances were described as illegal drugs or prescription medication for another person by The Queensland Government of Australia. The term street drugs was used by The Public Health Agency of Canada and marijuana was discussed specifically as a risk factor for adverse foetal outcomes. Behaviourally specific advice was provided by NICE guidelines whereby guidance was provided for health professionals managing patients who used opioids and those who injected illicit substances. The Health Council of the Netherlands also stated the importance of advising against hallucinogenic drug use and discuss cannabis, cocaine, opiates and amphetamines specifically.

Alcohol

Table 2.16 Summary of recommendations for alcohol consumption

Country/Region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	Alcohol consumption risks are stated in the context of pregnancy	Women
NHS Forth Valley	Advises not to drink alcohol when trying to become pregnant	Women
NHS Greater Glasgow & Clyde	Advises to stop alcohol consumption from trying to achieve pregnancy until birth	Women
NHS Lanarkshire	Advises not to drink any alcohol to minimise risks	Women
NHS UK Website	Advises not to drink any alcohol when trying to achieve pregnancy	Women
NICE Guidelines	Women planning a pregnancy should avoid drinking alcohol. Those unable to reduce their alcohol consumption without support should be referred to specialist services.	Women

Country/region	Recommendations and guidelines	Who is this recommendation for?
Germany Healthy Start	Alcohol should be avoided completely by women planning a pregnancy/pregnant	Women
Health Council of the Netherlands	Both prospective parents should refrain from consuming alcohol	Women and men
Public Health Agency of Canada	Complete avoidance of alcohol consumption is recommended for women trying to achieve pregnancy.	Women
Australia – Queensland Government	Refers to the Australian Government’s alcohol guidelines and advises that alcohol consumption should be avoided by women planning a pregnancy.	Women

Recommendations regarding alcohol consumption were included in all of the information sources. Guidance regarding alcohol consumption was consistent across all included guidelines whereby avoidance was recommended. One set of recommendations differed regarding when alcohol should be avoided. NHS Dumfries & Galloway recommend abstaining from alcohol during pregnancy however the preconception period was not mentioned.

Caffeine

Table 2.17 Summary of recommendations for caffeine intake

Country/Region	Recommendations and guidelines	Who is this recommendation for?
NHS Forth Valley	A 200mg daily allowance is recommended and risks of excessive caffeine intake are explained.	Women
Germany Healthy Start	A 200mg daily limit is suggested. Guidance is specific to pregnancy.	Women

Guidance around caffeine consumption was included by NHS Forth Valley and the Germany Healthy Start Network. Both recommended a daily allowance of 200mg and NHS Forth Valley provided specific information advising the public on foods and drinks with a high caffeine content. NHS Forth Valley discussed caffeine consumption in a preconception context however German guidelines on the matter were pregnancy specific.

Cervical Screening

Table 2.18 Summary of recommendations for cervical screening

Country/Region	Recommendations and guidelines
NHS Dumfries & Galloway	Advised to continue with regular cervical screening appointments
NHS Forth Valley	Advised to continue with regular cervical screening appointments
NICE Guidelines	All women planning a pregnancy should attend their cervical screening appointment if they are due before becoming pregnant.
Public Health Agency of Canada	Advice to health care practitioners to perform cervical cancer screening with women of reproductive age

Four sets of recommendations included guidance on cervical screening. Both Scottish health boards which included advice recommend that women continue with their regular cervical screening appointments. This was consistent with NICE Guidelines (2017) and the Public

Health Agency of Canada where it was recommended that cervical cancer screening should continue among women planning pregnancy who were due to attend an appointment.

Zika Virus

Table 2.19 Summary of recommendations for avoiding infection and transmission of Zika Virus

Country/Region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	Women should avoid pregnancy when in an area with active transmission and for 8 weeks upon returning home. Men should use condoms whilst travelling and for 8 weeks after, or 6 months if symptoms are compatible with the zika infection.	Women and partners
NHS Forth Valley	Recommended for women to avoid becoming pregnant if you have travelled to an area with active transmission for 8 weeks and for men, 6 months.	Women and partners
NHS Greater Glasgow & Clyde	Advised not to risk infection	Women
NICE Guidelines	Advised to avoid becoming pregnant when travelling in an area with active transmission. If travelling to an area with active transmission, Women should avoid pregnancy for 8 weeks if their male partner did not travel, and 6 months if they did.	Women and partners

Guidance regarding pregnancy planning after travelling in an area with active Zika transmission was provided by four sets of recommendations. Advice provided by each NHS board was consistent with NICE Guidelines (2017) in which women should avoid pregnancy for eight weeks upon returning from an area with active Zika transmission if her male partner did not travel, and six months if her male partner also travelled. Guidance differed regarding the time between visiting an area with active transmission and conception, whereby a timeframe of eight weeks is advised for women who have travelled. Advice varied for men in which eight weeks was also advised by NHS Dumfries and Galloway when they do not have symptoms, and six months if presenting with zika virus symptoms. NHS Forth Valley and NICE guidelines advised a timeframe of six months between travel and conception for men and NHS Greater Glasgow and Clyde did not provide any information for men and stated that women should avoid infection.

Hazardous/radioactive substances

Table 2.20 Summary of recommendations for exposure to hazardous/radioactive substances

County/region	Recommendations and guidelines	Who is this recommendations for?
Health Council of the Netherlands	HCPs should discuss any occupational exposure to chemicals. Compliance with health and safety recommendations is recommended to reduce risk.	Women
Public Health Agency of Canada	Health care professionals should assess chemical and physical exposure risk in the workplace.	Women

Avoiding exposure to hazardous substances and radiation was recommended by two review documents. Health professionals were advised to discuss any occupational exposure to chemicals and advise compliance with workplace health and safety recommendations to reduce risk of exposure.

Mental Health

Table 2.21 Summary of recommendations for managing mental health

Country/Region	Recommendations and guidelines	Who is this recommendation for?
NHS Dumfries & Galloway	HCPS to assist in addressing and treating underlying causes of mental ill health	Women
NHS Greater Glasgow & Clyde	Women advised to discuss mental health with their GP	Women
NHS Lanarkshire	States importance of mental wellbeing	Women
Health Council of the Netherlands	Mental health is discussed with regards to medication. Any necessary adjustments to any medication should be made.	Women
Public Health Agency of Canada	Health care practitioners should address mental health with patients	Women

Five of the included review documents included guidance regarding mental health prior to pregnancy with two documents aimed at the general public and three aimed at health professionals. NHS Greater Glasgow and Clyde along with NHS Dumfries & Galloway advised consultation with a health professional whereas NHS Lanarkshire promoted positive mental wellbeing.

Mental Health was also included in Dutch recommendations with emphasis on medication. Where antidepressants are prescribed, any required adjustments should be made prior to conception. If patients are symptom free, it was suggested that medication may be phased out under the supervision of a health professional. The Public Health Agency of Canada recommended that health practitioners should discuss support provided by friends, family and partners when assessing if patients may have poor mental health. Past or present

psychological problems with the patient or their family should be discussed along with any past or current alcohol or substance abuse.

Oral and dental hygiene

Table 2.22 Summary of recommendations for oral and dental hygiene

Country/Region	Recommendations and guidelines	Who is this recommendation for?
Germany Healthy Start	Advises that women planning a pregnancy should attend a dental check-up and undergo any necessary treatments	Women
Public Health Agency of Canada	Men and women should be advised on appropriate dental hygiene by health professionals.	Women and men

The Germany Healthy Start Network and the Public Health Agency of Canada included recommendations for dental hygiene among women planning pregnancy. Both advised that women planning a pregnancy should attend a dental appointment and undergo any required treatments. The Public Health Agency of Canada suggested that attention should be paid to women regarding prevention of periodontal disease during their pregnancy (appendix 1).

2.4 Discussion

This narrative review aimed to identify preconception guidelines within Scotland and compare them with those in the UK and in a sample of European and western international countries. Contribution to the literature was made by providing contextual information regarding what preconception health recommendations are available within Scotland and the UK. This review evidenced the availability of recommendations aimed towards health professionals, with limited advice available for the general public who may search for health information before conception. Preconception recommendations which were aimed at the general public are available on the NHS UK website and three Scottish health boards website.

The first objective within this review was to identify preconception guidelines within Scotland and compare them with the UK and a sample of European and international guidelines. Current preconception guidelines were identified in four Scottish health boards; Dumfries and Galloway, Forth Valley, Glasgow & Clyde and Lanarkshire. With the exception of NHS Dumfries and Galloway which targeted health professionals, all health boards provided information for the general public. Advice between Scottish health boards and NICE guidelines did not differ regarding the content of the behavioural advice, however differences were observed regarding the range of behaviours included and specificity of guidance.

Objective two examined the consistency of guidelines within Scottish and UK guidance in comparison with European and western international guidelines. Consistency was observed regarding inclusion of folic acid supplementation, weight management, alcohol and smoking guidance as these were the only behaviours to be included in every set of recommendations. Differences were observed regarding the inclusion of men and partners which is discussed in greater detail in section 2.4.3. Objective three involved analysing the specificity of the included behavioural recommendations. There was variation within recommendations between countries for most behaviours with the exception of smoking and alcohol consumption whereby abstinence was recommended by all. Variation in the specificity of behavioural guidance was discussed in detail in section 2.4.2.

2.4.1 Progression of guidelines

There was evidence of progression of preconception guidelines since the review of guidelines introduced in section 2.1 (Shawe et al., 2015), showing positive change in the comprehensiveness of guidelines over time. With regards to micronutrient supplementation

and alcohol consumption, previous recommendations focused on women living with a chronic illness (Shawe et al., 2015). In contrast, this review found that recommendations included both the general preconception population and those living with chronic illnesses. Speciality guidance was provided alongside general guidelines for people deemed more at risk of particular health outcomes e.g. increased risk of NTDS and folic acid supplementation advice. Variations in dosage advice for folic acid supplementation was noted by Shawe et al. (2015) however dosage advice was found to be consistent across guidance within this review. Variation among folic acid supplementation advice was found regarding the duration of time before conception in which supplementation should start. The findings from this review show a progression since 2015 whereby recommendations for important health promoting behaviours such as folic acid supplementation are becoming more consistent. There is also progression regarding the inclusion of women without a chronic illness however more inclusivity within behavioural guidelines is required to ensure men and partners are included.

A recently published systematic review of clinical guidelines for preconception care examining availability and quality of guidelines had similar findings to this review (Dorney et al., 2022). In their systematic review, authors reported that few high-quality guidelines for PCC (preconception care) whilst also acknowledging the limited inclusion of men and partners in preconception recommendations and describe this as a missed opportunity for preconception health improvement. Whilst the guidelines reviewed within this chapter evidence progression since Shawe et al. (2015), the findings from Dorney et al. (2022) along with the evidence gathered in this chapter suggest that there is scope to further improve preconception health recommendations by improving the quality of guidelines regarding their evidence base, specificity and by ensuring that men and partners are included.

2.4.2 Variation in specificity of guidance

Findings show that inconsistencies within the included guidelines were generally due to varying degrees of specificity as opposed to conflicting advice. An example of an inconsistency within guidelines for a behaviour included by all review documents was folic acid supplementation. The same observation can be made regarding physical activity and diet whereby advice was inconsistent due to variations in behavioural specificity of recommendations.

Nutrition advice was consistent between Scottish health boards and other included documents with varying degrees of specificity. Diets rich in wholegrains, fruits and vegetables were

recommended and included documents stressed the importance of a varied and balanced diet in line with respective national guidelines. Whilst NHS Dumfries & Galloway provided some guidance on what constituted a balanced diet, a more behaviourally specific example was provided by The Queensland Government (appendix 1) which provided advice around recommended serving sizes of different food groups.

An additional example of where Scottish guidelines were consistent with other national guidelines is the inclusion of vitamin D in micronutrient supplementation advice. Since (Shawe et al., 2015) review of European preconception care, in which no guidelines regarding vitamin D supplementation were reported, more detailed recommendations regarding micronutrient supplementation have been reported in updated guidelines (table 2.8). Scottish health boards recommended vitamin D supplementation which was consistent with other included countries. It must be acknowledged however, that despite the recommendation of vitamin D being consistent across information sources, there was a lack of specificity about dosage and when supplementation should commence. There has been progression regarding inclusion of vitamin D supplementation guidance since Shawe et al. (2015) however more specific behavioural guidance is required moving forward.

A potential explanation as to why variation in the specificity of guidelines occurred for certain behaviours may be attributed to the exclusion of people with a chronic illness. For behaviours such as medication use much of the guidance was vague and included suggestions to consult a health professional. More detail regarding the management of medication use may be found in guidelines which have sections which address the specific needs of people managing a chronic illness. The decision to exclude this group from the review was made due to the acknowledgement that when managing a chronic illness, a person should have more opportunities to consult with a health professional. Although such preconception counselling is not consistent between condition or healthcare provider, this variation would have influenced results. The decision was made to prioritise what information is available for the general public as a starting point to scope out the landscape for preconception health information.

The importance of guidelines being behaviourally specific is addressed by Michie & Johnson (2004). Defining behaviour clearly and specifically was suggested as important to improve implementation of guidelines by HCPs. In a study exploring the implementation of ten national clinical guidelines, findings showed that guidelines which were specific were

followed 67% of the time whereas guidelines which lacked clarity and specificity were implemented on 36% of occasions (Grol, Dalhuijsen, Thomas, Rutten, & Mokkink, 1998). Clearly defining recommended behaviours and stating the time, place and with whom the responsibility for their implementation lies is suggested to increase the likelihood of them being carried out (Michie & Johnston, 2004). Therefore, it is important that behavioural guidance aimed at people before conception is specific and defined clearly to increase their implementation.

2.4.3 Inclusion of men and partners

An important finding from this review is the limited inclusion of men and partners throughout behavioural recommendations with most advice being directed towards women. Men and partners were not included in any physical activity recommendations and were included in only one set of recommendations regarding dietary intake by NHS Lanarkshire. Behavioural recommendations that included men were for smoking and illicit drug use, however no Scottish or UK guidance included men for the latter. For alcohol consumption, only the Health Council of the Netherlands included guidance aimed at men and partners. When partners contribute biologically to the conception of the child, their health behaviours must be taken into consideration due to direct genetic influence they have on their offspring. In addition, it is important to consider partners, independent of biological contribution to pregnancy. Partner behaviours such as smoking can have detrimental effect on pregnancy and birth outcomes through maternal exposure to second hand tobacco smoke which has been associated with low birth weight, maternal infertility, spontaneous abortion and pre-term delivery (Meeker & Benedict, 2013). For certain behaviours, such as folic acid supplementation, this is expected due to the lack of research exploring paternal preconception risk factors as this behaviour is most appropriate to the mother, due to its influence regarding neural tube formation. However, there is some evidence to indicate that men's folate levels are related to longer gestation (Carter et al., 2023). However, for behaviours more broadly related to nutrition, alcohol consumption and smoking it is imperative that men are included in guidelines due to the potential influence of these behaviours on spermatogenesis (Borges et al., 2018).

Involving men and partners is important regardless of whether the other parent contributes biologically to the pregnancy (Shawe et al., 2019). From a biological perspective, paternal health behaviours which have been suggested to influence foetal health outcomes are

advanced paternal age (Alio et al., 2012), taking specific medications and recreational drug use, (Frey, Navarro, Kotelchuck, & Lu, 2008), smoking and alcohol consumption (Borges Jr et al., 2018), physical activity and eating behaviours (Cescon, Chianese, & Tavares, 2020). Despite evidence which highlights the importance of optimising paternal health before conception, this was not reflected in the majority of health recommendations reviewed. Additionally, greater attention has been paid in recent years to avoid exposing women/birthing parents to increased stigma. By including men and partners in behavioural recommendations the biological perspective regarding men and partners can be considered alongside the social and psychological support required for the woman/birthing parent.

2.4.4 Limitations

There are three notable limitations to this narrative review which should be considered. Firstly, it must be noted that guidance available online is subject to frequent change due to website design changes and editorial staff. This can impact the dissemination of guidance directly due to omission of certain behaviours, or indirectly through wording choice which can affect specificity of guidance. A second limitation to consider is that this review compares Scottish and general UK guidance to a selection of European and western international nations. There may be guidance available from other countries and their states/regions which may provide more contextual information.

Lastly, it must be noted that all included guidelines are from western cultures. Therefore, it is important for researchers to consider that whilst guidelines may be consistent with other western nations, they may lack cultural sensitivity for people living outside of western cultures and care should be taken when developing guidance for non-western populations.

2.4.5 Conclusions

This chapter identified preconception guidelines within Scotland and the UK and provided a comparison between those provided by European and western international countries. The inclusion of specific behaviours across all included guidelines supported the idea that increasing engagement in health promoting behaviours before conception is an issue of international importance. This review also drew attention to the lack of inclusion of men and partners in preconception health recommendations, which was raised as a concern by (Shawe et al., 2015) and still requires progress to be made.

CHAPTER 3: A SECONDARY ANALYSIS OF THE SCOTTISH MATERNAL AND INFANT NUTRITION SURVEY (2017)

The previous chapters highlighted the importance of health before conception, proposed suggestions to improve this (chapter 1) and what behaviours are recommended for people preparing their health for pregnancy (chapter 2). What is yet to be understood is how these multiple health promoting behaviours are engaged in before conception and what factors in a persons life influences health behaviour change. This chapter details a secondary analysis of the Scottish Maternal and Infant Nutrition Survey (2017) which aims to address these knowledge gaps. The aim of this chapter is to explore the influence of socio-economic status and pregnancy planning status on multiple behaviour change before conception.

3.1 Introduction

A woman's health before conception can have long lasting effects on pregnancy outcomes and the health of future offspring (Khan, Boyle, Lang, & Harrison, 2019). For example, maternal overweight or obesity before and during the early stages of pregnancy are associated with adverse birth outcomes. These can include pre-eclampsia, difficulty during labour and macrosomia; which is a birth weight of greater than 4500 grams (Siega-Riz & Laraia, 2006). Improving health before pregnancy has the potential to protect against these health problems, and as such, the period before conception has been recognised as a key period for intervention by the World Health Organisation to address childhood obesity (WHO, 2017). It was advised that support and guidance should be provided to people of reproductive age to improve their eating behaviours and increase physical activity whilst addressing other modifiable risk factors such as alcohol consumption and cigarette smoking.

As discussed in chapter one, in Scotland, 24% of children age six are overweight or obese. This increases to 34% of children being overweight or obese by age ten (Scottish Government, 2018). These statistics are similar to those reported by Public Health England where 22.6% of children aged four and five are overweight or obese with this increasing to 34.2% for children aged ten and eleven (Public Health England, 2019). Being overweight or obese carries specific health risks such as increased risk of diabetes mellitus, coronary heart disease along with cancer and respiratory conditions (Abdelaal, le Roux, & Docherty, 2017). A systematic review and meta-analysis reported that obese children and adolescents are five times as likely to live with obesity in adulthood as those who were not obese during childhood (Simmonds, Llewellyn, Owen & Woolacot, 2016). Considering evidence that suggests childhood obesity

may be a predictor of obesity in adulthood, it is important that appropriate and efficient interventions are developed to tackle childhood obesity.

The time before conception provides an opportunity for health behaviour change to improve pregnancy and birth outcomes along with child health later in life. Chapter two identified key health behaviours included in guidelines, namely, folic acid supplementation, healthy eating, smoking cessation and reducing/stopping alcohol consumption. Engagement in these health promoting behaviours before conception have been recognised as aiding in the reduction of childhood morbidity and mortality (Moholdt & Hawley, 2020). It therefore becomes important to understand engagement in these behaviours among the general public and what factors act as barriers and/or facilitators to health behaviour change. Some research has indicated that factors commonly associated with engaging in health promoting behaviours before pregnancy are socio-economic status and whether or not the pregnancy was planned (Goossens, Beeckman, Van Hecke, Delbaere, & Verhaeghe, 2018; Harellick, Viola, & Tahara, 2011). Additional factors which have been found to positively influence engagement in preconception health promoting behaviours are experience of a previous miscarriage (Goossens, Beeckman, Van Hecke, Delbaere, & Verhaeghe, 2018), knowledge of how to engage in health behaviours and social support (Kandel et al., 2021). Consideration of factors such as pregnancy planning prior to conception and socio-economic status is important to identify populations who are most at risk of not engaging in health promoting behaviours before conception and would benefit from intervention.

3.1.1 Pregnancy planning and behaviour change before conception

Research considering the effect of planning versus not planning a pregnancy in terms of influence on health behaviour change before conception is inconsistent. Some studies have shown that women who planned their pregnancies were more likely to engage in health promoting behaviours before conception such as supplementing with folic acid and quitting smoking. A cross sectional survey of 258 women in Denmark measured engagement in health promoting behaviours, folic acid supplementation, alcohol consumption and smoking cessation, and explored how planning influenced engagement in these behaviours (Backhausen et al., 2014). Findings revealed that planners were more likely to take folic acid and not smoke or drink alcohol. However, 20% of women who planned their pregnancy engaged in binge drinking in early pregnancy, compared to 30% of non-planners. Similar results were found from a study analysing the influence of pregnancy intention on

engagement in preconception health promotion using data collected from a telephone survey across the U.S.A. (Chuang, Hillemeier, Dyer, & Weisman, 2011). Their findings revealed that women intending to conceive were not any more likely to engage in preconception health promoting behaviours than non-planners, with the exception of folic acid supplementation.

Backhausen et al. (2022) suggested a potential explanation for the small differences in behaviour between planners and non-planners could be attributed to a gap between knowledge and practice. This is evidenced in similar surveys using different populations, such as data collected from a survey exploring knowledge and use of folic acid before conception across 18 European countries (Bitzer, von Stenglin, & Bannemerschult, 2013). The survey included 22,925 women aged between 15-49, of whom 58% had given birth previously. From the survey sample, 40% of women said they were aware of the health benefits of folic acid supplementation, however only 17% were aware of its protective effects against neural tube defects. Regarding use of folic acid before conception, 37% of participants reported taking folic acid, however of this number, folic acid was taken by 56% of women every day with the remainder reportedly missing days each week. It is unclear what factors contribute to poor adherence to folic acid supplementation guidelines from this study. However, for the other behaviours explored, factors such as education status and economic deprivation were associated with lack of uptake of health promoting behaviours such as eating healthily.

Understanding how people plan for pregnancy may be helpful to understand why there is variation in engagement in health behaviours between planners and non-planners and within planners themselves. The London Measure of Unplanned pregnancy (LMUP) uses six questionnaire items to measure the extent to which a person has planned their pregnancy. Three LMUP items measure a behavioural aspect to planning by asking whether an individual has taken specific action to prepare, have they agreed their intentions to become pregnant with their partner and had they ceased contraception at the time of conception. The remaining three items measured a more psychological and emotional aspect of planning by asking about the individuals feelings about the timing of conception, their intentions to become pregnant and their desire to become pregnant. Exploring the LMUP in more detail may be useful to determine whether specific items which focus on preparing a persons behaviours, e.g. stopping contraception, may influence behaviour change differently to a more psychological planning item e.g. feelings regarding the timing of pregnancy. This will be outlined in detail in section 3.2.5.

3.1.2 Sociodemographic factors

Research has suggested that alongside planning status, other factors can influence a person's engagement in health promoting behaviours before conception. Factors such as education and economic disadvantage were found to influence smoking behaviour before pregnancy. This was evidenced by analysis of data from the UK Millennium Cohort Study with a focus on pregnancy planning and smoking cessation (Flower, Shawe, Stephenson, & Doyle, 2013). Of the 17,462 mothers for whom data regarding smoking was provided, 34% were smokers before pregnancy. Of these women, 81% stopped or decreased their smoking during pregnancy. Those who were younger at conception, left education earlier and lived in areas of greater deprivation were more likely to be smokers. These findings are similar to those from the Scottish Maternal and Infant Nutrition Survey (2017) which indicated that deprivation was also found to influence pregnancy planning. A reported 84% of respondents from the least economically disadvantaged areas stated they had planned their pregnancy compared with 61% of those in the most disadvantaged areas. What remains unclear is whether factors such as deprivation are associated with differences regarding degree of pregnancy planning and engagement in multiple protective preconception behaviours.

In a review from the Health Foundation (Finch, Wilson & Bibby, 2023), it is acknowledged that health inequalities in Scotland continue to widen. This has been discussed in relation to the impact of the coronavirus pandemic, in which mortality rates were highest in economically disadvantaged areas. Additionally, the cost-of-living crisis has disproportionately impacted those living in the most disadvantaged areas who are most affected by rising food and fuel costs. An example of these health inequalities in relation to pregnancy and preparation for pregnancy is the proportion of women who report being smokers at their first antenatal appointment. Across the population in Scotland, smoking rates at the first antenatal appointment reduced from 29% in 2000 to 14% in 2020. Whilst this was an improvement generally regarding smoking cessation, the reduction in smoking was not reflected equally across the economic spectrum, with smoking rates in the most disadvantaged areas being 11 times higher than in the least disadvantaged areas in Scotland.

It should be noted however, that whilst economic disadvantage is associated with poorer health outcomes and less engagement in health promoting behaviours, contrasting findings were reported in the Scottish Maternal and Infant Nutrition Survey (2017) regarding alcohol consumption before pregnancy. Those living in the most economically disadvantaged areas

where more likely to report drinking less frequently and avoiding alcoholic beverages altogether in comparison with those from the least disadvantaged areas.

The Scottish Maternal and Infant Nutrition Survey (2017) gathered information regarding maternal nutrition, infant feeding and health behaviours during and before pregnancy. The antenatal questionnaire which was distributed to women who were 20 weeks pregnant or more across Scotland. The questionnaire measured pregnancy planning, engagement in protective health behaviours such as folic acid supplementation, reduction/cessation of smoking and alcohol consumption. Similar to surveys previously discussed, economic disadvantage was associated with degree of engagement in specific health behaviours. In the most disadvantaged areas of Scotland, 30% of survey respondents stated that they did not regularly eat the recommended five daily portions of fruits and vegetables whereas this was reported by 17% of respondents from the least deprived areas as measured by the Scottish Index of Multiple Deprivation (SIMD).

3.1.3 Multiple health behaviours

As discussed in sections 3.1.1 and 3.1.2, there are multiple health behaviours which appear to be influenced differently depending on factors such as planning for pregnancy and socio-economic status. Whilst healthy eating behaviours are reportedly engaged in less among economically disadvantaged populations, alcohol consumption appears to be greater in less disadvantaged populations. As multiple health behaviours have been identified within preconception health recommendations (chapter 2), it is important to consider how the factors discussed in sections 1.3.1 and 1.3.2 (pregnancy planning status and sociodemographic information) influence multiple behaviour change. This is important that future interventions aiming to increase awareness of preconception, or aide in behaviour change can effectively target the relevant behaviours and do so in a way that is acceptable to the target population. Understanding how specific health behaviours are prioritised and engaged in before conception across different demographics may facilitate the development of effective behaviour change interventions by identifying as risk populations and prioritising key health behaviours.

3.1.4 Aim and objectives

This secondary analysis aimed to explore, in detail, how pregnancy planning and socio-economic status influence engagement in multiple behaviour change before conception. The specific objectives are outlined below.

1. What is the association between socio-economic status and engagement in multiple health behaviours prior to conception?
2. Is pregnancy planning associated with engagement in multiple health behaviours prior to conception?
3. Are different facets of pregnancy planning associated with the performance of multiple health behaviours prior to conception?
4. How do psychological and behavioural pregnancy planning relate to multiple behaviour change?

3.2 Methods

3.2.1 Participants

Potential respondents for the antenatal survey were identified by the Scottish Government who commissioned the survey, using the National Records of Scotland (NRS) Birth Registration Records for previous years and from this, estimates were made regarding the approximate number of women who met the inclusion criteria of being 20 or more weeks pregnant.

For the purpose of this analysis, respondents who answered the antenatal section of the survey were included as this section addressed health behaviours before pregnancy (appendix 2). Recruitment took place between 1st May 2017 and 30th June 2017. The target sample size was 3800 and survey packs were provided by staff from maternity services. As there is no definitive list of women who are pregnant in Scotland at any time, the survey packs were given at the antenatal appointment when mothers are around 20 weeks pregnant.

3.2.2 Survey Packs

Survey packs which were given to potential participants included; an invitational cover letter which included information regarding the purpose of the survey, a web address and access code for those who preferred to complete the questionnaire online, a list of frequently asked questions and responses, a paper copy of the questionnaires and a prepaid envelope for those choosing to complete the paper questionnaire to return.

3.2.3 Questionnaire

The survey was authorised by the Children and Families Directorate of the Scottish Government. The survey was designed to gather information regarding maternal nutrition pre and post conception. This analysis involves the antenatal questionnaire which asks women about behaviours before conception.

Information was gathered regarding the number of weeks pregnant the respondent was at the time of questionnaire completion along with information about whether they had any previous children or a history of any pregnancy or birth complications. This was followed by items from the London Measure of Unplanned Pregnancy (LMUP) and questions regarding health behaviours engaged in before conception.

Additional questions explored multivitamin use and the commencement of any multivitamin or folic acid supplementation. Weight was explored by asking the respondent how they perceived their weight before conception, their BMI at their maternity booking visit and whether they made any attempts to modify their weight before pregnancy. Provision of information about changing diet, reducing/stopping tobacco and alcohol use and vitamin supplementation both before and during pregnancy was measured and respondents were asked what the source of this information was. The following items in the antenatal survey focused on dietary change during pregnancy, history of health conditions before conception and healthy start vouchers.

3.2.4 Data Analysis

Generation of composite score for multiple behaviour change

The antenatal survey posed the question “Before you became pregnant, did you do anything to improve your health in preparation for pregnancy?”. Options for different behaviours were listed below and respondents could select yes or no for each option. Of the seven options, four items were included for use in the secondary analysis. Excluded items included “Sought medical/health advice” which was not included due to ambiguity regarding what the advice sought was and whether it was related to pregnancy. “Took some other action” was also excluded as it was unclear what the action was and if it was related to pregnancy and preconception health. The last item which was excluded was “I did not do any of the above for my pregnancy” as it did not add additional information regarding specific health behaviours.

To generate the composite score for multiple behaviour change, a score of one was given when items were answered with yes and a score of zero was given when items were answered with no. This allowed a highest total score of 4 where yes was selected for each item, indicating greater engagement with health promoting behaviours.

Table 3.1: Items used to generate a composite score for multiple behaviour change

Item	Survey question	Participant answer
1	Took folic acid	Yes/no
2	Stopped/cut down smoking	Yes/no
3	Stopped/cut down drinking	Yes/no

4	Ate more healthily	Yes/no
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Analysis of the research questions

For research question 1, a one-way ANOVA was conducted to compare mean composite scores for multiple behaviour change across SIMD quintiles with a Bonferroni adjustment conducted as a post-hoc test. Research question 2 also required a one-way ANOVA to be conducted to compare the mean composite scores for multiple behaviour change across LMUP categories, with the Bonferroni adjustment conducted as a post-hoc test. Research question 3 required the mean and standard deviation to be calculated to measure composite scores for multiple behaviour change across LMUP categories. Research question 4 initially required a paired samples t test to be carried out to compare the means between the psychological and behavioural planning components. To determine if mean composite scores for multiple behaviour change differed between the two planning components, a one-way ANOVA was conducted with a Bonferroni adjustment used as a post-hoc test.

3.2.5 Generating variables for behavioural and psychological planning

The London Measure of Unplanned Pregnancy (LMUP) (Hall, Barrett, Copas, & Stephenson, 2017) was included in the antenatal survey to measure pregnancy planning. This consisted of six items which are displayed in figure 3.1. To explore planning in greater depth, two variables were generated to consider items from a behavioural and a psychological perspective. The behavioural component was constituted of three LMUP items which involve action such as discussions with partners and taking specific action to optimise health or choose to cease contraceptive use. The psychological component included items which concern thoughts, feelings and intentions regarding pregnancy rather than actions.

The LMUP separates respondents into three categories based on their score out a maximum of twelve on the questionnaire. A score of ten to twelve is designated to the “planned” category, a score between four and nine is termed the “ambiguous” category and a score between zero and four is the “unplanned” category. Each item resulted in a score of zero, one or two. Once the two components were created for this analysis, the maximum score for each component which could be achieved was six. This was due to three items being included for each component for which a maximum score of two could be achieved per item.

These variables were generated to further analyse whether specific aspects of planning influence engagement in the included health behaviours, by considering these two aspects of planning alongside the individual LMUP items.

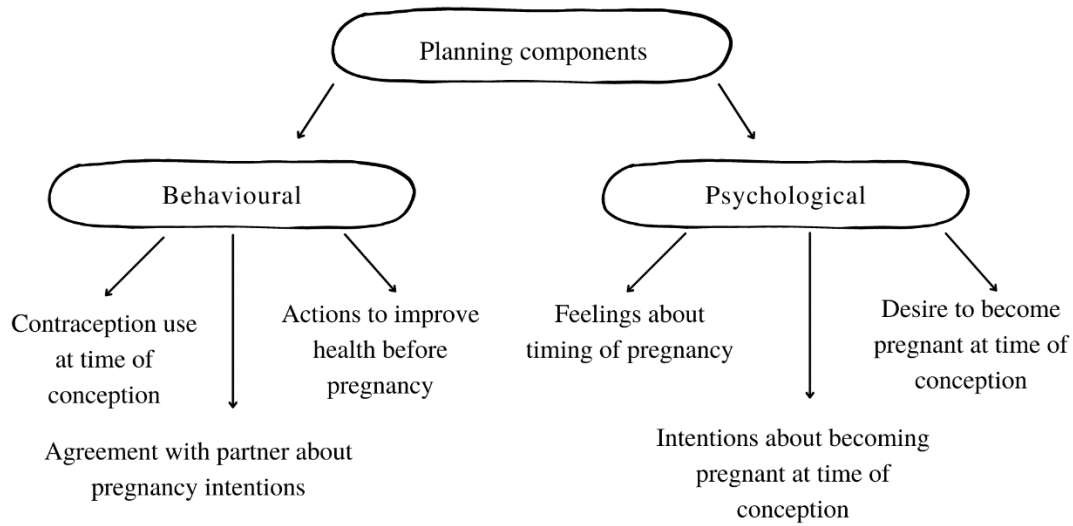


Figure 3.1 Generation of behavioural and psychological planning components

3.3 Results

3.3.1 Demographic information

The antenatal questionnaire received 2,523 responses from 24,895 distributed questionnaires, a response rate of 10%. The distribution of participants across Scottish Index of Multiple Deprivation (SIMD) quintiles are displayed in figure 3.2. SIMD considers how deprived areas of Scotland are according to specific domains including income, education, health, employment, crime, housing and access to services. SIMD quintiles range from the most deprived (SIMD 1) to the least deprived (SIMD 5) areas of Scotland. Fifty one participants did not specify their postcode to be included in Scottish Index of Multiple Deprivation analysis, therefore those participants data have been removed from deprivation analyses.

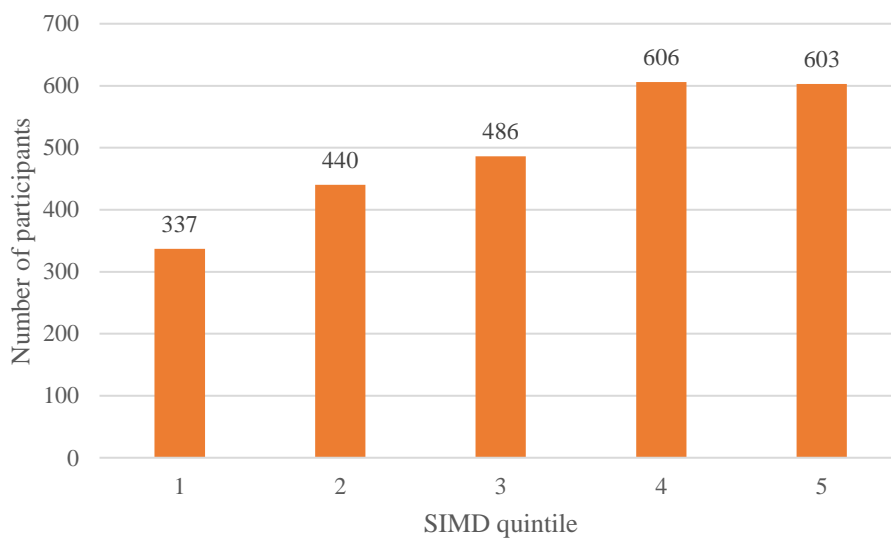


Figure 3.2 Number of participants within each SIMD quintile

Respondents were asked if they did anything to improve their health before becoming pregnant and were presented with the options: a) took folic acid, b) ate more healthily, c) stopped/cut down smoking, d) stopped/cut down alcohol consumption, e) sought medical/health advice, f) took some other action or g) did not do any of the above. The four included behaviours (folic acid, smoking, alcohol and diet) and the percentage of participants who engaged with them is displayed in figure 3.3. The behaviour which was engaged with most was folic acid supplementation whereby 58.2% of participants reported taking it before

conception. This was followed by eating more healthily where 29.7% stated that they engaged in the behaviour and 70.3% did not.

Regarding reducing or stopping alcohol consumption, 28.3% of participants stated that they did this whilst 71.7% did not. Smoking cessation or reduction was reported by 6.7% of participants whereas 93.3% reported that they did not. It should be noted that data regarding respondent’s history regarding any baseline smoking or alcohol consumption before pregnancy planning was unavailable.

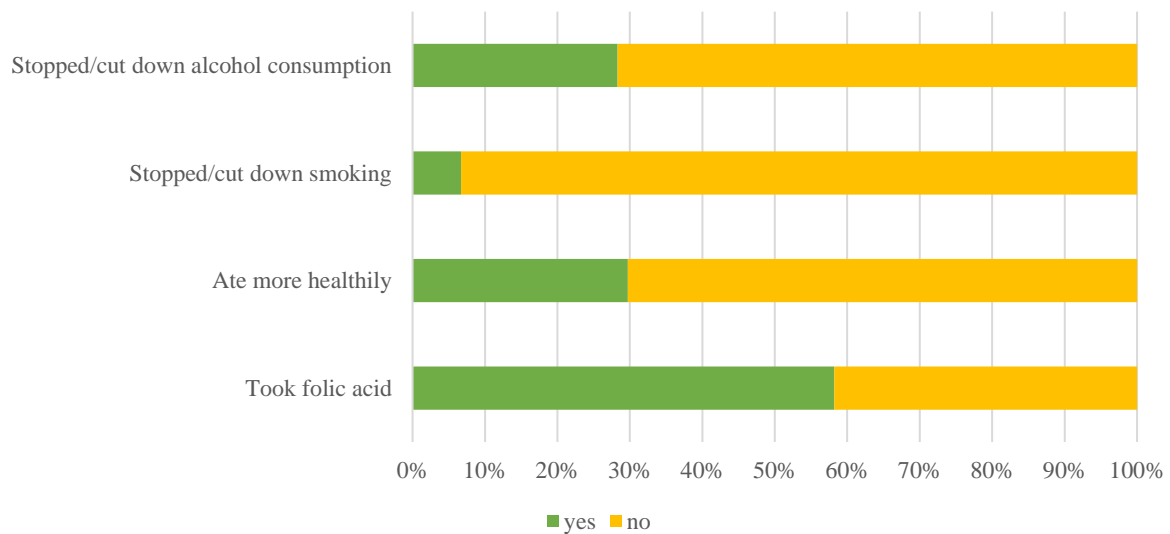


Figure 3.3 - Percentage of participants who engaged in the target behaviours before conception

3.3.2 Research question 1: What is the association between socio-economic status and engagement in multiple behaviour change prior to conception?

Figure 3.4 displays the mean scores for engagement in multiple behaviour change across SIMD quintiles. A one-way ANOVA was conducted to compare the mean composite score for behaviour change across SIMD quintiles. There was a significant effect of relative deprivation on mean composite score for behaviour change ($F_{4,2467} = 12.44, p < .05$). Post hoc comparisons using the Bonferroni Adjustment indicated that the mean score for composite behaviour change in the most deprived quintile, SIMD 1 ($M = .93, SD = 1.08$), was significantly lower than every other SIMD quintile. The mean score for composite behaviour change in the least deprived quintile, SIMD 5 ($M = 1.44, SD = 1.11$), was significantly higher

than every other SIMD quintile with the exception of SIMD 4 (M=1.24, SD=1.12). The results of the one-way ANOVA are displayed in table 3.2.

Table 3.2 ANOVA comparisons of multiple behaviour change across SIMD quintiles

SIMD Quintile	<i>n</i>	Mean	<i>SD</i>	Bonferonni Adjustment				
				SIMD	SIMD	SIMD	SIMD	SIMD
				1	2	3	4	5
1	337	.93	1.08		<.05	<.05	<.01	<.01
2	440	1.16	1.14	<.05				<.01
3	486	1.18	1.09	<.05				<.01
4	606	1.28	1.12	<.01				
5	603	1.44	1.44	<.01	<.01	<.01		

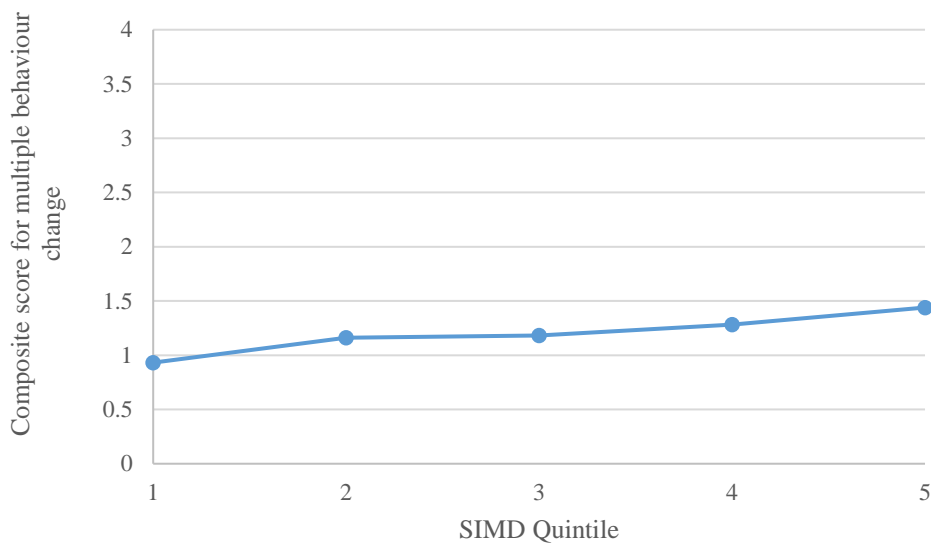


Figure 3.4 - Mean score for engagement in multiple behaviour change across SIMD quintiles

3.3.3 Research question 2: Is pregnancy planning associated with engagement in multiple health behaviours prior to pregnancy?

Table 3.3 displays the distribution of participants across the different bands of the London Measure of Unplanned Pregnancy (LMUP).

Table 3.3 Number of people within each LMUP category

LMUP Category	0-3 (unplanned)	4-9 (ambiguous)	10-12 (planned)
Number of people	76	476	1969

Figure 3.5 displays the mean scores for engagement in multiple behaviour change across the three bands of the LMUP. A one-way ANOVA was conducted to compare the mean composite score for behaviour change across LMUP categories. There was a significant effect of LMUP category on mean composite score for multiple behaviour change ($F_{2,2518} = 393.45, p < .001$). Post hoc comparisons using the Bonferroni adjustment identified that there was a significant effect of LMUP category on composite score for multiple behaviour change in the planned category ($M=1.5, SD=1.06$). The mean composite score for multiple behaviour change was significantly higher in the planned category than the ambiguous group ($M=0.23, SD=0.60$) and the unplanned group ($M=0.04, SD=0.26$).

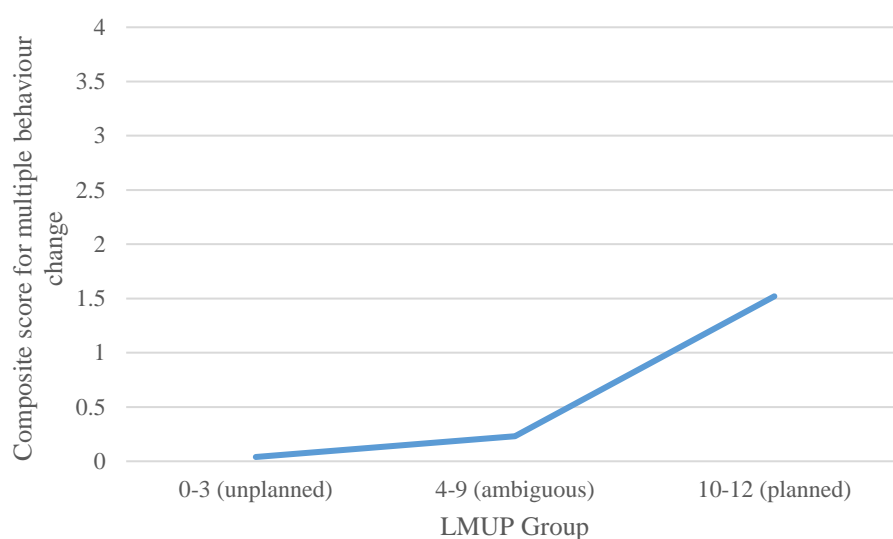


Figure 3.5 – Mean score for engagement in multiple behaviour change across LMUP groups

3.3.4 Research question 3: Are different categories of pregnancy planning associated with the performance of multiple health behaviours prior to conception?

Figure 3.6 illustrates the mean composite score for multiple behaviour change across each LMUP band. For every LMUP item with the exception of item six, the mean composite score

for multiple behaviour change in the unplanned and ambiguous groups both differed significantly from the planned groups. The mean composite score for multiple behaviour change did not differ significantly between the unplanned and ambiguous group for any item except item six (specific actions to improve health before pregnancy), where each group differed significantly from the others. The means and standard deviations for each group across the LMUP items is displayed in table 3.5.

Table 3.4 Summary of the means and standard deviations for engagement in multiple behaviour change across each LMUP group for individual LMUP items

LMUP Item	Unplanned group (0-3)		Ambiguous group (4-9)		Planned group (10-12)	
	M	SD	M	SD	M	SD
LMUP 1 “In the month that I became pregnant...”	0.10	0.39	0.34	0.79	1.33*	1.11
Contraception use						
LMUP Q2 Feeling the pregnancy happened at the right time	0.21	0.64	0.54	0.95	1.37*	1.10
LMUP Q3 Intentions to become pregnant	0.22	0.64	0.34	0.69	1.46*	1.08
LMUP Q4 Wanting to have a baby	0.17	0.55	0.43	0.80	1.37*	1.10
LMUP Q5 Agreement with partner about becoming pregnant	0.23	0.65	0.23	0.62	1.42*	1.09
LMUP Q6 Specific actions to improve health before pregnancy	0.00*	0.00	0.95*	0.22	2.31*	0.73

* Significant at $p < 0.01$

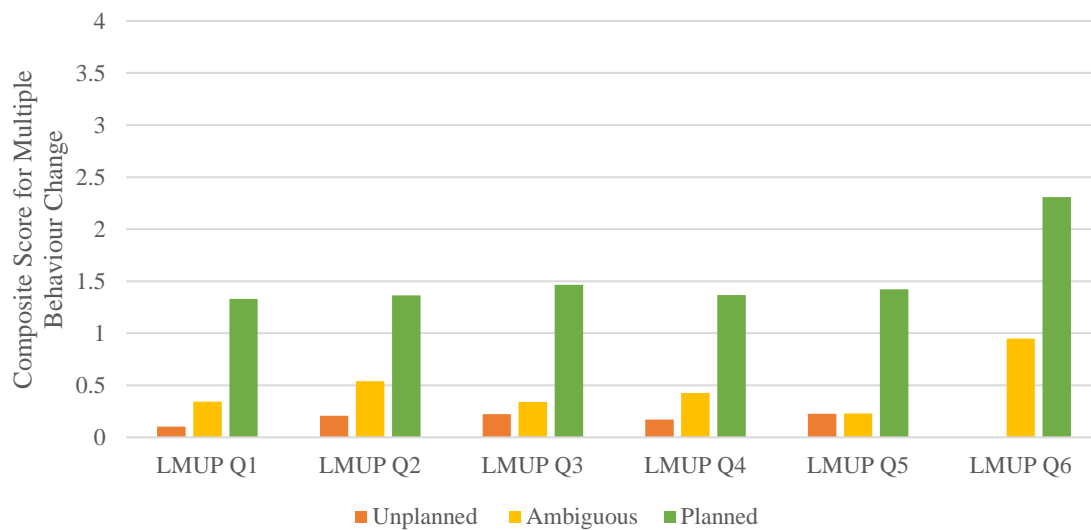


Figure 3.6: The composite score for engagement in multiple behaviour change across the LMUP bands for each question

3.3.5 Research question 4: How do psychological and behavioural pregnancy planning aspects relate to multiple behaviour change?

A paired samples t-test was conducted to compare LMUP score in the behavioural planning and the psychological planning component. There was a significant difference in the scores for the behavioural component ($M=4.78$, $SD=1.34$) and the psychological component ($M=5.34$, $SD=1.34$); $t(2520) = 27.2$, $p < 0.05$. There was a higher degree of psychological planning compared to behavioural planning. To determine whether the mean composite score for behaviour change differed between the two planning components, a one way ANOVA was conducted. Each component consists of three items with a maximum possible score of two per item, allowing a maximum score of six to be achieved for each component.

Composite score compared with mean score for items in each component

A one way ANOVA was conducted to investigate if there was a difference between mean composite score for multiple behaviour change and the mean score for items in the behavioural and psychological components of the LMUP. There was a significant difference between the mean scores for behavioural planning and engagement in multiple health behaviours ($F_{4,2517}=1500.41$, $p=.00$). Post hoc comparisons using the Bonferroni correction identified that there were significant differences between those who had a composite

behaviour change score of 0 ($M=1.08$, $SD = .38$) and for those who scored 1 ($M=1.69$, $SD=.19$) with every other composite behaviour change score.

A significant difference was also found between the mean scores for psychological planning and engagement in multiple health behaviours ($F_{4,2516} = 188.74$, $p=.00$). Post hoc comparisons using the Bonferroni correction identified that there were significant differences between those who had a mean score of 0 for composite behaviour change ($M=1.48$, $SD=.59$) and every other behaviour change score. This is illustrated in figure 3.7.

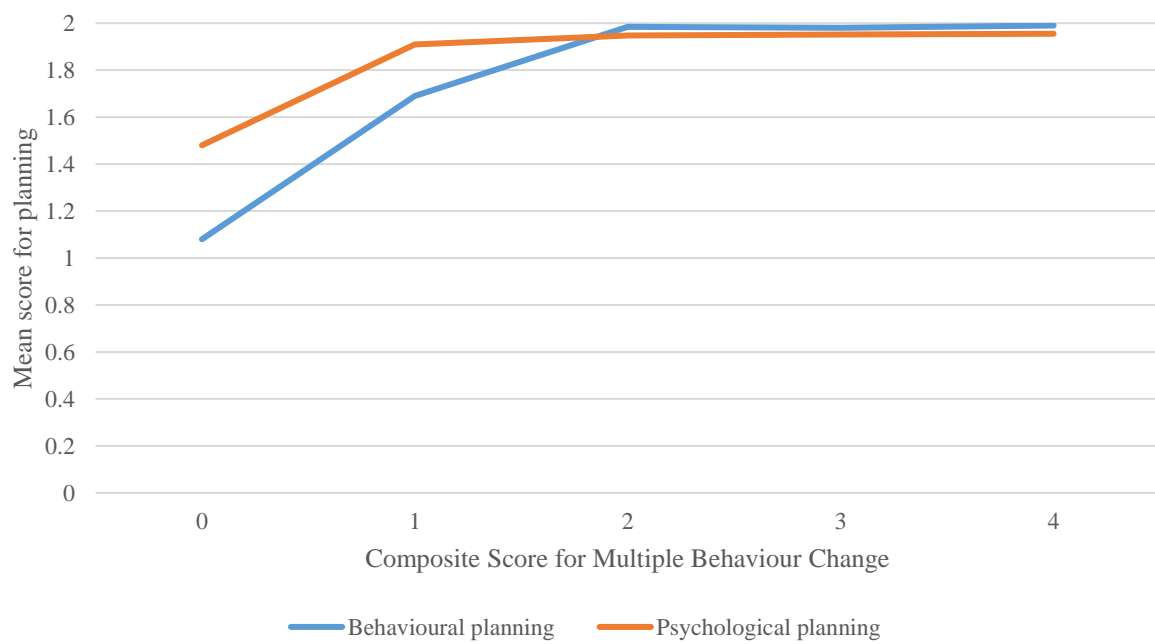


Figure 3.7 – The composite score for engagement in multiple behaviour change for behavioural and psychological planning

3.4 Discussion

The aim of this secondary analysis was to explore the factors associated with engagement in multiple health behaviours. Socio-economic status was measured by SIMD quintiles and degree of pregnancy planning was quantified using the London Measure of Unplanned Pregnancy (LMUP). Associations between planning and engagement in multiple health behaviours was measured using LMUP scores and composite scores for multiple behaviour change. Individual items of the LMUP were then considered individually to explore whether any items were particularly relevant in influencing behavioural outcomes.

3.4.1 Principal findings

This analysis found that engagement in multiple behaviour change is influenced by socio-economic status and degree of pregnancy planning engaged in by an individual. When considered in greater detail, no specific planning measures, as measured by the LMUP, were associated with greater engagement in multiple behaviour change with the exception of item six (specific action taken to improve health before pregnancy). When the LMUP components were considered from two perspectives, psychological and behavioural planning, it was observed that among the sample a greater amount of psychological planning was engaged in, compared to behavioural planning in relation to multiple behaviour change.

3.4.2 The association between socio-economic status and engagement in multiple behaviour change prior to conception

Living in an economically disadvantaged area was associated with lesser engagement in multiple behaviour change, whereas those in the most affluent areas were most likely to engage in multiple health behaviour change before conception. This reflects the literature whereby living in economically disadvantaged areas has been associated with reduced engagement in health behaviours such as eating healthily (Calloway, Parks, Bowen, & Yaroch, 2019). As discussed in chapter one, children born into families living in economically disadvantaged areas are at greater risk of comorbidities associated with poor diet quality and physical inactivity. Research suggests that living in economic disadvantage is associated with adverse effects on other health behaviours such as sleep behaviours in children (Sheehan, Powers, Margerison-Zilko, McDevitt, & Cubbin, 2018) and micronutrient intake in adults (Novaković et al., 2014).

The built environment and accessibility of healthy food have been evidenced as contributing factors to low engagement in health promoting behaviours however research also considers

increased stress associated with living in socioeconomically disadvantaged areas (Kramer et al., 2017). Consideration of increased exposure to stressors has raised the question as to whether risks to health among those experiencing poverty can be associated with behaviours or biological processes associated with chronic stress (Cubbin, Kim, Vohra-Gupta, & Margerison, 2020). Whilst research acknowledges a complex interaction between factors such as a person's environment and stress which influences engagement in health behaviours, there is limited evidence detailing why engagement in health promoting behaviours is poor in the time before conception and how preparing ones health for pregnancy is prioritised, if at all.

3.4.3 The association between pregnancy planning and engagement in multiple health behaviours before conception

Those who were categorised as planners had a significantly higher score for engagement in multiple behaviour change. Greater engagement with health behaviours such as reducing alcohol intake and smoking cessation has been reported among women planning to conceive within the next year in comparison to those whose pregnancy intentions span further than a year ahead (Green-Raleigh, Lawrence, Chen, Devine, & Prue, 2005). Likewise, women who had sought health advice from a medical practitioner when considering pregnancy were more likely to improve their diet and take folic acid before conception than those who had not (Stephenson et al., 2014). It must be acknowledged, however, that even among the planning group, the mean composite score for multiple behaviour change was 1.5 when the maximum achievable score was 4. Whilst those planning a pregnancy engaged more in health promoting behaviours than non-planners, this is still low.

These findings are also supported by Stewart and Hall (2022) who aimed to identify changes that women and their partners made in preparation for pregnancy and to understand why they did or did not prepare. Their findings showed that 49% of women prepared for pregnancy, with the most common behaviour changes being eating healthier and supplementing with folic acid. Of the women who reported their partners behaviour, data showed that 24% of partners prepared for pregnancy with the most common changes being wating healthier and reducing alcohol consumption.

Within this chapter, it cannot be determined from the data why there is a difference in engagement in multiple health behaviour change between these planning groups. One argument for increased behaviour change among planners is the increase in folic acid

supplementation and health eating among women who had sought health from a medical practitioner as noted in the paragraph above. However along with awareness of the importance of health before conception and its implications for pregnancy and infant health, motivations may differ between those planning a pregnancy in the immediate future and those not planning. Understanding the reasons for the differences noted between planning groups regarding multiple behaviour change may provide a window of opportunity for researchers to develop effective behaviour change interventions to support engagement in health promoting behaviours.

3.4.4 The association between individual LMUP items and engagement in multiple health behaviours before conception

Regarding engagement in multiple behaviour change, no LMUP items differed significantly with the exception of item six “specific actions to improve health before pregnancy” which was significantly higher in the planning group. Item six addresses making changes in behaviours directly and appropriately and was associated with greater engagement in health behaviours in the planned group. The planned group also scored significantly higher for every item compared to the ambiguous and unplanned groups. This is important to acknowledge when considering what aspects of planning may be important to people to facilitate behaviour change, especially among people who are not actively planning a pregnancy. No individual item was shown to be more influential than the others except the final item which addressed behaviour change directly. These findings add complexity to those of research question 2 as no specific element of planning could be used to predict behaviour other than if the individual had already started to engage in health promoting behaviours. As the planning group scored significantly higher for each item it suggests that all items have influence, however it raises the question as to whether different subpopulations are motivated to engage in preconception health promoting behaviours for different reasons.

These findings align with the wider literature in which planning a pregnancy is not necessarily indicative of engagement in health promoting behaviours. Maas et al. (2022) explored the associations between pregnancy planning using the LMUP, health beliefs and engagement in health promoting behaviours. They found that despite high scores on LMUP constructs one to five as described in the current study, the majority of participants with planned pregnancies did not engage in behaviour change. Explorations into health beliefs revealed an overestimation of individual health status being associated with less of a need to

prepare for pregnancy. Authors called for a public health approach to encourage engagement in health promoting behaviours before conception and reduce risks to health. Further exploration of health beliefs and their implications regarding pregnancy preparation was advised to determine causal relationships to understand what motivates people to make changes to their health behaviours when planning a pregnancy.

3.4.5 The associations between behavioural and psychological planning with multiple behaviour change

In this sample, scores were higher for the psychological component of planning than the behavioural component. These findings can be considered in relation to the wider literature discussed in section 3.4.4 whereby the majority of participants in the study planned their pregnancy in a psychological sense but did not necessarily engage in health promoting behaviours before pregnancy (Maas et al., 2022). In this study, the behavioural component was comprised of LMUP items which were actionable, the individual had talked to their partner, they had stopped using contraception and they had started to take specific action in preparation for pregnancy. The psychological component conceptualises the thought processes involved when thinking about conception, including intentions and wants.

When both behavioural and psychological components were compared regarding their influence on behaviour change, there was a significant difference between composite behaviour change scores only for those who scored zero, indicating no behavioural changes. Among those who had a mean score of one or above for composite behaviour change, there were no significant differences between composite scores for behaviour change for either pregnancy planning component. This reflects the literature again whereby even amongst planned pregnancies, behaviour change is not always engaged in. Goossens et al. (2018) conducted a secondary analysis of a cross sectional study measuring pregnancy planning and found that despite 83% of participants planning their pregnancy, 55% engaged in alcohol consumption before conception and only 18% of the sample made efforts to improve their diet quality. These findings are similar to those of Stewart and Hall (2022) outlined in section 3.4.3 who also used a survey to explore why people chose not to prepare, with the main reasons cited being a lack of awareness of the importance of preconception health. In an effort to support people planning to become pregnant, a life course perspective was suggested whereby preconception care could be integrated in school-based education, social media

campaigns and contraceptive services to engage with women at opportune moments (Hall et al., 2023).

3.4.6 Strengths and weaknesses

A strength of this analysis was the large sample size of the original survey. This allowed a distribution of participants across the range of SIMD quintiles. As is reflected in research, participation in research is largely from people living in areas of economic advantage however the large sample size allowed comparisons to be made with those living in areas of greater disadvantage. This is important in health research as those living in areas of economic deprivation may be at greater risk of health inequalities and lower life expectancy (Marmot, 2020). Understanding how those living in areas of economic disadvantage engage in health promoting behaviours is critical to address key recommendations to reduce the impact of economic disadvantage on health outcomes for children. Involving those living in areas of economic disadvantage in research will facilitate the identification of at risk groups when developing behaviour change interventions and services.

Weaknesses which must be acknowledged are the absence of baseline data measuring engagement in behaviours before women began to prepare for pregnancy. This is important for measures such as smoking and alcohol consumption as the original survey items asked women if they “stopped/cut down” on these behaviours. This has implications for the secondary analysis of the data as women did not receive a score unless they were seen to have engaged in behaviour change. This may result in women not receiving a score for reducing these behaviours not because they continued to practice them, but rather they did not smoke or drink alcohol originally and did not need to reduce or stop either behaviour. An additional weakness of the study in terms of original survey measures was the use of retrospective self-reported data. Social desirability may influence responses in cases and is noted more frequently when items are measuring a sensitive topic (Krumpal, 2013). This may be the case when addressing health behaviours such as smoking and alcohol consumption.

3.4.7 Conclusions

This chapter identifies how women in Scotland engage in multiple behaviour change and considers factors such as socio-economic status and pregnancy planning influence this. Key findings include the low engagement in multiple behaviour change before conception, particularly among non-planners and people living in areas of economic disadvantage. When related to the wider literature it appears that planning for pregnancy and preparing for

pregnancy differ and as such, it is unclear what motivates people to engage in health behaviour change before conception and research is required to explore what people understand and believe regarding the preconception period and optimising their health before conception.

CHAPTER 4: PRECONCEPTION KNOWLEDGE, BELIEFS AND BEHAVIOURS AMONG PEOPLE OF REPRODUCTIVE AGE: A SYSTEMATIC REVIEW OF QUALITATIVE STUDIES

The previous chapters have examined why a person's health before conception is important and how it can be improved (chapter 1) and which key health behaviours are important and have been recommended before conception (chapter 2). Chapter 3 evidenced how people within Scotland engage in multiple health promoting behaviours and what groups within the population may be at risk of not engaging in these. What is yet to be understood is why people choose to engage in health promoting behaviours or not. It is important to understand whether people understand what preconception means and if they view it as important and relevant to them. This chapter outlines a systematic review of qualitative studies which aims to develop an understanding of what people of reproductive age know and believe about improving their health before conception.

4.1 Introduction

The health of parents before conception can impact the health of the mother during pregnancy and her developing child (Stephenson et al., 2018). Engaging in health promoting behaviours such as physical activity and eating a balanced diet along with avoiding harmful behaviours such as alcohol consumption and smoking can protect against adverse health outcomes for mother and child, for example, by reducing the risk of foetal growth restriction (Aliyu et al., 2009). Improving diet quality can reduce health risks such as gestational diabetes and preterm birth (Yao et al., 2020). Likewise, folic acid supplementation can protect against neural tube defects in infants (Yi, Lindemann, Colligs, & Snowball, 2011). Therefore, supporting women and their partners to optimise health behaviours before conception presents an opportunity to optimise subsequent health outcomes.

Despite evidence of the benefits of engaging in health promoting behaviours before conception, people often do not make behavioural changes during this time (Crozier et al., 2009). A study analysing data from 35,351 women from the USA found that many participants did not reduce their smoking and alcohol consumption even when planning a pregnancy within the following 12 months (Chuang, Hillemeier, Dyer, & Weisman, 2011). A longitudinal study in Australia found that diet, physical activity and sedentary behaviour were not associated with pregnancy intentions (Hill et al., 2019). This study also suggested that lack of engagement in health promoting behaviours is particularly relevant among

interconception women, (i.e. those who have been pregnant previously and intend to conceive again).

A recent systematic review of 38 quantitative and four qualitative studies explored the barriers and enablers to engaging in behaviour change before conception using the Capability, Opportunity, Motivation, Behaviour (COM-B) model and the theoretical domains framework (TDF) (Kandel et al., 2021). The review concluded that knowledge was both an enabler and a barrier for engagement in every included health behaviour including diet, physical activity, supplement use, smoking and alcohol consumption. For example, misunderstanding what comprised a healthy diet was a barrier to improving eating behaviours, whereas having appropriate knowledge of nutrition was considered an enabler. Positive social support was found to enable dietary improvements whilst beliefs about the positive consequences of engaging in a behaviour influenced dietary improvement, micronutrient supplementation and physical activity.

Qualitative researchers have examined the barriers and facilitators to behaviour change before conception in detail by exploring people's knowledge and beliefs around general preconception health. Developing an understanding of what people understand, prioritise and prefer when considering improvement of their health before pregnancy has potential to inform effective behaviour change interventions. In the context of this systematic review, the term 'preconception' refers to people of reproductive age who are not currently pregnant, regardless of intention to conceive. This refers to the working definition of preconception as discussed in chapter one (Hill, Hall, Skouteris & Currie, 2020) whereby the preconception population is conceptualised as having three defining attributes. These attributes include being of reproductive age, being a man or a woman and the woman or partner not currently being pregnant. This review aims to systematically review the knowledge, beliefs and behaviours of men and women of childbearing age in relation to health before conception.

4.2 Methods

This review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance (Page et al., 2021). The protocol for this review was registered with PROSPERO (CRD42020176845).

4.2.1 Inclusion criteria

Studies were eligible for inclusion if they met the following criteria:

- Population should be men and/or women of reproductive age (16-45) and should not include health professionals
- Examine health behaviours in the preconception period or participants knowledge or views about engaging in behaviours which optimise health before conception
- Outcomes focus on knowledge and beliefs about optimising health before conception and health behaviours (e.g. folic acid supplementation, increasing physical activity, smoking cessation, increasing fruit/vegetable consumption)
- Primary studies only
- Qualitative data collection and analysis only

Studies which included participants who had pre-existing health conditions such as diabetes were excluded due to chronic health conditions association with specific or pre-existing preconception care as they receive routine consultations as part of their care which includes preconception care. Studies which included health professionals were excluded as this review focused on the perceptions and behaviours of parents. Only studies published in English were considered.

4.2.2 Search strategy

Literature searches were conducted in February 2020 using the following databases; Ovid MEDLINE, PsycINFO (EBSCO), CINAHL Full-text (EBSCO), EMBASE (Elsevier) (Appendix 3). Searches were limited to a ten year time frame (from 2009) to ensure all included studies were recent and inferences could be made from their findings. An updated literature search was carried out in February 2022 to ensure recently published studies which met inclusion criteria were included which resulted in three additional papers. The search strategy is included in appendix 3.

4.2.3 Screening and data extraction

All titles and abstracts were screened independently by two reviewers (HW and SD). Full text screening was carried out independently using systematic review screening software Rayyan (HW and SD). Full text screening had an 83% agreement as two studies out of 12 required discussion between HW and SD before a final decision was made to remove them both due to focus on chronic illnesses in one paper and participants being under the age of 16 in the other. All disagreements were resolved through discussion between HW and SD and did not require a third arbitrator.

All data extraction was carried out by one reviewer (HW) and checked by a second reviewer (SD).

4.2.4 Quality Appraisal

This review used the Critical Appraisal Skills Programme qualitative checklist (Critical Appraisal Skills Programme (CASP) UK, 2018). Using the original categories of ‘yes’, ‘can’t tell’ and ‘no’ for appraising each checklist item, a score of one was given when criteria were appraised as met and marked with ‘yes’. Zero points were given if criteria were marked as ‘no’ or ‘can’t tell’. All studies were appraised by one reviewer (HW) and checked by a second reviewer (SD). Any disagreement between reviewers was resolved through discussion. This allowed a maximum score of 10 which could be awarded to each study, indicating all quality criteria had been met.

4.2.5 Analysis and synthesis

The data was analysed using a thematic synthesis (Thomas & Harden, 2008). This involved three stages including; line by line coding of the text, development of descriptive themes, followed by development of analytical themes. Data for analysis included the studies’ full results including participant quotes and author interpretations of them. Themes generated in individual studies by the authors were not used for multiple reasons. Firstly, excluding authors themes allowed the reviewers to get as close to the raw data as possible and secondly, authors used different methods across the studies which would have resulted in themes being generated differently.

One reviewer (HW) closely read the included studies and carried out line by line coding. Codes and themes were discussed and developed with the review team (VS, AG, SC, SD & HW). Through discussions, themes were refined and some themes merged. Although coding

was performed by one reviewer, HW, this was under constant supervision and in close contact with the wider supervisory team to ensure consistency and increase rigour.

4.3 Results

4.3.1 Search results and study selection

The study selection process is displayed in the PRISMA flow chart (figure 4.1). The initial search identified 1984 records. After the screening process was complete, nine studies met the inclusion criteria for this review. An updated search was conducted in February 2022 and three additional studies met inclusion criteria, resulting in 12 studies being included overall. From this point of the chapter onwards, studies will be referred to numerically. The table of characteristics (table 4.1) can be used as a key to identify the included papers.

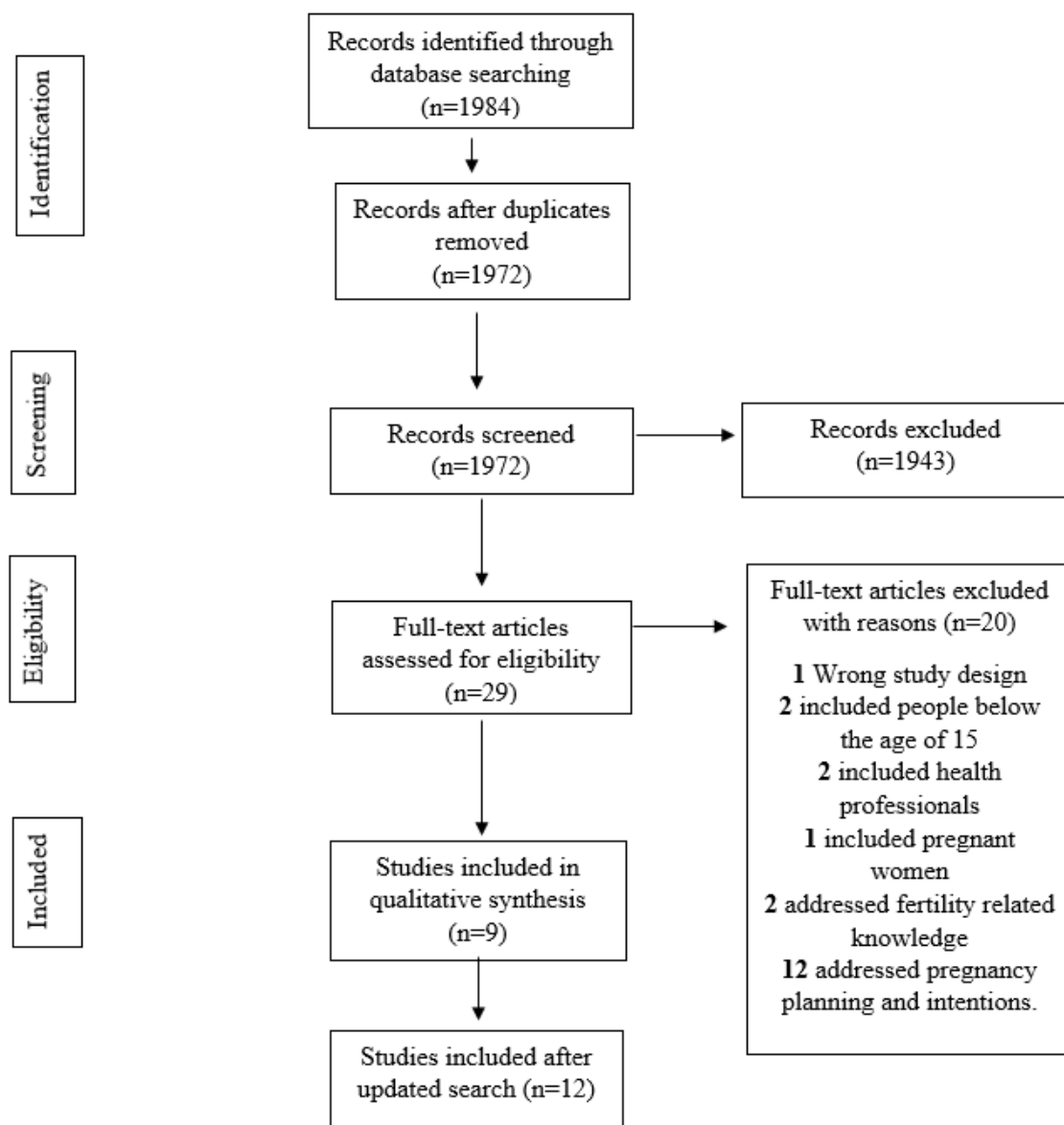


Figure 4.1 PRISMA flow diagram of literature search from initial search

4.3.2 Study characteristics and quality appraisal

The included studies were published between 2010 and 2022. Nine studies included women only (1, 2, 4, 5, 7, 9, 10, 11, 12), and three included men and women (3, 6, 8). Of the three studies including both genders, two involved individuals and one involved couples. Studies included participants from a range of countries. Three studies were conducted in the UK (1, 6, 9), three in Australia (2, 5, 10), and each remaining study was conducted in the USA (3), South Africa (11), China (4), Canada (8), Uganda (12) and the Netherlands (7) respectively. Of the three studies conducted in the UK, one included participants of various ethnicities (9), whilst one of the studies carried out in Australia focused on migrant women from different countries of origin (2). Other remaining studies did not focus on specific subpopulations.

Methods of data collection included eight studies using focus groups (1, 2, 5, 6, 9, 10, 11, 12), of which, two studies (2, 9) included optional interviews after focus group completion to ensure all participants could contribute to discussions. One study (3) used a structured telephone interview with couples and three used a semi-structured interview with individuals (4, 7, 8). The characteristics described within this section are presented in table 4.1.

Quality appraisal

As outlined in section 4.2.4, the CASP qualitative checklist was used to appraise quality of studies. Of the 12 included studies, a score of 10 was given for three studies, a score of 9 was given for seven studies and a score of 8 was given for two studies. CASP scores are presented in table 4.1.

Table 4.1 - Characteristics of primary studies included analysis

	Reference; CASP score	Number of participants	Location of study	Participant demographics	Status regarding previous pregnancies	Participants planning a pregnancy	Method of data collection
1	Kretowicz et al. (2018) CASP 9	20	UK	-Age range 18-49 -All women -All white UK residents	All without children	Not specified	6 focus groups
2	Lang et al. (2019) CASP 10	25	Australia	-Lowest age 18 -All women -Migrant and refugee backgrounds	13 without children 12 with children	Not specified	2 focus groups with optional interviews if participants preferred
3	Lewis et al. (2013) CASP 9	116	USA	-Age range 18-44 -58 couples (all heterosexual)	13 couples without children 45 couples with children	3 groups of participants: planners, non-planners and recent parents	Couple based structured interviews
4	Liu (2014) CASP 8	40	China	-Age range 20-29 -All women -All from Zhejiang Province, China	Not specified	Not specified	Semi structured interviews
5	Mazza & Chapman (2010) CASP 8	17	Australia	-Age range 18-45 -All women -All native to Australia	Not specified	Not specified	3 focus groups
6	McGowan et al. (2020)	21	UK	-Age range 18-45 -13 women, 8 men	13 without children 8 with children	Not specified	5 focus groups

	CASP 9			-All from Northern Ireland			
7	M'hamdi et al. (2018)	28	Netherlands	-Age range 18-41 -All women	22 without children 6 with children	All planning to conceive in the future	Semi structured interviews
	CASP 9						
8	Quayyum & Dombrowski (2021)	19	Canada	-Age range 19-23 -14 women, 5 men	All without children	All planning to conceive in the future	Semi structured interviews
	CASP 9						
9	Tuomainen et al. (2013)	41	UK	-Age range 18-45 -All women	18 without children 23 with children	Not specified	9 focus groups, 19 follow up interviews
	CASP 10						
10	Walker, Drakeley & Boyle (2020)	31	Australia	-Age range 18-45 -All women	All without children	Not specified	7 focus groups
	CASP 9						
11	Ware et al. (2019)	29	South Africa	-Age range 18-24 -All black women living in Soweto, South Africa	All without children	Not specified	4 focus groups
	CASP 10						
12	Yiga et al. (2020)	41	Uganda	-Age range 18-45 -All women	Not specified	Not specified	12 focus groups
	CASP 9						

4.3.3 Synthesis

Six themes were identified and developed; these are listed along with their identified sub-themes and descriptions in table 4.2. These were: i) gender roles and perceived responsibilities, ii) cultural factors influence information seeking and family support, iii) limited knowledge of health behaviours and risks, iv) information seeking, v) pregnancy planning stage influences how people prepare, and vi) barriers and facilitators of engagement vary for different behaviours. All data from participants in primary studies is presented in italics and quotation marks. Data from study authors is non-italicised and also in quotation marks.

Table 4.2 – Developed themes including associated subthemes and descriptions

Themes	Subthemes	Description of theme
Gender roles and responsibilities	Men left out of conversations and less likely to talk	Men perceive preconception to be focused on women and felt uncomfortable discussing it with peers.
	Women seen as more knowledgeable with greater responsibility	Women are perceived as knowing more about pregnancy preparation and men acknowledged that greater responsibility for a baby's health is placed on the mother
	Partners behaviours influencing woman's wellbeing	Partners are of great importance when supporting women with engaging in specific health behaviours
Cultural factors	Cultural beliefs influence specific behaviours	Culture influences prioritisation of specific behaviours along with avoidance of behaviours which do not align with women's cultural norms.
	Cultural practices and family structure relate to information seeking	Conversations centre around acculturation and the contrasting attitudes towards preconception healthcare between family members and western education.
Limited knowledge	Some awareness of important behaviours	Health behaviours such as smoking cessation, avoiding alcohol along with

		improving ones fitness and nutrition are frequently recognised as being important.
	Limited understanding of nutrition and supplementation	Limited understanding as to what a healthy diet entails, along with a lack of knowledge regarding folic acid supplementation and its benefits.
	Limited awareness of preconception and health risks	Health risks often conceptualised within the context of pregnancy and there is limited awareness of the benefits of engaging in health promoting behaviours before conception.
Information seeking	Preference for online information	Seeking health information online preferred by people across ages and cultures rather than speaking to a health professional initially.
	Health professionals considered when complications arise	Consultations with health professionals are considered in the instance of a problem arising. This could be after finding conflicting information online, or when a couple had fertility concerns.
Pregnancy planning stage	Planners more receptive to preconception health information	People who are planning a pregnancy re interested in receiving health information. Receptiveness to health information among inter-conception couples planning a pregnancy is influenced by previous pregnancy and birth experiences.
	Planners/Non-planners prioritise different ways to prepare for pregnancy	Planners are more receptive to health information, unlike non-planners who prioritise financial stability and building a healthy relationship with their partner. There is uncertainty as to the appropriate time to engage with health information.

	Life stage and degree of planning influence engagement in behaviours	Motivation to engage in health promoting behaviours differs according to life stage and stage of planning. Whilst those not planning a pregnancy are less receptive to health specific information in relation to conception, younger people not currently planning pregnancy are motivated to engage in behaviours such as healthy eating for different reasons such as aesthetics.
Behaviour specific barriers and facilitators	Influence of the family	Family dynamics are particularly important regarding behaviours such as eating healthily. Families can be a source of motivation or a barrier to changing behaviour.
	Cost of a healthy diet	The perception of the cost of particular foods could be either a facilitator or a barrier to engagement in a healthy diet. Fresh foods are seen as too expensive to be practical for some.
	Waning motivation	Motivation to engage in health promoting behaviours reduces the longer it takes to achieve pregnancy.

The six identified themes were developed into an organising framework as shown in figure 4.2. Gender roles and pregnancy planning status influenced information seeking behaviour, which in turn was associated with knowledge. Gender roles, knowledge and pregnancy planning status are all associated with engagement in health promoting behaviours before conception. The contextual role of cultural factors influenced five other identified themes.

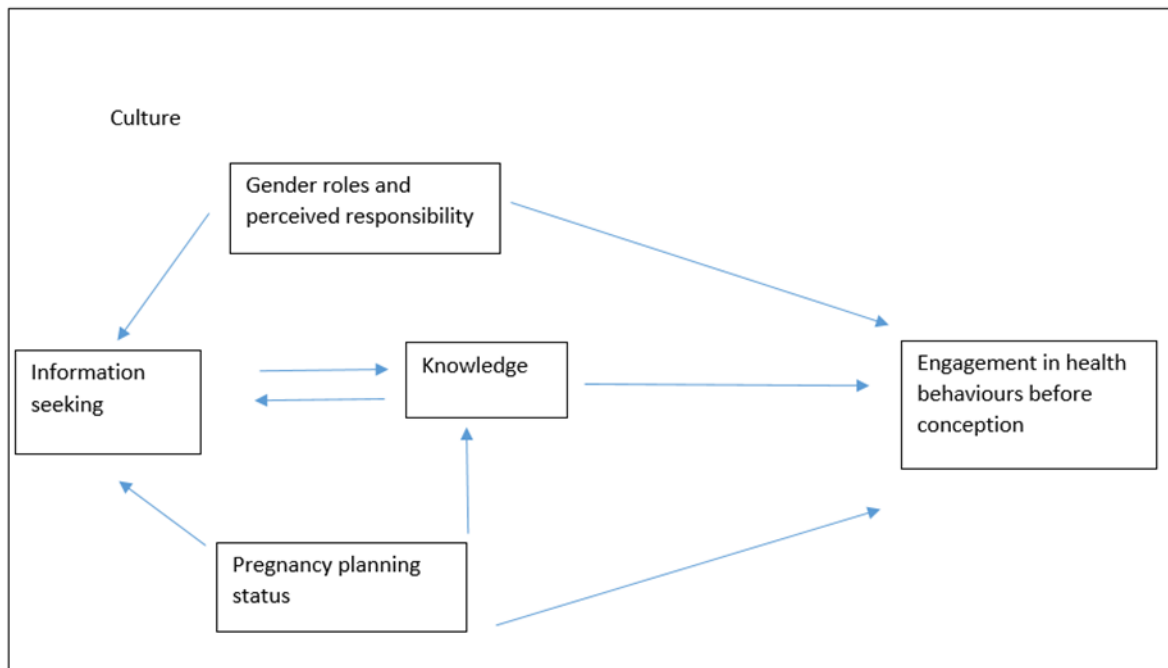


Figure 4.2. Behaviour change organising framework including developed themes

4.3.4 Gender roles and responsibilities

Gender roles and responsibilities when preparing for pregnancy were discussed across eight included studies, (1,2,3,4,6,7,8,9) often in terms of partner support and men’s involvement in the preconception period. Participants in several studies mentioned that women had greater understanding of how and why to improve health before conception and that information was aimed primarily at women. Stability within a relationship and support from partners was stated as being important. Men recognised the importance of being in good health before conception, however, they reported feeling less inclined to discuss preconception health with friends.

Men left out of conversations and less likely to talk

Men discussed preconception and pregnancy as something to be focused on by women and therefore felt less inclined to discuss it. *“I can imagine there would be a bit of a stigma*

around [discussing] pregnancy in general [with males] because it's just perceived as a female-led operation” (6). Tuomainen et al. (2013) (9) described how women felt that preconception health should “encompass men more directly”, this was echoed by a male participant from Lewis et al. (2013) (3) study who described how a shared approach to pregnancy preparation would be “pretty motivating”.

Women seen as being more knowledgeable with greater responsibility

Men perceived women as being more knowledgeable about health before conception and recognised that women often bear greater responsibility for infant health outcomes. They considered the implications that can arise from focus and pressure being applied to women. *“They [people] would probably have blamed the woman if there were any problems [with a baby]” (6).*

Despite women being perceived as knowing more and preconception health being viewed as a female dominant area, both men and women expressed a desire for both genders to be included in discussions about preconception health. Women expressed a particular discomfort with health messages being aimed at improving health for the purpose of having a baby (1). *“You feel kind of like a baby making machine, if they're like ‘you need to do this because it will be good for your pregnancy’ and just not highlight other things and be like actually this is really good for your health in the long term”*

Partners behaviours influencing woman's wellbeing

Support from partners was recognised as important for engagement in health behaviours and general mental and emotional well-being. This was discussed by a woman from an interconception couple regarding behaviour change *“...the support of a spouse can greatly affect the positive behaviors...”*. (3). The importance of partner support was echoed with regards to dietary changes specifically *“...we'd be a team and I'd get jealous if I saw him eating a hamburger all the time and I was stuck to salads and fish” (8).*

Partner's behaviours were also recognised as being important regarding the woman's mental and emotional wellbeing. *“A man's temper will affect a woman's emotions, and it will have an impact on the future baby” (4).* Women stated that in their communities, some behaviours such as smoking and alcohol are more relevant to men and due to this, preconception health information should include them (9). The importance of preconception health messaging

being aimed at men was suggested to include encouragement to support and communicate with their partner (2).

4.3.5 Cultural factors

The perceived influence of culture was reported in terms of attitudes and preferences towards healthcare. This was discussed across four studies (2,4,9,11). Regarding migrants and refugees, acculturation was discussed with differences arising within specific communities in relation to the contrasting attitudes towards preconception healthcare between family members and western education. Differing cultural contexts influenced gender roles and how families discussed and prepared for pregnancy. This ranged from the ability to talk about pregnancy preparation with family members to accessing healthcare.

Cultural beliefs influenced specific behaviours

Among a sample of native Chinese women, maintaining a healthy physique was viewed as important for both partners (4). Concerns were expressed regarding a greater risk of miscarriage if the woman was not physically strong and, for men, a strong physique was associated with a healthy infant but also as a factor to determine the sex of the baby. *“If a man maintains good physical strength before conception, it’s likely for a couple to have a baby boy.”*(4).

In this sample (4), women focused on regulating their menstrual cycle and engaging with Chinese medicine approaches as opposed to western medicine. Cultural views regarding food were discussed in relation to the belief that cold foods should be avoided to preserve fertility and so called tonic foods such as red dates and donkey-hide gelatin should be consumed alongside dietary supplements to promote health. Nutrition was also discussed amongst a group of black, South African women who stated that they engaged in particular behaviours because that was seen as normal among their race. *“...As a black kid, I was raised to eat like pap, meat, and sweets”*(11). The concept of race was discussed regarding physical activity where engaging in health promoting behaviours such as exercise were viewed as an activity exclusively practiced by white people.

“I leave the house early in the morning at 5 and tell myself, you know what? I’m going to jog today. I’m going to start this diet thing. The minute you walk out, there are people that literally laugh at you. She is acting like a white person, she is running, she is jogging, what is she doing?”(11)

Cultural practices and family structure relate to information seeking

A difference between cultural norms within the context of education was discussed in regards to the availability of sexual and reproductive health information “...Here [in Australia] we learn about period, whatever... how to use condoms... stuff like that. But there [in Thailand, where I lived] no, you just learn math, English...They don't have... proper health [education]...” (2). Among women who received sexual and reproductive health education in Australia, there was discussion about the difficulties they experienced in having subsequent discussions with older family members. One participant, originating from Pakistan said “I’ve been raised [in Australia]... so I’ve been taught all of these things in high school... At first I remember her [my mother] being a bit not willing to talk... about it; but I’ve seen over the years that she’s more open to it...” (2).

Conversations around accessing preconception health information was positive and women felt it was important to engage with this after marriage due to cultural expectations of pregnancy (9). One woman with Indian ethnicity stated “because we are thinking about our culture, if you are married then obviously you’re going to be having babies.” Due to the cultural expectations for pregnancy after marriage, women in this study discussed a lack of preparation which was associated with lack of awareness of preconception health. However, within this study, women with a South Asian ethnicity had concerns about stigma associated with infertility in their communities which resulted in a reluctance to discuss pregnancy preparation with friends, family and health professionals (9).

4.3.6 Limited knowledge

Knowledge of health behaviours and risks was discussed across eight studies (2,3,5,6,7,8,9,12). Behaviours such as alcohol consumption and smoking were frequently recognised as being detrimental to health during pregnancy, however risks were not always understood in terms of preconception. When planning a pregnancy, a healthy diet was often acknowledged as being important however depth of knowledge was varied. There was a limited understanding as to why it was important to engage in health promoting behaviours before conception and most behavioural changes were discussed within the context of pregnancy.

Some awareness of important behaviours

Abstaining from smoking and alcohol consumption was commonly mentioned across included studies by participants of different age, gender and culture. In some cases engaging in preconception health promoting behaviours was viewed as important generally. *“The only precautions beforehand are quit smoking, drink less, get into some sort of a healthy routine, make sure that your body is in good shape. But that's a very general kind of precaution. It's not even a precaution. It's what everyone should do anyway”* (2).

The concept of maintaining a healthy physique by adhering to a healthy diet and engaging in physical activity was frequently mentioned. Lewis et al. (2013) (3) discussed how participants felt it important to have a *“healthy lifestyle”*. This concept was also described by McGowan et al. (2020) (6) with exercise and diet being mentioned specifically as important behaviours to engage in when planning a pregnancy *“But weight, fitness and nutrition are really the main things, and stay away from bad habits.”*

Limited understanding of nutrition and supplementation

When discussing folic acid supplementation before conception, there was limited awareness as to why folic acid was important along with confusion regarding dosage and timing of starting supplementation. *“I've always bought them [folate supplements] and had them ready to go but never really knew why.”* (3) Amongst women with previous pregnancies there was some scepticism regarding the protective health benefits of folic acid supplementation. *“Because you think you know it. I don't have a child with spina bifida, so why should I take the folate? And I don't need to go the doctor because I've done it all before.”* (3).

Adequate nutrition was also deemed important however participants' understanding of how to prepare nutritionally was often superficial. *“Nutrition [is important for preconception health] probably with the lifestyle choices that you make too, but I don't really know [what else], probably more nutrition I would say”* (6)

Whilst participants felt there was wealth of available information regarding nutrition, this led to a sense of confusion due to variation of advice. *“There are so many different things out there, so many different diets that's a benefit and there's another bit of research that goes against it, and for everything they say is good, there is something else saying it's bad, so I don't really tend to pay too much attention”* (1).

Limited awareness of preconception and health risks

When asked about health prior to conception, risks to health were mentioned in relation to pregnancy specific behaviours (6). A male participant discussed the risks they perceived to be associated with alcohol consumption, *“I’ve just heard about miscarriages and stuff with drinking alcohol and things like that and smoking causing...I don’t know if it’s a myth, about it [smoking]stunting growth and that sort of thing. I’ve heard that before.”* (6). The same study reported how smoking cessation was considered as something to be considered after conception. *“But I did stop drinking alcohol. Regarding smoking, yes I’ll consider that when I really am pregnant....I have started to smoke a bit less.”* (6). Health risks associated with smoking were also discussed in terms of harm to the smoker, with risks related to passive smoking not mentioned.

Lang et al. (2019) (2) also reported the health risks caused by smoking and alcohol consumption and the benefits of behaviours such as folic acid supplementation being discussed in the context of pregnancy rather than before conception. *“I’ve heard of iron... thing that you just said [folic-acid] ... But I didn’t know that you have to take before you get pregnant...”* (2).

4.3.7 Information seeking

Eight studies included discussions about seeking information regarding pregnancy planning and changing health behaviours (1, 2, 3,5, 6, 7, 9, 10). Accessing preconception information was deemed desirable by men and women of different ages and cultures, however there are differences of opinion regarding timing of information being accessed and the delivery of that information.

Preference for online information

Across age and cultural groups there was a preference for using internet sources as a method to find relevant health information. Online resources were discussed across included papers from two perspectives, that of the planner and that of passive social media users with no immediate plans to conceive. For planners and couples who had other children, the internet was seen as a useful tool (2, 10). *“I would seek information beforehand... My first source would be the internet. If I find... conflicting messages then I would go to a doctor and... asking around who I know has been pregnant...”* (2). Among planners, online resources were used as an initial method of information seeking with health professionals being considered if further guidance was deemed necessary. Online health information was also found to be able to reach those not actively planning a pregnancy. McGowan et al. (2020) (6) discussed using

the internet to seek information as being appealing for younger people and men who may consider reading an article they happen to come across whilst browsing their social media. *'So, if it's on Facebook, if there's like an article or something that seems of interest...[you're] going to look[at it]'*. The use of social media was described in many studies with younger participants discussing Instagram influencers as providers of information that they could relate to.

Health professionals considered when complications arise

When discussing the idea of consulting a health professional about pregnancy planning, there was a concern expressed by participants across some studies that seeking advice was not the appropriate use of a doctor's appointment. Consultations with a GP were considered to discuss any fertility issues or stopping contraceptive use rather than general advice. *"We already had a desire to have child for some time but still had not succeeded. Therefore, we wanted an appointment with the GP..."* (7). The concept of having a particular issue or problem to discuss was viewed as a justification for visiting a health professional more so than the desire for general preconception health advice. *"but for preconception care it's an appointment to go and talk, it's not actually a procedure"*. This perception of the appropriate use of a doctor's appointment led to participants feeling an obligation to seek information independently before consulting a health professional.

4.3.8 Pregnancy planning stage

Attitudes towards preparing for pregnancy was influenced by how soon people wished to become pregnant with planners and non-planners having different priorities. Eight studies included discussion about various aspects of planning such as engaging in health promoting behaviours with the goal of optimising health before pregnancy and perceived appropriate time to receive preconception health information (2,3,4,5,6,7,9,10).

Planners more receptive to preconception health information

Couples who were classed as planning pregnancy were open to receiving information about preconception health at routine check-ups with health professionals (3). Women suggested that delivering preconception health information to people actively planning a pregnancy would be motivating (5, 8). *"If you were actively trying I think you would be more inclined to make the effort [to be healthy], but I think that at the minute it's not in my radar"* (6).

However, receptiveness to preconception health information differed among interconception couples depending upon their previous pregnancy experiences. Those who had experienced a healthy pregnancy previously were less likely to view pregnancy preparation as important (5). For women who had previous complications, this viewpoint was different. One participant expressed regret about not having planned her pregnancy after experiencing complications *“For my unexpected baby, I didn’t have idea I had fibroid... I should have done more check-ups before falling pregnant... I should have prepared”*. (2)

Planners/Non-planners prioritise different ways to prepare for pregnancy

Couples at different stages of pregnancy planning were found to prioritise different behaviours to prepare for pregnancy. For those who were not planning a pregnancy, financial preparation was prioritised more than optimising health (3). This was also noted by Lang et al. (2019) (2), who discussed how women who were yet to have children also focused on financial readiness along with their career and having a good relationship with the partner and family. *“...It’s more to do with practicalities rather than to do with health...”*. (2)

There was a general confusion among people as to when the most appropriate time is to engage with health advice (2) *“It’s kind of hard to say, like, ‘When do I sign up for these things?’”*.

Life stage and degree of planning influence engagement in behaviours

Factors which influenced engagement in health promoting behaviours among those not planning a pregnancy included aesthetic reasons along with mental health and prevention of illness. *“I think more about fitness and what I am going to look like in a bikini”* (1). Among younger people, the intention to exercise and eat a balanced diet was largely driven by the desire to appear physically attractive.

These views are in contrast with those of people who are planning their pregnancy. It was recognised by study participants that among those who had an intention to conceive in the near future, there was a greater motivation to seek health information. *“If they’re planning on having a child in the next couple of years, there’d definitely be some motivation to try and make sure that you had a healthy baby and stayed healthy yourself”* (3).

4.3.9 Behaviour specific barriers and facilitators

Behaviour specific barriers and facilitators were addressed by five studies (1, 7, 8, 11, 12). These included practical concerns such as financial cost and accessibility, knowledge around what made a diet healthy and understanding of the importance of folic acid supplementation. Engagement in specific behaviours were also influenced by family roles, cultural contexts and motivation when preparing for pregnancy.

Influence of the family

Family roles were seen to influence diet quality and could act as a barrier or a facilitator to improving diet, depending on context. One participant stated her husband was a barrier to improving the family's diet *"I would love to cook with them [lentils and pulses] actually, I really would, but I would need to work on my other half, because he thinks a meal without meat is not a meal"*(1). Whilst this participant was from the UK, family influences were observed across cultures. One participant living in South Africa found the support of the family to be important regarding dietary change, *"...my mother. I draw inspiration from her. I want to live a healthier lifestyle because I saw what happened to her when she was leading a healthy life..."* (11).

Cost of a healthy diet

The cost of buying healthy food was discussed across studies were some participants felt that price of certain foods was a barrier to healthy eating. When experiencing financial barriers, food choice preferences included low cost, high satiety options which are energy dense (12). Fresh food was often viewed as unattainable due to financial constraints *"Fruits and veg and quality meat is actually really quite expensive"* (1). However, within the same study, participants identified methods to improve diet quality at a low cost *"I don't think it has to be expensive, eating healthy, as people think, because frozen vegetables have just as much nutritional value as fresh I think, and things like lentils and beans and pulses are very cheap"*. (1)

Whilst perceived financial barriers influenced food choices, availability of healthy foods was a factor which influenced eating behaviours in deprived communities, *"There is no accessibility of healthy food; the only things you get is chips, bunny chow. It's the only things we can afford"* (11).

Waning motivation

In some cases, motivation to engage in health behaviours diminished over time whilst trying to become pregnant “*Yeah I tried quitting smoking but it took so long, so .. yeah... Well my mother also smoked during her pregnancy and here I am, so yeah...*” (7). This same concept was discussed within the context of taking folic acid supplements and eating a healthy diet, with the longer the time taken to achieve pregnancy, and therefore the timeframe leading to conception was unknown, the more likely people found it ‘difficult to commit’ to behaviour changes. Women described feeling more motivation to make changes to their behaviours once they knew they were pregnant.

4.4 Discussion

This study systematically reviewed the qualitative literature addressing the knowledge, beliefs and behaviours of men and women of childbearing age in relation to health before conception. Findings were based on 12 studies and show how engagement in health behaviours before conception is influenced by knowledge, life stage and pregnancy planning status along with gender and family roles within specific cultural contexts.

4.4.1 Principal findings

This systematic review provides a detailed evaluation of the knowledge, beliefs and support needs identified by people of childbearing age in relation to pregnancy preparation. To understand what influences knowledge of preconception health and degree of support required to change behaviour, aspects of an individual's life such as their culture and family structure, ability to seek health information and role within their relationships should be considered. Findings from this review indicate that gender roles are related to individual responsibility regarding preparation for pregnancy, which influences information seeking behaviours along with engagement in health behaviours (figure 4.2). Male partners appear to be open to receiving preconception health information however they express a reluctance to discuss the topic of pregnancy planning within social groups.

Whilst men recognised that women experienced greater pressure regarding responsibility for pregnancy preparation, both men's and women's knowledge of the importance of engaging in health promoting behaviours before conception was limited. Behaviours such as smoking cessation and abstaining from alcohol were identified but often only discussed within the context of pregnancy. Knowledge of how and when to engage in folic acid supplementation in particular was poor, with participants stating that they were unaware of the appropriate time to start considering preparing their health for pregnancy.

4.4.2 Integration with existing literature

Findings indicate that across ages, locations and cultures, people are generally unaware of the importance of engaging in health promoting behaviours before conception. For example, folic acid supplementation was poorly understood in terms of practical issues such as timing of supplementation along with the protective health benefits. Research has found that knowledge regarding folic acid is associated with adherence to supplementation (Bayrami, Didarloo, & Asadinejad, 2020; Zadarko-Domaradzka, Kruszyńska, & Zadarko, 2021). This is

important as knowledge and beliefs about the consequences of engaging in behaviour have been identified as enablers and barriers to engaging in multiple health behaviours in a previous systematic review (Kandel et al., 2021). Whilst it has been recognised that knowledge alone is not sufficient for behaviour change, it is important that people have sufficient knowledge of important health behaviours and their implications to be aware of the need to engage in them (Alm-Roijer, Stagmo, Udén, & Erhardt, 2004).

Whilst cultural context was not associated with knowledge of the importance of engaging in preconception health behaviours, it was important due to its association with family and gender roles, preferences for receiving information and how certain health behaviours are engaged in. Given that research has indicated higher pregnancy related mortality and morbidity among ethnic minority groups (Badura, Johnson, Hench, & Reyes, 2008; Horner-Johnson, Akobirshoev, Amutah-Onukagha, Slaughter-Acey, & Mitra, 2021) it is important to ensure that preconception health information is delivered in a way that is culturally sensitive and accessible.

Another key finding from this review is how gender roles relate to perceived responsibility for preparation for pregnancy. This has relevance as research has called for greater attention to be paid to addressing perceived gender roles with healthcare providers taking care not to reinforce gender stereotypes which put undue pressure on women (Mello, Tan, Sanders-Jackson, & Bigman, 2019). In this systematic review, specific behaviours were discussed within the context of gender. For example, some women expressed concerns over male partner's alcohol consumption and smoking behaviours. This was discussed in the context of improving men's health, and also in terms of partner support when women were engaging in behaviour change before conception. Receiving support from partners was discussed across included studies as being important when preparing for pregnancy. When preconception health is discussed, it is often perceived as stigmatising for women who feel under pressure and in need of support from their partners.

Despite gender roles influencing perceived responsibility to prepare for pregnancy, men and women across the included studies were receptive to the idea of receiving health information before conception. However, this seemed different according to life stage and timeframe of when people wished to conceive. Those who were planning to conceive were more receptive to receiving health specific information, whereas those not planning a pregnancy prioritised financial readiness and relationship stability. This relates to the model of preconception

action phases (Barker, Mary et al., 2018) which posits that receptiveness to health information is greater after there is intention to conceive, with efforts to raise awareness of preconception health being more relevant for those of reproductive age with no stated intention to conceive. Whilst planning stage was related to openness to seek and receive information, this relationship was complex regarding those who had already experienced pregnancy previously. Those who had previous healthy pregnancies and births were more likely to report not feeling that they needed more information whereas those who had experienced complications expressed regret over lack of prior information seeking and planning. The interconception population are found to be less likely to engage in behaviour change before conception than preconception population (Hill et al., 2019).

Regarding the delivery of health specific preconception information, there was a preference across ages and cultures for online information which could be accessed privately. Consultations with a health professional were viewed as an option if the couple experienced any problems or were struggling to conceive. Online resources can provide low cost intervention opportunities for researchers to increase awareness of the importance of preconception health for those not actively planning a pregnancy, whilst also providing specific health information for those planning to conceive (Barker et al., 2018). Evidence of online preconception resources supporting behaviour change before conception have had promising results. One particular support, developed in the USA, used a support agent named “Gabby”, an online character who interacted with participants to identify risks to health before conception and support changes in behaviour to promote good health (Gardiner et al., 2013; Jack et al., 2020). “Gabby” was shown to be an effective behaviour change support, however when piloted it was reported to be limited by lacking sufficient depth to the health information provided (Gardiner et al., 2013). When “Gabby” was tested in a randomised controlled trial, it was found to be effective to support women in changing their health behaviours, particularly those who perceived their social support as low (Jack et al., 2020). The findings from this systematic review could be used to contribute to online interventions such as the Gabby tool to ensure that appropriate information is given to users at the correct time whilst addressing knowledge gaps and including a gender neutral approach to ensure that partners can be included.

4.4.3 Implications and future research

By exploring knowledge and beliefs regarding engagement in specific health behaviours along with the importance of health before conception generally, it is clear that behaviour change interventions designed to support people to optimise health before conception should include an educational component to facilitate behaviour change. Development of online resources may be a method to increase accessibility for people across ages, cultures and stages of planning.

An important outcome of this chapter to be taken forward is the development of a model which shows the relationships between key themes relating to knowledge, beliefs and engagement in health promoting behaviours before pregnancy. The model illustrates that engagement in preconception health behaviours must be considered in terms of the individual, their family structure, community and access to resources all within the different cultures in which people live. The developed model can be used to guide future research to consider the wider influences on the health behaviours of an interventions target population, whether that be tailored interventions aimed at identified at risk groups or at the population level.

Regarding clinical implications, the model may add value to the development of interventions whereby the target population should be clearly identified, and consideration must be given to how themes displayed in the model relate to those individuals. This allows effective interventions to be developed with the selection of theory and behaviour change techniques which are in response to the needs of the specific population. Additionally, the format of delivery of developed interventions should be designed to ensure that it is accessible to the target population not only logistically, but in a manner that considers cultural context and family values important to those recruited to allow them to participate.

Further research is also required to explore the experiences of the LGBTQI+ community to ensure that people have the opportunity to access preconception health information and behaviour change support which is non-stigmatising.

4.4.4 Strengths and limitations

This review systematically summarised the current qualitative evidence describing what people of childbearing age know and believe about pregnancy preparation across different locations, cultural backgrounds and life stages. The inclusion of men and women across studies meant that individual perspectives could be examined along with views regarding partner support before conception.

Limitations included a variation in methodological quality as measured by the CASP checklist (CASP, 2018). However, studies scored between 8 and 10 out of a maximum score of 10, which suggests that study's methodology was of high quality. An additional limitation is that although men and women's perspectives are reviewed, only one study included partners which limits any inferences which can be made about dyadic planning within couples. Lastly, no included studies examined the beliefs of people who were in same sex relationships or those who identify as transgender or non-binary.

4.4.5 Conclusions

This review found that preconception health is often poorly understood by the general population, regardless of gender, cultural background and life stage. Attention should be paid towards raising awareness of preconception health among people of reproductive age not actively planning a pregnancy, with a more targeted approach including education and behaviour change support for those actively planning a pregnancy.

CHAPTER 5: PATIENT AND PUBLIC INVOLVEMENT

This section presents the patient and public involvement (PPI) that assisted in the development of the subsequently intervention (detailed in chapter 6). The Guidance for Reporting Involvement of Patients and the Public (GRIPP 2) Checklist was used to present this process. The work outlined in this chapter was conducted in parallel with that in chapter 6, whereby PPI was used to inform the development of an intervention to improve preconception health among men and women of reproductive age.

5.1 Introduction

5.1.1 Definition of Patient and Public Involvement Used and Links to Comparable Studies

There are limited publication of studies which have used co-production or PPI in the development of behaviour change interventions among the preconception population. PPI is defined by INVOLVE as research that is conducted with members of the public rather than being conducted to them or about them. Co-production is described as being encompassed within the concept of PPI but includes greater involvement and is centred around a sharing of power between contributors (Price et al., 2022).

The purpose of PPI is to ensure that research addresses topics and concerns that are most relevant to the target population. By including patient and/or public perspectives, research studies are more focused on appropriate information which improves the quality and effectiveness of the study content. It must be noted that whilst PPI is discussed in the context of research, the two are distinct from each other. PPI is the contribution of patients and/or the public in discussions regarding the focus and methods of the research from its conception to its dissemination. Research is when participants provide information which is used as data to aid the answering of a specific research question. Whilst PPI members provide information and perspectives which guide the development of a research study, that information is not used as data to answer any specific research question.

As introduced in chapter 1, it is important to include those who can provide a valid perspective from the target population, whilst ensuring that inclusivity of a range of backgrounds is considered in acknowledgement of health equity (Rayment, Lanlehin, McCourt, & Husain, 2017). Targeting those from economically disadvantaged areas was important for this intervention as despite evidence from chapter 4 suggesting that understanding of the importance of preconception health is limited in the general population,

evidence from chapter 3 shows that those from more economically disadvantaged areas are less likely to engage in multiple health promoting behaviours before conception. This is supported by evidence from the wider literature suggesting that attitudes towards health and decisions to engage with health promoting behaviours are influenced by socioeconomic disadvantage (Wardle & Steptoe, 2003). In their survey, it was found that low SES was associated with thinking less about one's health by attributing a stronger influence of chance in determining health outcomes which in turn, results in less engagement in health promoting behaviours.

5.1.2 Theoretical Rationale and Influences

PPI activities within this project were conducted according to Hawkins et al. (2017) framework for intervention co-design and prototyping. The stages involved in this framework aid in addressing the six core elements which the updated Medical Research Council (MRC) framework state should be considered during every phase of intervention development. The intervention development process which was informed by the PPI outlined in this chapter is presented in detail in chapter 6.

The Hawkins et al. (2017) framework is comprised of three stages which allow evidence from the literature to be considered alongside the knowledge of stakeholders involved in PPI. The three stages are outlined below.



Figure 5.1 Stages of PPI

Stage 1 involved the gathering of different perspectives about what was important to the individual regarding preconception health promotion and will be discussed in detail within this chapter. The conversations in stage 1 aimed to gain an understanding of how preconception health promotion methods deemed appropriate from the literature were perceived among members of the target population. The outcomes of the conversations in stage 1 informed the selected form of delivery which was shared with PPI members in stage 2 for feedback. The combination of PPI and evidence from the literature resulted in the

selection of a video-based intervention, the content of which was informed by evidence gathered in previous chapters along with further PPI.

Stage 2 involved gathering feedback from the PPI members regarding the content of proposed intervention materials. The details of stage 2 are outlined within this chapter and within chapter 6. The outcomes of PPI members review of intervention materials informed the final version of the developed intervention which would be tested in stage 3, prototyping (chapter 7).

5.1.3 Aims

The PPI work in this project was conducted to ensure key stakeholder involvement in designing a preconception health intervention. The aims were:

- i. To increase understanding of women's preferences for receiving preconception health information in an online context
- ii. Ensure key stakeholders contribute to the development of the intervention through involvement in decision making processes regarding the format of delivery
- iii. Ensure stakeholder feedback is obtained and used to inform the content of the intervention

5.2 Methods

5.2.1 Design

The PPI followed a co-design approach using the three stages of evidence review, stakeholder consultation and prototyping as described by Hawkins et al. (2017) to inform the development of an intervention.

5.2.2 People Involved

When recruiting PPI members there was an emphasis on targeting areas of economic disadvantage to ensure a range of perspectives were included in the development of the intervention. The PPI group was formed with five women who lived in the central belt of Scotland, within areas of Glasgow and Falkirk. Recruitment was carried out using online platforms such as community Facebook groups which specifically targeted areas in the Falkirk and Glasgow areas with a SIMD score of 1 or 2, indicating areas of greater socio-economic disadvantage. Whilst it was not required to be a parent, all the women had given birth within the previous year.

Initially, HW had planned to volunteer with charities in areas of socio-economic disadvantage to build relationships with people in these areas before recruitment, however this was impacted by the COVID-19 pandemic and resulting national lockdowns. Instead, recruitment began online in adherence with social distancing measures and assistance was provided by the Poverty Alliance who shared the advertisement in their newsletter (figure 5.2). After some easing of restrictions which allowed people to meet outdoors, some face-to-face recruitment occurred in these neighbourhoods. Face to face recruitment resulted in involvement of four women and advertising on Facebook groups resulted in the addition of one woman. All PPI members took part in a short one on one telephone conversation with HW and were asked after the initial conversation if they would like to continue to be involved in the project in the coming months.

Evidence collected in chapter 4 suggested that limited understanding of preconception health was apparent across the general population and therefore it became apparent that intervention in the preconception period was required for everyone. Additionally, research stressed the importance of information remaining accessible to those from lower socioeconomic status who are at greater risk of adverse health outcomes (Wardle & Steptoe, 2003).



CAN YOU HELP US WITH RESEARCH TO IMPROVE CHILD HEALTH?

WE WOULD LIKE TO ASK WHAT YOU THINK IS MOST IMPORTANT TO SUPPORT WOMEN WHO ARE PLANNING TO BECOME PREGNANT

This involves a quick chat over phone or zoom.

After the chat, if you would like, there is the opportunity to share your views on the support as it is developed

RECEIVE £25 SHOPPING VOUCHERS FOR YOUR TIME

Contact: Hannah Welshman

hannah.welshman1@stir.ac.uk for more info



I am a PhD student at the University of Stirling . I am trying to develop a support to help women and their partners improve their health before pregnancy

Figure 5.2 – Advertisement used to recruit women to the PPI group

5.2.3 Stages of Involvement and nature of involvement at each stage

There were two stages of PPI in the development of the intervention. The first stage was comprised of one-to-one conversations between the PPI member and the researcher. The aim of these conversations was to inform decisions for the format of delivery (Dombrowski, O'Carroll & Williams, 2016). The second stage of PPI in the development process involved co-production whereby the PPI group were involved in editing the video script and storyboard for the video.

Due to social distancing measures in place by the Scottish government in response to the COVID-19 pandemic, the co-production group could not meet in person. Instead, individual phone calls were conducted with each member to introduce them to the project and gather information to develop ideas for the format of delivery of the intervention. As included on the recruitment poster displayed in figure 5.2, the PPI members were provided with £25 in shopping vouchers in line with university guidelines. Involvement in each stage of PPI involved reimbursement with a £25 shopping voucher. The telephone conversations were informal in nature and HW used a semi-structured interview approach. After greeting the individual and asking them if they are happy to share their opinions and experiences, HW introduced the concept of the project and emphasised that the aims of these conversations was to gather the opinions of women living in Central Scotland and use them to develop a tool to help women preparing for pregnancy.

The questions used to structure the telephone conversation were as follows:

1. Did you think much about trying to be healthier in any way before you became pregnant? For example exercising more, changing your diet or taking folic acid?

If they say yes, what was most important to you? If no, ask also, what was most important to you at that time?

2.If there was an online platform where you could find information, tips and support to improve your health before pregnancy, would you be interested in looking at it?

3.What sort of information or support would you like to see?

4. What would you like to know/ have known more about before becoming pregnant?

5.Is there anything that would put you off finding information or asking questions about planning a pregnancy?

6.If there was a website with this information, what do you think would be the best way to help people find out about it?

After ensuring the questions listed above had been covered, HW moved onto explaining that we would like to create a resource like this to help people, what would involvement require in terms of commitment and output, and asked if they would be interested. HW explained that PPI members would continue to be paid for their time with shopping vouchers which could be redeemed online. PPI members were welcomed to take some time to consider their future involvement if they wished to do so before answering. After the telephone conversations with PPI members had been carried out, the research team considered the findings of the research projects presented in chapters 2, 3 and 4 in relation to the public opinion gathered. The research team was comprised of five members with differing areas of expertise with regards to health psychology and intervention development and is expanded on in greater detail in section 6.1. From these considerations, a draft intervention protocol was generated in the form of a storyboard with accompanying script to be presented to PPI members. The storyboard is discussed in greater detail in chapter 6.

Stage 2 involved introducing members of the PPI group to the intervention script and accompanying storyboard to obtain feedback. This was carried out by arranging a time to have a telephone conversation with the individual PPI member to discuss the content of the script and storyboard which would be sent to them via email in advance.

In the email with the attached script and storyboard, HW reminded PPI members of the aims of the video (detailed in chapter 6) and asked PPI members to reflect on three talking points which would structure the coming telephone conversation. These talking points were 1) if the storyboard clearly explained the concept of preconception and its importance and described the key health promoting behaviours clearly, 2) if the language used in the script made sense and 3) their thoughts on the script and storyboard generally. PPI members were able to look at the script and storyboard in their own time and arrange a telephone conversation with HW at a time that suited them.

The steps in which co-production was used in the intervention development process is outlined in the timeline below.

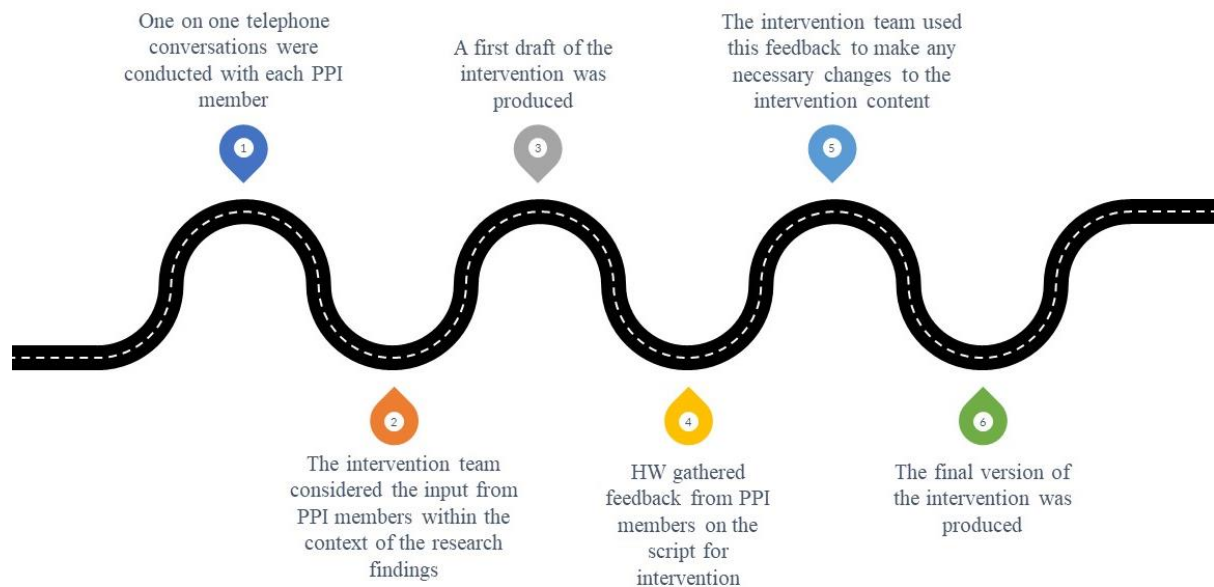


Figure 5.3 Roadmap of PPI process

5.2.4 Measurement of PPI impact

Information gathered during both stages of PPI was collected using written notes. Due to the informal nature of the conversations with PPI members, a non-invasive method of reporting information was selected rather than audio-recording the meetings. PPI members were informed that some notes would be taken throughout the conversations to inform decision making about the intervention. HW then collated the notes from each conversation to present the feedback from the PPI work to the research team.

5.3 Results

5.3.1 Outcomes and Impact of PPI

Stage 1 Outcomes and Impact

Stage 1 of PPI informed decisions made regarding the format of delivery. The online delivery suggested by evidence gathered in chapter 4 was supported by the PPI group. Contextual information was provided by PPI members who had experience using online platforms to search for health information when planning their pregnancies. Those who had not planned their pregnancies provided context on how they would have liked to have been able to access information online.

An important outcome from stage 1 of PPI was the narrowing down of delivery options from a website with a support element to having information only. One PPI member recounted previous experiences of using an online platform to access pregnancy specific health information which also included a poorly regulated support forum which became filled with misinformation, causing confusion and anxiety among users. The reflections of the PPI member were that support forums, if not continuously monitored, can detract from the information initially provided. This perspective was discussed by the research team who made the decision to adhere to the preferences of women in the PPI group and ensure the developed intervention had a focused information component and did not include an interactive social support element.

After the fifth conversation had taken place with the last PPI member who was recruited, no new perspectives were contributed to discussions aimed at narrowing down delivery options. At this point the research team concluded recruiting and carrying out conversations with PPI members in stage 1.

Stage 2 Outcomes and Impact

Stage 2 of PPI involved reviewing of the script and storyboard. PPI members received the storyboard including the video script in advance of an online meeting with HW to discuss the materials. This stage of PPI involved ensuring that the aims of the video were communicated clearly and that the language used in the script was inclusive and could be easily understood.

Both the animation drawn in the storyboard and the written information in the script were received positively by PPI members. HW met remotely with individual PPI members to

discuss the aims of the video and their clarity within the animation and script. Stage 2 did not result in any changes being made to the intervention materials as PPI members agreed that the aims of the video were communicated clearly, the script was easily understood and the animation images clear and supportive of the script. This feedback was brought to the research team and animation company who could continue with the process of developing the video.

5.3.2 Context of PPI

The main contextual factor influencing decision making regarding how PPI was conducted and which hindered stage 1 of the PPI was the COVID-19 pandemic and resulting national lockdowns and social distancing measures. Recruitment and meetings with the PPI group were negatively impacted by the COVID-19 pandemic. Key work in deprived areas of Stirling and Glasgow had been planned to build relationships with people in the interventions target population. This work was important to aid recruitment for both the PPI group and participants for the behaviour change intervention developed. Reorientation of the project involved online recruitment along with use of online platforms to meet with the group and share project materials.

Whilst the aims of the thesis in general remained the same, modifications had to be made as to how PPI could be carried out safely and in line with government recommendations to adhere to social distancing. Recruitment was started online through nursery schools in the target areas and through advertisements in the Poverty Alliance's newsletter. In person recruitment occurred through a contact at a primary school within a target area and face to face conversations with people whilst remaining socially distanced in line with national COVID-19 guidelines

Another contextual factor which influenced how PPI was conducted was the issue of childcare for women who were involved. Whilst it was not specified that women who wished to join the PPI group should be mothers, every woman was the mother of a child under two years old. This required flexibility on behalf of HW to ensure that women could take part remotely regardless of COVID-19 restrictions and they could review any intervention materials within a sympathetic timeframe.

5.3.3 Process of PPI

Process factors such as AG's professional networks enabled recruitment specifically whereby HW was able to approach senior researchers and individuals working within the Poverty Alliance. This resulted in the advertisement used to recruit PPI members being shared widely beyond the scope of what would be possible of HW's own network.

An additional process factor which enabled the impact of the PPI was the continued involvement of two of the women who were initially recruited to contribute during stage 1 providing feedback on stage 2, thus providing continuous PPI. The same two women also aided with recruitment by posting the PPI advertisement on a closed Facebook page for mothers in Falkirk and by recommending a friend who would be interested in talking about preconception which enabled the impact of the PPI in this project.

5.4 Discussion

5.4.1 Outcomes

The main outcome of the PPI was the influence on decision making when developing the intervention. Two key decisions which were influenced by the PPI group were the exclusion of a support forum, and format of delivery in the form of an educational video rather than a website.

Evidence gathered in chapter 4 supported the interventions delivery being online, however the format of this was unclear. Key findings from chapter 4 indicated three priorities for behaviour change interventions targeting the preconception population, these were: education, support and relevance to the individuals stage of life. This raised the question of how to develop a tool which could be accessed online remotely to educate people about preconception health whilst providing a secure support element.

One concern raised by PPI members regarding the support element was the potential for misinformation spread in support forums to cause distress to users and contradict the health information being provided by the online service. This issue was highlighted in a systematic review exploring how misinformation related to health can spread on social media platforms (Wang, McKee, Torbica & Stuckler, 2019). It was suggested that people who lack confidence in their knowledge are more vulnerable to being adversely affected by misinformation online which can take away from the knowledge they gain from credible sources. This was raised by PPI members reflecting on personal experiences using online resources to seek information containing fear provoking messages on chat forums. To ensure this input from PPI was recognised, the decision was made to exclude a support element on the online resource developed and instead focus on the educational component.

The second important decision guided by PPI members was the format of this online resource. Two options for format of delivery were discussed with PPI members, these included a website which users could access and read through relevant preconception health information, or an awareness raising video which could be shared on social media platforms or hosted on a website. PPI members shared a preference for clear, concise information which could be easily accessed and supported both delivery options. Decision making regarding the platform the intervention would be delivered via was based on a combination of evidence gathered in previous chapters and responses to concerns raised by PPI members. Despite support from the PPI members for both a website and a video, some PPI members shared that

they felt uncertain where to look for health information and viewing a video on social media or an advertisement on television would make health information more accessible to them. This concern about being able to easily find relevant health information was supported by evidence gathered in chapter 4 and in the wider literature. Based on the concerns raised by PPI members, a decision was made to develop a health promotion video that could be widely shared on social media and not solely hosted on a website which may be more difficult to promote.

5.4.2 Impacts

The intervention has two main components: the theory-based content and the format of delivery. The theory-based content was developed based on evidence gathered in chapters 2, 3 and 4, however PPI input was used to ensure that the content could be understood easily by people of varying literacy levels. The format of delivery was initially conceptualised using evidence collected in chapter 4 and from the wider literature, however the PPI had the greatest impact on this component of the intervention by allowing HW to narrow down options for online delivery based on PPI input.

Regarding impact of the PPI process on the individuals involved, this seemed to be positive. Discussion of health in relation to pregnancy and childbirth can be challenging due to the personal nature of the topic and individuals may feel reluctant to discuss aspects of their pregnancy or the period before conception.

5.4.3 Definition

This definition of PPI stated previously in this chapter was that of INVOLVE which describes PPI as research that is conducted with members of the public rather than being conducted to them or about them. The PPI which informed the development of this intervention reflected the values set by INVOLVE and therefore no recommendations for an updated definition are provided.

5.4.4 Context

The main contextual factor influencing the process of conducting the PPI was the impact of the COVID-19 pandemic, national lockdowns and social distancing measures. Stage 1 of the PPI work required conversations with PPI members and occurred during a period of time when COVID-19 restrictions were frequently changing in response to fluctuating case

numbers. To ensure consistency when conducting PPI, the decision was made to ensure all forms of contact with PPI members occurred online.

It was very challenging to recruit due to social distancing measures. Initially, HW had planned to volunteer at organisations to build rapport within communities however this was unable to happen due to the national COVID-19 lockdowns in the UK. Face to face recruitment was also limited whereby many mother and baby groups which had been considered for recruitment transitioned to online delivery, removing the opportunity for HW to introduce themselves to potential PPI members, allow them to ask questions and build rapport. The majority of recruitment efforts occurred online, which was less personal in nature and communication with interested PPI members was challenging.

5.4.5 Process

The key process factor which influenced the PPI was the input from the PPI members regarding recruitment. As discussed in 5.3.3, using networks within the research team enabled recruitment and the continuous involvement of some PPI members allowed stage 2 of PPI to be informed by those who understood the aims of the project well and had been influential in the chosen format of delivery.

5.4.6 Conclusions

To conclude, the PPI process facilitated the development of an intervention to promote health improvement before conception. The PPI group ensured that the format of delivery was appropriate and that the messaging in the video clearly communicated the interventions aims and could be easily understood by people with varying levels of health literacy.

CHAPTER 6: DEVELOPMENT OF THE INTERVENTION

This chapter outlines the development of a theory based intervention designed to raise awareness of the importance of preparing health for pregnancy. The preceding chapters have identified key health behaviours which should be promoted before conception and groups within the population who may be at risk of not engaging in those key behaviours. Chapter 5 outlined the involvement of a PPI group who informed the format of delivery for an intervention and its content. The process of developing that intervention is outlined in this chapter.

The objectives of the intervention are to introduce the term preconception as a concept, explain why this period is important for health, and to increase the knowledge required to consider engagement in key health behaviours. These objectives are based on findings from chapter 4 which indicate that people of reproductive age do not understand the importance of improving health before conception. Knowledge improvement before preconception and developing an intervention to improve it builds on evidence introduced in chapter 1 whereby the needs of the preconception population should be understood and prioritised to improve preconception health as part of efforts to prevent childhood obesity. This intervention was based on the Information – Motivation – Behavioural Skills Model (Fisher, J. D., Fisher, Williams, & Malloy, 1994), detailed in section 6.4 and delivered in the form of an animated video. Decision making regarding the theoretical model, form of delivery and the content of the intervention was based on evidence gathered in three studies presented in previous chapters and was guided by input from the PPI group.

The approach taken to develop this intervention was based on Medical Research Council (MRC) Framework guidance (Skivington et al., 2021). The framework suggests identifying the evidence base, identifying and developing theory, and modelling the process and outcomes. This intervention development process followed these steps, with the evidence base being identified in chapters 2, 3 and 4. The application of evidence gathered in chapters 2, 3 and 4 will be outlined throughout this chapter as each intervention component is presented.

Skivington et al. (2021) signposts to the INDEX study (O’Cathain et al., 2019) which provides greater detail on the intervention development phase specifically. O’Cathain et al. (2019) followed the key principles outlined by the MRC guidance, ensuring that intervention development was iterative and considered evaluation and implementation work which would

be required upon completion. These steps include identifying the research problem and planning the approach, involving key stakeholders early and throughout the development process, creating a research team with relevant expertise to aid in decision making and drawing upon existing theory and literature to develop an intervention in which the context it will be delivered in has been considered. These steps allow researchers to consider future implementation of the intervention in an environment where continuous refinements can be made in terms of acceptability, feasibility and mitigation of content risk or potential harm. The intervention development outlined in this chapter follows this approach by O’Caithin et al. (2019) and is supported by PPI reported in chapter 5 and testing of the intervention in chapter 7.

This chapter presents the systematic process of developing the intervention and addresses the MRC guidance by outlining a new intervention which is evidence based. The components of the intervention and their rationale for selection will be outlined in this chapter in the following sections:

6.1 Background of the intervention: Including an overview of the development process and the individuals who were involved in decision making

6.2 The intervention: The content of the intervention

6.3 Format of delivery: How the intervention is delivered

6.4 Theoretical model: The selection and application of the theoretical model

6.5 Target Population: Identification of the target population

6.6 Target behaviours: The identified behaviours for change

6.1 Background of the intervention

To incorporate evidence from the literature along with the newly gathered evidence presented in previous chapters into the intervention development, expert-based consultation was required to adhere to O’Cathain et al., (2019). To achieve this, the intervention development team was comprised of individuals with experience in developing and evaluating interventions, knowledge of the preconception population and mixed methods research.

The intervention team was comprised of four PhD supervisors and the PhD student.

-SC: Lecturer and Health Psychologist

-SD: Associate Professor and Health Psychologist

-VS: Professor and Health Psychologist

-AG: Senior Research Fellow and Medical Sociologist

-HW: PhD student

6.1.1 Relevant experience of the research team

SC is a lecturer in health psychology and a chartered health psychologist. Her area of research expertise is maternal health, with a focus on behaviour change, i.e. addressing health behaviours to improve the health of women and their families before, during and after pregnancy. Her research experience and skills span systematic reviewing, quantitative and qualitative data collection and analysis and co-production of health based intervention.

SD is an associate professor and health psychologist. His area of research expertise is in the development, testing and application of behaviour change theory and interventions for health, particularly in relation to aspects concerning behaviour change maintenance, and the use of evidence-based behaviour change techniques. His research to date covers a range of health behaviours (e.g. diet, physical activity, health service use) and populations (e.g. members of the public, individuals with risk factors for health, or health care professionals). In his empirical work he uses qualitative, quantitative as well as mixed methodologies.

VS is a reader in psychology, health psychologist and programme lead for Health Psychology as part of NHS Education for Scotland. Their extensive research expertise includes psychological wellbeing and models of behaviour change in relation to health promoting behaviours along with management of and coping with long term health conditions.

AG is a medical sociologist with 15 years of experience in intervention development and evaluation. They also have extensive experience in mixed method research and exploring the social dimensions of health.

HW is the PhD student and thesis author.

6.1.2 Timeline of intervention development

The evidence collected to inform decision making during the intervention development process occurred between April 2019 and March 2021. This included a narrative review of preconception policy (chapter 2), a secondary analysis of The Scottish Maternal and Infant Nutrition Survey 2017 (chapter 3) and a qualitative systematic review (chapter 4).

Intervention development took place between January 2021 and May 2022. The details of activities which contributed to intervention development are outlined in the table below (table 6.1).

Table 6.1 – Timeline of intervention development activities

Date	Activities
April 2019 – March 2021	-Evidence gathered
March 2021	-Meetings to plan PPI started
April 2021 – September 2021	-Recruitment for PPI work started -First meetings with PPI members
October – December 2021	-First meeting with intervention development team to consider PPI contributions
November-December 2021	-Second meeting with intervention development team
January – February 2022	-First meeting with Beluga Animation Ltd. -Development of materials for intervention content
March 2022	-Sketched storyboard developed -Meetings with PPI members to review intervention content
April – May 2022	-Revisions made to intervention content based on PPI feedback
May-September 2022	-Pilot study gathering knowledge, motivation and acceptability data with preconception women

As stated in table 6.1, revisions were made to the intervention content based on feedback from the PPI group. An annotated storyboard detailing these changes will be presented in appendix 5.

6.2 The intervention

A storyboard was used to create the intervention video and the process of its development is presented below. The video begins by showing a couple who have just delivered their baby in hospital. The mother begins to talk about the couple's experiences preparing for pregnancy by conceptualising preconception and describing important health behaviours which are recommended during this time. As these behaviours are described, the viewer is shown characters from different families enacting the behaviours. This section outlines the justification for the key points covered in the intervention content and the formats considered to present this information. Amendments made to the script and style of the video are documented within this section. The full script and storyboard can be found in appendix 4 and 5 and the video can be viewed on Youtube using the following link <https://youtu.be/r8FRpEXzE6U>

6.2.1 Video aims

The aims of the video were to address the four following questions:

- i) What is preconception?
- ii) Why is it important?
- iii) What behaviours are important and why?
- iv) How and when should these be engaged in?

Table 6.2 Description and justification of intervention aims

Question to be addressed	What the question addresses	Justification for question choice
What is preconception?	Introduces the concept of preconception to the audience.	This question was selected due to evidence from chapter 4 indicating that there is poor understanding of the term preconception with a tendency for discussions regarding preconception becoming focused on pregnancy.

Why is it important?	Addresses lack of understanding as to what the importance of improving health before conception is and the benefits associated.	Chapter 4 suggested a lack of understanding of what the preconception period is and why it is important. This question aims to ensure that the importance of changing behaviour before conception is important.
What behaviours are important and why?	By addressing this question, the video can ensure that the audience is informed with clear and accurate information and will be more likely to act, in line with the IMB model.	Chapters 2 and 3 aided in identifying key target behaviours which should be considered in terms of multiple health before change before conception. Chapter 4 provided insight into some behaviours being considered in the context of pregnancy and not before and therefore specific health behaviours should be included.
How and when should these behaviours be engaged in?	This question ensures that the video explicitly states that the included health promoting behaviours should be engaged in before conception, and provides visual examples of how to perform them.	The content of this question was developed using evidence gathered in chapter 4 which suggested that improving health is often considered within the context of pregnancy rather than before.

6.2.2 Alternative intervention formats which were considered

A website was considered as a platform in which people can access health information and receive social support in one place. This would address key findings from the systematic review which highlighted the need for information which can improve understanding of

preconception along with outlining key health behaviours and how to engage in them whilst providing a social support element.

Limitations associated with using a website as the format of delivery impacted the aims of the intervention however. The underlying problem that became apparent in chapter 4 was that there is a lack of understanding of what the preconception period is and why improving health during this time is beneficial. Accessing information on a website requires the user to actively seek information. As the preconception population has been identified as lacking understanding of why behaviour change before conception is important, they may not be motivated to seek information purposefully. This concept was supported by findings from chapter 4 which found that there was a preference for information to be accessible by being presented in a way that allowed it to appear on social media feeds which requires less effort on the part of the user to access the information.

An additional limitation to using a website to display information is the risk of overestimating literacy levels of users. A meta-narrative systematic review exploring the reading level required to understand the content of health information websites found that the majority of included websites required a university stage reading level to understand their content (Daraz et al., 2018). This inaccessibility of health information must be considered in relation to findings from previous chapters. Whilst chapter 4 supported the inclusion of the general population being included in preconception health promotion efforts due to widespread lack of understanding, chapter 3 highlighted less engagement in health promoting behaviours before conception among people of low SES. Therefore, any format of delivery must be able to include the general population but also be accessible to people without a university stage reading level.

6.2.3 Choosing a video based intervention

A method of disseminating health information online is through the use of video based social media. This has been adopted by the World Health Organisation who used social media platform TikTok to spread health information in relation to the COVID-19 pandemic (Basch, Hillyer, & Jaime, 2020). Video based platforms have been effective regarding widespread dissemination of health information, with the hashtag “coronavirus” being searched 93.1 billion times (Ostrovsky & Chen, 2020). Due to the popularity of social media being used as a method of accessing health information, health professionals have encouraged its use in communication of health information.

Whilst TikTok has gained popularity in recent years, the platform requires intensive effort from account holders to continuously create video content to promote engagement from users. Whilst an option for dissemination later, the continuous creation of health promotion content is beyond the scope of this thesis. The use of an informational video can however, still be considered to disseminate information about preconception. As people within the general population have a limited understanding of preconception and may not actively search for formal health information, there is an opportunity to introduce people to the concept in a user-friendly way by creating a video which can be shared across multiple social media platforms.

6.2.4 Future implementation of the preconception health promotion video

The preconception health promotion video is designed to be shared widely as a public health measure to increase awareness and knowledge. This is in line with recommendations to improve the knowledge of the general public regarding the importance of health before pregnancy (Barker, Mary et al., 2018) and evidence gathered in previous chapters (chapter 4).

6.2.5 Potential for wide dissemination at low cost

Health information is frequently sought online and social media has been referenced as a source of information among young adults. In a survey carried out with women in Australia it was reported that 32% of women aged 18 and 25 used social media, most commonly Facebook, to seek preconception health information (Skouteris & Savaglio, 2021). Using social media to seek information was more common among younger women and those planning to conceive within the next five years. By embedding the preconception health promotion video to play automatically when a Facebook post or a tweet is shown on an electronic device, key health promotion messages raising awareness of the preconception period can be widely distributed at a low cost.

6.2.6 Incorporation into structured informational websites and educational tools

The preconception health promotion video can be incorporated into educational websites which provide detailed advice and recommendations regarding preparation for pregnancy. Whilst having a smaller audience than that achieved by social media dissemination, the video could be used to introduce health information websites through which people can access more detailed preconception advice and recommendations.

With organisations such as the UK Preconception Partnership becoming established, there is scope for the preconception health promotion video to be shared widely through social media and evaluated among different populations within the UK. Opportunities to share the preconception health promotion video will be expanded upon in chapter 8.

6.2.7 Opportunities within primary care settings

Opportunities for dissemination of health information may lie in primary care settings, particularly in community pharmacy. Pharmacists have seen expansion to the role they provide in their community and the promotion of health promoting behaviours has become a part of this role. This new expansion into health promotion has been considered in the contractual framework for community pharmacy within the National Health Service (NHS) which includes three levels of service: essential, advanced and locally commissioned. Expert consultation was carried out with a practicing pharmacist also working in research and potential opportunities for intervention were identified. Pharmacists have taken on more responsibility regarding health promotion and whilst sexual health services provided centre around the provision of emergency and bridging contraception, there is scope to include preconception health promotion within locally commissioned services.

This scope to include preconception health promotion in primary care settings was explored in a study using semi-structured interviews based on the Theoretical Domains Framework with primary care practitioners (Sissons, Grant, Kirkland, & Currie, 2020). GPs reported experiencing time pressures which presented barriers to providing preconception health information, however community pharmacists had scope within their role to provide this. Whilst community pharmacists presented an opportunity for the provision of preventative health care, they reported a discomfort in providing preconception health information. The study authors reported the need for an intervention to be developed which community pharmacists can direct people to. Due to the scope within the role of primary care practitioners, there may be opportunities to explore the effectiveness of the preconception health promotion video within community pharmacy services.

A potential pitfall which must be considered regarding dissemination of the health promotion video is the potential to widen health inequalities if care is not taken to share the video with appropriate stakeholders. This has been acknowledged through the Inverse Care Law which describes how the availability of medical care is inversely proportionate to population needs and as a result, health inequalities are widened (Hart, 1971). Despite this paper being

published 50 years ago, the same problems with accessibility of healthcare are apparent today (Mercer et al., 2021). In an effort to address this, community pharmacies now offer services which have been commissioned by local authorities and address the needs of the local population. This provides an opportunity to reach populations who are less likely to engage in health promoting behaviours before conception.

In this case, the preconception health promotion video could be played on screen in pharmacies which offer locally commissioned services. The selection of appropriate locations to show the video through conversations with health boards and local councils may aid in targeting at risk areas to avoid the widening of health inequalities. Emerging research suggests that using community pharmacies to increase awareness of preconception health is feasible and acceptable to both women and pharmacy staff (Eastwood, Allen-Walker, Maxwell & McKinley, 2022). Acceptability of this awareness raising intervention will be tested for acceptability in chapter 7 and opportunities for dissemination within community pharmacy will be discussed in more detail in chapter 8.

6.3 Format of delivery

This section outlines the process of selecting the format of delivery for the developed intervention, considering context and future implementation in adherence to O’Cathain et al., (2019).

An introductory telephone meeting was conducted with an animation company who were selected based on their prior experience translating research into video content working with PhD students and within health communication. The first meeting was held to discuss the aims of the intervention and format of delivery required. A brief was put together by the intervention team detailing the aims and objectives of the video, the evidence for including each behaviour and outlining the desired structure of the intervention script. The animators developed a draft script based on the brief which was reviewed by the intervention team and edited in a meeting between HW and the animators. Following on from the editing meeting, the animators developed a revised script and storyboard based on direction from HW.

6.3.1 Justification of video

Evidence gathered from chapter 4 supported an online approach to introducing the concept of preconception health to the general public. This evidence was discussed with the Patient and Public Involvement (PPI) group, discussed in detail in chapter 5. Discussions with PPI members favoured an informational video due to a preference for receiving clear information presented in a focused and accessible way. Evidence from the systematic review supported the use of social media to promote preconception health. This concept was refined through PPI discussions regarding moderation of social media sites to prevent misinformation, the management of the interactive nature of social media and the desire to be presented with information from a credible source such as the NHS or universities.

A systematic review examining the effectiveness of video-based interventions to change health behaviour supported the use of video based intervention for certain behaviours (Tuong, Larsen, & Armstrong, 2014). Video based interventions were found to be more effective at increasing engagement in health promoting behaviours when they were informed by theory, using positive message framing and included appropriate behaviours i.e. not including behaviours which are associated with addiction.

Strengths of video-based information are the accessibility of the information included and the ability to reach large audiences across video sharing platforms on social media whilst remaining cost effective (Sweat, O'Donnell, & O'Donnell, 2001). Some research has

criticised the use of video-based literacy in comparison to written materials in populations with poor health literacy due to individual's ability to control the pace at which they read information (Davis, Michielutte, Askov, Williams, & Weiss, 1998). However, recent studies have contradicted this by suggesting that video-based health information can be beneficial to educate people specifically with low health literacy about health-related topics. (Sobel et al., 2009) conducted a pre-test post-test study measuring the effect of an educational video on knowledge improvement about asthma within a low literacy population. Knowledge significantly improved among participants, with the smallest increase in knowledge scores among those with the lowest literacy. The authors concluded that for those with the lowest literacy, repeated viewings of the video, additional information or materials may be beneficial to maintain improved knowledge in the long term.

6.3.2 Addressing limitations of other video based interventions

Limitations of previously developed educational videos for interventions are lack of involvement of members of the target population in the development process. In a comparative analysis of printed materials and educational multimedia, five out of 30 included studies incorporated patient involvement in the development of the informational tool (Wilson et al., 2012). The development of the intervention video addresses this limitation by including members of the target population in the development of the intervention content to ensure that the information provided is relevant to the target population and provided in a format which is deemed acceptable.

The inclusion of members of the target population in the development of the intervention video also addresses limitations of print-based informational interventions discussed in chapter 5. Including members of the target population when developing intervention content, the research team was able to ensure that health messages were comprehensible via the language used and the animated characters enacting the target behaviours.

6.4 Theoretical Model

This section presents the Information-Motivation-Behavioural Skills Model (IMB) and how it was selected and applied to the intervention.

The integration of theory can provide a framework to design interventions and evaluate their effectiveness (Dalgetty, Miller, & Dombrowski, 2019). A problem with integration, however, is that there are limitations to commonly used social-cognition theories which do not necessarily result in theory improving the effectiveness of behaviour change interventions (Barker, M. & Swift, 2009). These limitations include variation amongst construct definitions between models, which consequently creates the challenge of accurately inferring why behaviour change does and does not occur in specific populations. Alongside this, another limitation affecting the quality of behaviour change interventions is the difficulty of translating theoretical constructs into working components of an intervention.

The IMB model was designed to address some of the previously mentioned limitations and focuses its structure to aid the translation of theoretical constructs into behaviour change interventions (Fisher, J. D. & Fisher, 1992). Due to its focused structure, the IMB model has been used widely despite originally being used to understand and improve adherence to anti-retroviral treatment (Fisher, J. D., Fisher, Amico, & Harman, 2006). The model has since been used within secondary data analyses to explore engagement in physical activity and healthy eating (Kelly, Melnyk, & Belyea, 2012; Osborn, Rivet Amico, Fisher, Egede, & Fisher, 2010), survey studies exploring engagement in health promoting behaviours during the COVID-19 pandemic (Luo, Yao, Zhou, Yuan, & Zhong, 2020) and within the context of preconception to inform qualitative interview studies exploring behaviour change (Scott et al., 2020).

The IMB model posits that when information is accurate and communicated clearly to an individual, they are more likely to adopt and maintain the target behaviour. This is due to three interacting components which make up the model: information, motivation and behavioural skills (figure 6.1). Therefore, by being well informed, motivated and in possession of the necessary skills to engage in the behaviour, an individual is expected to be more likely to engage in the interventions target behaviour. To ensure that the target population can engage with the target behaviour, information that is provided should directly address the behaviour and be easily translated into action (Fisher, J. D. & Fisher, 1992). This

is achieved by ensuring interventions contain clear, behaviourally specific guidance regarding how and when to engage in the target behaviours.

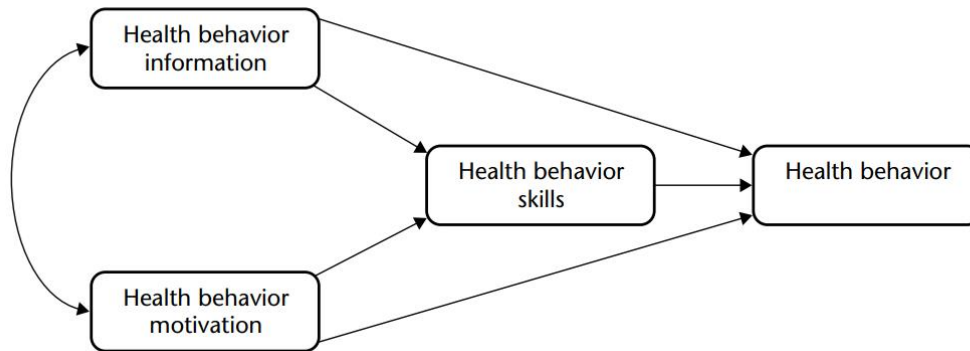


Figure 6.1 – The Information-Motivation-Behavioural Skills Model of health behaviour (Fisher, J. D. & Fisher, 1992)

In the current project, the IMB model was applied to develop a behaviour change intervention taking the form of an animated informational video. This intervention has a focus on the information component of the IMB due to evidence collected in previous chapters highlighting a need for increased awareness and improved knowledge of preconception health. This is in line with suggested methods of applying the model to health behaviour change interventions whereby the constructs most relevant to the target populations engagement within the specific health behaviours should be identified. Identifying the most relevant construct for specific populations is necessary to enhance intervention effectiveness due to the variation of influence each construct of the IMB can have on specific health behaviours.

The information component of the IMB was identified as being the most relevant to the preconception population in chapter 4 as insufficient knowledge regarding preconception was a key finding. The information component was addressed in this intervention by providing a clear explanation of the term preconception and its importance for the health of parents and their future offspring within the video script. The excerpts from the script below address the concept of preconception and is supported by animation. Preconception health is first introduced as a concept before the importance of preconception health influencing the health of the baby during pregnancy and after birth is described. The information provided in the script is supported by the animation showing the narrator at the different stages of pregnancy

from preconception to after birth (appendix 6). Information provided in the script was clear and concise due to the supporting element of the video which used images to add more contextual information to build upon the initial script.

Whilst the information component was identified as being most relevant to achieve the aims of this intervention among the target audience, the remaining IMB model constructs were considered in the development of the intervention video.

The motivation construct comprises personal and social motivation. This involves an individual's attitudes towards the practice of the target behaviour and their perception of social norms and support for engaging in the behaviour. Whilst evidence gathered in chapter 4 suggested that information is the most relevant construct for preconception health, variation in what motivates the preconception population to engage in behaviour change was identified. For those actively planning to conceive, motivation to improve one's health before conception was driven by a desire to ensure positive health outcomes for the baby during and after pregnancy. For those not actively planning pregnancy, improving health before pregnancy was largely driven by aesthetic goals the individual held. Due to the focus on raising awareness and increasing knowledge of preconception health, focusing on the complexities of motivation is beyond the scope of this intervention. However, this component has been acknowledged by the beginning of the video directly addressing those preparing for pregnancy and the health implications of doing so.

The behavioural skills component of the IMB is comprised of the perceived and objective skills an individual has to engage in the target behaviour, and their self-efficacy in doing so (Fisher, J. D. & Fisher, 1992). In findings from a cross-sectional study examining the role of self-efficacy in health literacy and engagement in health behaviour, self-efficacy was associated with greater engagement in health promoting behaviours before conception (Astantekin, Erkal, & Sema, 2019). Greater self-efficacy was also associated with greater health literacy, which stresses the importance of ensuring that health behaviours which are associated with preparing one's health for pregnancy are clearly demonstrated. Due to the role that a person's perceived behavioural skills have in supporting the information component and improving engagement in health behaviours, the intervention video displays examples of engagement in key preconception health promoting behaviours.

The process of selecting a model to develop future interventions followed guidance by O’Cathain et al., (2019) by basing decisions on primary studies and wider context. Evidence from the wider literature suggests that education results in improved knowledge long term, however increased knowledge does not always translate to behaviour change (Lindberg, Stahle & Ryden, 2006). In consideration of this, considerable time was spent exploring relevant models and approaches before selecting the IMB as the model to base the preconception health promotion video on.

The COM-B model was considered due to the inclusion of components such as opportunity, which considers the wider context which influences the physical and social opportunities a person has to engage in a behaviour (Willmott, Pang & Rundle-Thiele, 2021). This relates to evidence gathered in chapter four whereby gender roles and the cultural influences of an individual’s environment influenced preparation for pregnancy. An additional relevant component of the model is the focus on motivation which, in this model, is described as being a mediator of the associations of the other model components. This has relevance to the preconception health promotion video due to planning status influencing why people engaged in health promoting behaviours and barriers such as waning motivation when trying to achieve pregnancy, noted in chapter 4. Whilst the COM-B model had relevant components, the IMB was selected in this thesis due to the widespread lack of understanding of the importance of preconception health. This is particularly relevant to preparation for pregnancy as a lack of understanding as to why this is important was found to be an underlying barrier to engagement in preconception health promoting behaviours across all populations regardless of socio-economic status, age and stage of pregnancy planning.

Prioritisation of raising awareness of the preconception period and its importance was therefore recognised as being an important first step to increase engagement in health promoting behaviours before conception. However to build upon the work within this thesis, models such as the COM-B can provide a method of targeting wider social contexts influencing motivation and opportunity.

6.5 Target population

This section outlines how decisions were made as to who the primary and secondary target populations should be for the developed intervention.

Difficulties in defining the target population were present throughout the evidence gathering phase of the PhD. This was due to preconception health research being in its infancy, lacking clear definitions as to who the preconception population is. In response to this problem, a working definition of the preconception population was developed (Hill et al., 2020) which can be considered from four perspectives, as presented in figure 5.2. Three attributes which are used to define the preconception population are included in each perspective, these being that the individual is a man or woman, that they are of reproductive age and that the woman or partner are not pregnant.

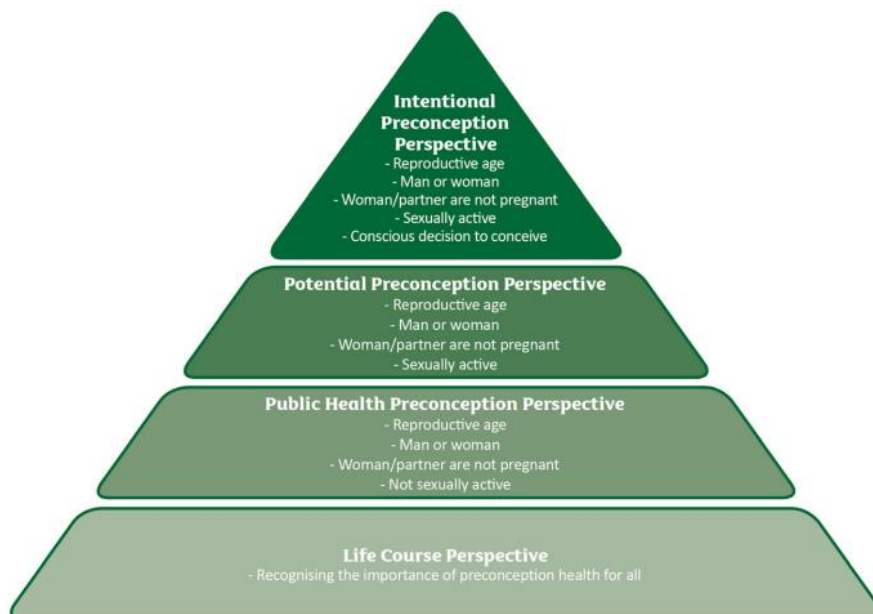


Figure 6.2 – Four preconception population perspectives (Hill et al., 2020)

6.5.1 Primary target population

The primary target population selected were people who were planning to conceive in the future, encompassing the intentional preconception perspective and the potential preconception perspective (Hill et al., 2020). This was supported by evidence from the wider literature which suggests that those who are planning to conceive are more likely to view themselves as being preconception (Lynch et al., 2014). The targeting of people planning to conceive in the future is also supported by evidence gathered in chapter 4, which suggested that those who have a goal to become pregnant in the near future are more receptive to health

information whereas those not planning a pregnancy at that time prioritised financial and relationship stability. Therefore, the primary target population for the intervention was people who are pursuing the goal to conceive a child in the near future.

6.5.2 Secondary target population

Whilst the wider literature and evidence from chapter 4 support the concept that those planning to become pregnant are more receptive to health information, the preconception population also consists of men and women who are not actively planning to become pregnant (Hill et al., 2020). Evidence gathered in chapter 4 suggested that knowledge of preconception health was poor among those actively planning to conceive and among those not actively planning. Therefore, those not actively planning to conceive may benefit from health promotion efforts to raise awareness of preconception health. Whilst they may not be considering pregnancy in the given moment, intervention may inform future decision making. The public health perspective encompasses this population who should not be excluded from preconception health promotion efforts despite the challenges regarding receptivity. These challenges of promoting preconception health to non-planners have been commented on in the literature (Lynch et al., 2014). The noted issues faced were non-planners being unfamiliar with preconception as a term, the risk of overwhelming people with the multitude of health behaviours that fall within the scope of preconception health and the association between conception and pregnancy which may not feel relevant to the individual.

Due to the lack of awareness regarding the importance of optimising health before conception evidenced in previous chapters, alongside the support from the wider literature to include non-planners in preconception health promotion, people of reproductive age who were not actively planning to conceive are included as they may indirectly benefit.

6.6 Target behaviours

This section outlines the process of selecting the behaviours included in the developed intervention.

The higher-level behavioural outcome conceptualised within the video was preparation for pregnancy, alongside this, additional target behaviours were specified and considered simultaneously. The additional target behaviours included in the concept of preparing for pregnancy were eating behaviours, physical activity, folic acid supplementation, smoking cessation and the avoidance of alcohol. The selection of these behaviours was based on evidence from previous chapters (2, 3 and 4) and the wider literature surrounding preconception health promotion. The evidence for the selection of each behaviour is outlined below.

6.6.1 Preparation for pregnancy

Findings from chapter 4 suggest a widespread lack of knowledge and understanding of what preconception means, along with the importance of preparing one's health before conception. The concept of preparing one's health before pregnancy can have different meanings depending on an individual's pre-existing health conditions which may require seeking support from a health professional, their mental health and well-being and their wider financial and social environment.

The intervention largely focuses on increasing the awareness of the concept of preconception and the effect of the parent's health before conception on the health of the baby during and after pregnancy. Alongside this concept, specific behaviours are included in the video as examples of how to prepare for pregnancy, these are:

- Folic acid supplementation
- Eating behaviours
- Physical Activity
- Smoking cessation
- Avoiding alcohol

The focus of preparation for pregnancy as an overarching concept was largely decided based on findings from the qualitative review reported in chapter 4. The inclusion of specific health behaviours was based on the evidence gathered across chapters 2, 3 and 4. A summary of the

key findings which informed the selection of included behaviours for the intervention video are included below by each chapter.

6.6.2 Evidence from chapter 2 – Narrative review of preconception policy and guidelines

The narrative overview of policy, recommendations and guidelines provided context regarding the range of health behaviours which were recommended before conception, and the specificity of those recommendations. Across all included documents reviewed, weight was included with advice based on achieving the healthy BMI range. Alongside weight advice, three behaviours were included across all documents. These included folic acid supplementation, avoiding alcohol and smoking cessation.

6.6.3. Evidence from chapter 3 - Secondary analysis of the Scottish Maternal and Infant Nutrition Survey 2017

The secondary analysis of the Scottish Maternal and Infant nutrition survey included four key behaviours which were considered together and engagement in these multiple behaviours simultaneously was analysed. These were folic acid supplementation, eating a healthy diet, cessation/reduction of smoking and cessation/reduction of alcohol consumption. Evidence gathered in chapter 3 suggested poor engagement in multiple behaviour change particularly among people from areas of socioeconomic deprivation and among those who had not planned their pregnancies so these groups were a focus of the intervention.

6.6.4 Evidence from chapter 4 – Qualitative systematic review exploring the preconception knowledge, beliefs, and health behaviours among people of reproductive age

Information regarding key behaviours was provided which was supported by footage of different characters acting out the specific behaviours. The chosen behaviours were selected from evidence gathered in chapters 2 and 3. The IMB requires that information which is provided should be easily translated into action to promote engagement in that behaviour within the target population (Fisher, W. A., Fisher, & Harman, 2003). To ensure this requirement was met, the animation video presents different scenarios in which the target behaviours are being engaged in.

As knowledge of the preconception period is poor generally, it was agreed by the intervention team that an intervention should aim to raise awareness of this time period and provide accurate information about why and how to improve health before conception. The PPI group assisted in refining what this online intervention could look like.

6.6.5 Conclusions

This chapter outlined the development of the intervention based on evidence collected in chapters 2, 3 and 4 alongside input from PPI members discussed in chapter 5. The following chapters will present a pilot study testing the effectiveness and acceptability of the intervention and a discussion of the intervention in relation to the aims of the thesis and the field of preconception.

CHAPTER 7: THE EFFECTIVENESS AND ACCEPTABILITY OF AN EDUCATIONAL PRECONCEPTION HEALTH VIDEO – AN EXPERIMENTAL SURVEY STUDY

This chapter presents the findings from an experimental survey assessing the impact and acceptability of an educational preconception health video based on the Information Motivation Behavioural Skills Model. The development of the preconception health promotion video is outlined in chapter 6 and was based on evidence presented in chapters 2, 3 and 4 and PPI discussed in chapter 5.

7.1 Introduction

The literature presented in chapter 1 outlines the importance of improving health before conception, however these behaviours are not frequently engaged in. In a UK study examining engagement in health promoting behaviours before pregnancy in 131,182 women found that even though 64.8% of the sample planned pregnancy, these behaviours were not optimised before pregnancy (McDougall et al., 2021). Less than half (44%) of women actively planning their pregnancy took folic acid in the months before conception, with this number being lower still among women aged between 18-24 (29.1%). A study in Australia reported similar findings with 58% of women taking folic acid in the months before pregnancy, and 64% continuing to drink alcohol within 3 months of conception (Lang et al., 2021).

Chapter 4 provided an insight into the problem of limited engagement in health promoting behaviours before conception by evidencing a lack of understanding of what the preconception period is. Whilst evidence gathered in chapter 3 suggested that those living in areas of economic disadvantage and those not planning a pregnancy are less likely to engage in health promoting behaviours before conception, understanding of what the preconception period is limited across the general preconception population. Interventions which have aimed to provide preconception health information are often centred around preconception counselling (Elsinga et al., 2008). Whilst this can be effective regarding knowledge improvement, it requires motivation to attend sessions. If there is a lack of awareness and understanding that the time before conception is important to optimise health, these preconception counselling sessions may have limited engagement. Additionally, at risk populations such as non-planners will be unlikely to attend counselling sessions.

Finding acceptable methods of providing preconception health information should be prioritised. Research has suggested that people are open to receiving information and have a preference to receive that information online in a way that can be accessed easily (McGowan, Lennon-Caughey, Chun, McKinley, & Woodside, 2020). Information shared from trusted sources, such as Public Health England, can have numerous benefits such as increasing the availability of tailored health information, greater accessibility of information, peer support and increased interaction with others (Moorhead et al., 2013). Stakeholder consultation outlined in chapter 5/6 allowed the format of delivery to be refined, resulting in an online method of delivering preconception health information to be selected.

Therefore, an intervention addressing awareness of the importance of health improvement before conception should provide information that states what preconception means, why it is important and illustrate which behaviours are important during this time and how to engage in them. Providing information at a population level would involve introducing preconception as a concept which is applicable to everyone regardless of pregnancy planning status. Furthermore, key behaviours should be introduced supported by demonstrations of how to perform these to benefit those planning to become parents, and indirectly benefiting those not actively planning to conceive.

7.1.1 MRC Guidance for developing and evaluating complex interventions

Previous guidance was based on the identification of an intervention's effectiveness (Craig et al., 2013). However, a limitation to this approach is that it is unclear if developed interventions can be translated into a real-world setting. Updated MRC guidance for developing and evaluating complex interventions builds on previous frameworks by identifying four key phases for effective intervention development; 1) developing an intervention or identifying an existing intervention, 2) feasibility, 3) evaluation and 4) implementation (Skivington et al., 2021). The MRC has been acknowledged as a useful framework through its use in the development and evaluations of behaviour change interventions. An example of MRC guidance in the process evaluation of a behaviour change intervention is that of the FitMum randomised controlled trial whereby a mixed methods approach was taken in adherence with MRC guidance (Knudsen et al., 2022). These methods were used to assess the reach, fidelity, dose and mechanisms of impact as suggested in MRC guidance. This shaped the evaluation whereby assessing the implementation of the project in terms of reaching the target population, the quality of the intervention and the mechanisms in

which the FitMum intervention facilitated behaviour change. In addition, the MRC framework was adopted in the development of an intervention targeting breathing exercises for pain management among breast cancer survivors which used phase 1 of the framework to guide the development process (Wang et al., 2022).

In terms of the intervention developed within this thesis, phase 1 of the MRC guidance was met by the development of a new intervention which is outlined in chapter 6 (O’Cathain et al., 2019). Phase 1 was informed by evidence gathered in chapters 2, 3 and 4 and supported by PPI involvement described in chapter 5. This chapter is relevant to phases 2 and 3 of the MRC guidance, feasibility and evaluation, whereby the acceptability of the intervention is measured within the preconception population and its effectiveness is tested according to IMB constructs. Early contact with stakeholders during the development of an intervention is recommended to consider whether an intervention can be implemented in a real-world context. This stage of intervention development is outlined in chapter 5 and will be discussed in greater detail in chapter 8.

This chapter presents an evaluation of the developed intervention and assesses its acceptability among the target population. The research conducted as part of this chapter is in line with the updated MRC framework in which evaluation of an intervention should occur before testing its feasibility in real life contexts (Skivington et al., 2021). This was achieved by the continuous involvement of the PPI group who gave feedback on the intervention as it was developed. This allowed the research team to ensure that the intervention used the correct method to appropriately answer the research question. This study assesses whether an informational video is effective at improving knowledge of preconception health along with improving motivation and perceived behavioural skills to prepare for pregnancy. In addition to assessing intervention effectiveness, acceptability measures are included.

7.1.2 Acceptability

To ensure healthcare interventions are appropriate, their acceptability among the target population should be measured. The Theoretical Framework of Acceptability (TFA) defines constructs by which acceptability of healthcare interventions can be measured (Sekhon, Cartwright, & Francis, 2017). The TFA suggests that acceptability can be associated with intervention drop-out rates and discontinuation of participation in interventions and therefore measurement of acceptability is key for effective implementation. Acceptability can be measured prospectively or retrospectively and it is recommended within the TFA that timing

of collecting acceptability data should be selected according to the purpose of the data collection. This study aims to assess the effectiveness of the preconception health promotion video and assess its acceptability to ensure any changes could be made to the intervention content before dissemination in real world contexts such as community pharmacy settings outlined in chapter 6.

The TFA consists of seven defined constructs which were developed to address ambiguity in the measurement of acceptability within interventions previously. A review of reviews was undertaken to create a definition of acceptability which centred around interventions being appropriate to the target population and measuring this based on people's thoughts and feelings about the intervention (Sekhon, Cartwright, & Francis, 2017). Due to acceptability of interventions being associated with drop-out rates, it is important that studies developing behaviour change interventions incorporate acceptability testing into their development process.

7.1.3 Aims

This pilot study had two aims:

1. To assess whether a novel preconception intervention could improve knowledge, motivation and perceived behavioural skills in relation to preparing for pregnancy
2. To assess the acceptability of a novel preconception intervention for providing information about health before conception.

7.2 Methods

7.2.1 Study Design

A cross sectional online survey study of people of reproductive age (18-45) and living within the UK.

7.2.2 Participants and recruitment

The inclusion criteria consisted of being of reproductive age (defined as between 18 and 45 years old) and living within the UK. Recruitment took place across four weeks in August 2022. An electronic link to the survey was promoted on social media through community groups and sports teams in the UK. The advertisement inviting people to participate in the survey can be found in appendix 9. A Gpower analysis was carried and a sample size of 126 was required for 80% power and a medium effect size of 0.5. Challenges recruiting men resulted in targeting men's sports teams to reach a wider audience and to include men in the research. Overall, 188 people made an attempt to complete the survey, of which 130 responses were acceptable, 58 responses were deemed incomplete due to item responses not continuing after the demographic section, or through participants answering less than 50% of the IMB items.

7.2.3 Measures

The survey had three sections (see appendix 10 for the full survey). Section one measured demographic information, section two measured the constructs of the IMB model, and section three measured acceptability of the intervention based on the TFA. Section two and three both use a 5 point Likert scale on a scale of 1 (strongly agree) to 5 (strongly disagree). Scores for each IMB construct were given by calculating the total score for the items measuring each construct. To allow a higher score to indicate greater knowledge, motivation or behavioural skills, survey items were reverse coded in SPSS, whereby strongly agree resulted in a score of 5 and strongly disagree resulted in a score of 1.

Section one collected data on age, gender, relationship status, education, current children, future pregnancy intentions and preconception health information seeking behaviour.

Section two measured IMB constructs centred around the concept of 'preparing for pregnancy'. Preparing for pregnancy was described to participants as engaging in multiple health behaviours including eating a nutritious and balanced diet, being physically active,

taking folic acid, not smoking tobacco and not drinking alcohol. Information (knowledge) was measured using five items adapted from (Luo, Yao, Zhou, Yuan, & Zhong, 2020). An example item is “The health of mothers before becoming pregnant can affect her health during pregnancy”. Items measuring personal and social motivation were adapted from the Situational Motivational Scale (Guay, Vallerand, & Blanchard, 2000). Four items were used to measure motivation, two for personal motivation and two for social motivation. An example item measuring personal motivation is “I would feel good about myself when preparing for pregnancy” and an example item measuring social motivation is “I feel that preparing for pregnancy is something I should do”. Four items measuring behavioural skills were adapted from multiple sources and tailored to ask about behavioural skills specifically in preparation for pregnancy (Peng et al., 2020; Schwarzer et al., 2003). An example item is “I believe that I would be able to continue preparing for pregnancy for a few months”. A reliability analysis was calculated for each construct and Cronbach’s alphas for the five information items was .80, .49 for the four motivation items and .89 for the four behavioural skills items.

Section three measured the acceptability of the video using items based on the TFA (Sekhon, Cartwright, & Francis, 2017). The seven constructs which the TFA is comprised of have individual definitions which were adapted in this study for the purpose of measuring acceptance of a preconception health intervention among people of reproductive age. TFA constructs are presented in table 7.1 along with their definitions and adapted definitions for this intervention.

Table 7.1 Original and adapted definitions of TFA constructs

TFA Construct	Original TFA definition (Sekhon, Cartwright, & Francis, 2017)	Definition regarding preconception
Affective attitude	How an individual feels about the intervention	How much participants liked the video
Perceived effectiveness	The extent to which the intervention is perceived as being likely to achieve its purpose	How much participants felt the video was effective at introducing and explaining preconception health
Intervention coherence	The extent to which the participant understands the intervention and how it works	How much participants understood the key messages of the video
Ethicality	The extent to which the intervention has good fit with an individual's value system	How much the messages within the video aligned with the participants personal values
Burden	The perceived amount of effort that is required to participate in the intervention	Amount of time and effort participants perceived as being necessary to watch the video
Self-efficacy	The participant's confidence that they can perform the behaviour(s) required to participate in the intervention	Participants feel confident that they could engage in the behaviours demonstrated in the video
Opportunity costs	The extent to which benefits, profits or values must be given up to engage in the intervention	The expense of time taken to watch the video

7.2.4 Procedure

Participants accessed the survey by clicking on the URL within the online advertisement. An information sheet was presented to inform the participant regarding the details of the study, how their data would be stored and used along with how to exit the study or withdraw their data within two weeks of survey completion. The participant was then asked to provide their consent by checking an electronic check box at the bottom of the information sheet. After providing consent, all participants are asked a series of demographic questions along with items assessing intentions to become a parent. After completion of these items, participants were randomised within survey software Qualtrics to one of two conditions: (1) preconception video; and (2) no video using the built-in randomisation function of Qualtrics.

The first condition was the intervention group which was asked to watch the preconception health promotion video outlined in chapter 6. The second condition was a no intervention control group which did not have any intervention content and participants are instead moved onto the next section of the survey measuring the IMB constructs. This section of the survey was completed by all participants regardless of which condition they were randomised to; the only difference was when participants received it. For those randomised to condition 1, acceptability measures follow directly after the video before participants move on to complete the same set of questions answered by those in condition 2 which assess each construct of the IMB model.

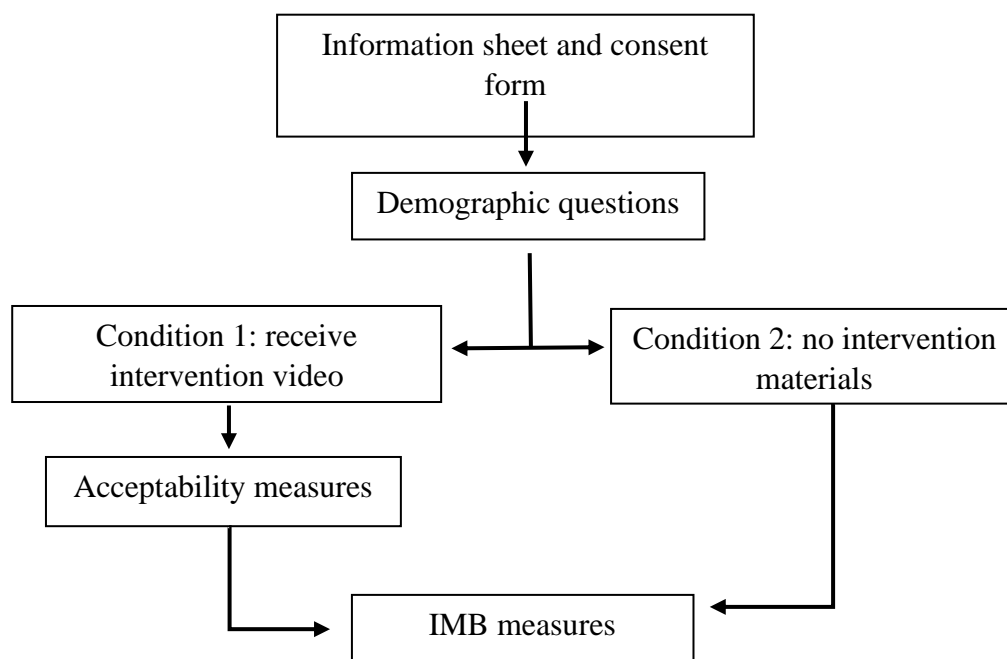


Figure 7.1 Flow diagram of the two intervention conditions and their respective survey routes

7.2.5 Analysis

The statistical software package for the social sciences (SPSS) was used to analyse the data collected. Raw survey data was downloaded from qualtrics and incomplete participant responses were removed. Responses were removed if only the demographic section had been answered and if participants completed less than 50% of the items measuring IMB constructs. For research aim one, a one-way ANOVA was carried out to compare mean scores for each IMB construct for the intervention and non-intervention group. For research aim 2, descriptive data was calculated for each TFA item, including means and frequencies.

7.2.6 Coding

The survey consisted of two blocks of questions, with one assessing each construct of the IMB and the second measuring acceptability. Items in both blocks of questions were measured using a five point likert scale. The likert scale was presented consistently across both blocks of the survey from strongly agree to strongly disagree, whereby strongly agree resulted in a score of 1 and strongly disagree resulted in a score of 5. As mentioned in 7.2.3, these items were reverse coded in SPSS to give a score ranging from 1 (strongly disagree) to 5 (strongly agree). For the items measuring the IMB constructs this meant a higher score

indicated greater knowledge, motivation and behavioural skills. For the acceptability items, a higher score indicated greater acceptability.

7.2.7 Ethical approval

Ethical approval was granted by the University of Stirling General University Ethics Panel (GUEP). See appendix 7 for letter of approval.

7.3 Results

7.3.1 Participant demographics

A total of 130 people completed the survey (video group n=67, no video n=63) which, considering 188 participant attempts were made, yielded a 69% survey completion rate. Within the 58 responses who were excluded due to incomplete responses and drop out, 6 identified as men and 52 as women. Of the 130 participants who completed the survey, 106 identified as female (82%), 19 as male (15%), four as non-binary (3%) and one participant did not specify their gender. The majority of participants had achieved a university degree (n=87, 67%), with 13 having achieved a higher national diploma (HND) or equivalent (10), 19 people had completed their A levels/advanced highers (15%) and 11 listed GCSEs/standard grades as their highest educational attainment (8%). The mean age of participants was 30 with a range from 18 to 45.

Ninety seven participants stated they did not have children (75%) with 33 stating they were currently parents (25%). The majority of participants (n=73, 56%) did not have any plans for pregnancy or had longer term plans to become pregnant in the next 3-5 years (n=32, 25%).

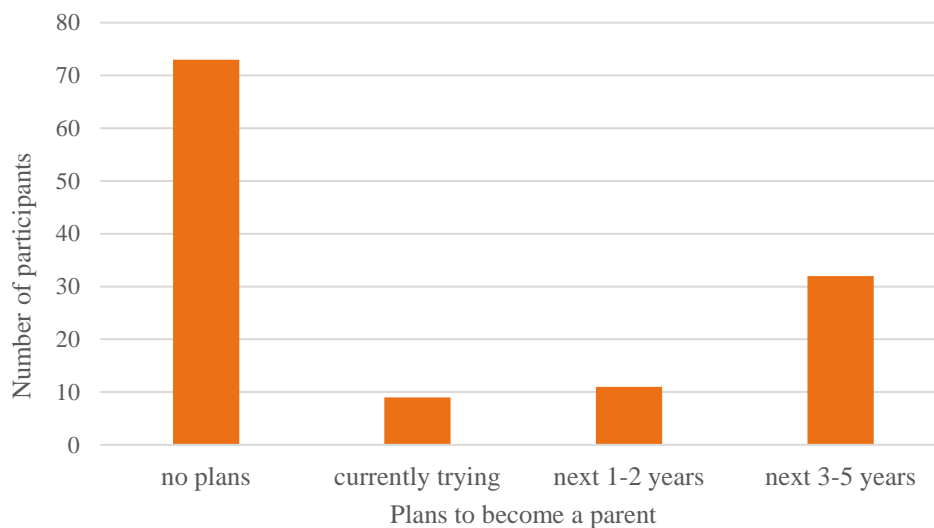


Figure 7.2 Participants plans for parenthood

7.3.2 Research aim 1: Assess whether the intervention can improve knowledge, motivation and perceived behavioural skills

A one way ANOVA was conducted to compare the effect of the intervention on scores for information, motivation and behavioural skills constructs in the video and no video condition

group. There was a significant effect of the intervention video on greater knowledge scores [F(1,126)=8.47, p=0.004, $\eta^2=0.063$] where the mean score for knowledge was 4.44 (SD=.48) in the intervention group and 4.12. (SD=.76) in the control group. There was no significant effect of the intervention video on motivation scores [F(1,126)=3.64, p=0.059, $\eta^2=0.028$] where the mean score for motivation was 4.32 (SD=.54) for the intervention group and 4.09 (SD=.76) for the control group. for the intervention There was also no significant effect of the intervention on scores for behavioural skills [F(1,123)=3.00, p=0.086, $\eta^2=0.024$] where the intervention group had a mean score of 4.13 (SD=.88) and the control group had a mean score of 3.85 (SD=.92). The mean scores for each IMB construct are presented in figure 7.3.

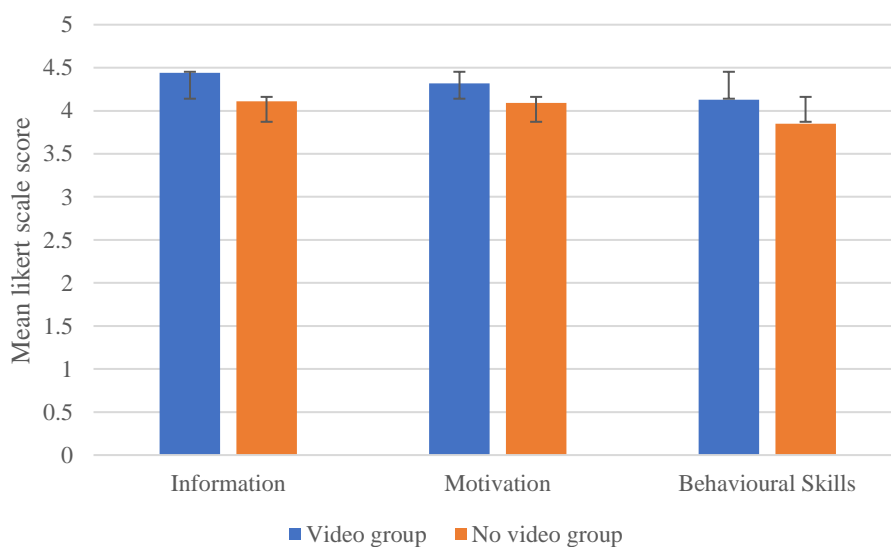


Figure 7.3 Mean Likert scores for each IMB construct for the video and no video group

Table 7.2, below, presents the mean scores for each TFA component along with the percentage of participants who answered agree or strongly agree, resulting in a score of 4 or 5 respectively. The highest mean score achieved was for the opportunity costs component (“Watching the videos did not take up too much of my time”) which was one of three components for which 100% of participants responded with agree or strongly agree. The component with the lowest mean score was affective attitude (“The video was enjoyable to watch”) with a score of 4.10 and 96.7% of responses given being agree or strongly agree. Whilst affective attitude had the lowest mean score, the component with the lowest percentage of strongly agree/agree responses of 93.2% was for self efficacy (“I am confident I would be able to follow the advice mentioned in the video”).

Table 7.2 Mean likert scale responses regarding the acceptability of the preconception health promotion video

Component	N	Mean	SD	% strongly agree or agree
Affective Attitude	60	4.10	0.63	96.7
Intervention effectiveness	62	4.48	0.50	100
Coherence	62	4.55	0.50	100
Ethicality	59	4.66	0.80	94.9
Burden	61	4.69	0.65	98.4
Self-efficacy	59	4.53	0.82	93.2
Opportunity costs	63	4.73	0.45	100

7.4 Discussion

7.4.1 Statement of findings

Findings from this acceptability study suggest that the developed preconception health promotion video may be effective at improving knowledge of preconception health among people of reproductive age. The video can be used to inform the foundations of improving peoples understanding of preconception health to facilitate further work to improve motivations to engage in preconception health promoting behaviours and increase perceived behavioural skills. The video appeared to be received positively by being perceived as an acceptable length, effective at conveying the target health messages and being inoffensive to study participants.

7.4.2 Integration with the literature

This is the first study to develop an educational video on preconception health for the general population which is based on behaviour change theory. Video interventions have been used previously within the preconception population however to improve the understanding of the general public regarding genetic carrier screening. A recent study explored the effects of an education video and a text summary on improvement in genetic knowledge, perceived severity of autosomal recessive disorders, perceived risk of being a carrier and attitudes towards screening (Conijn et al., 2020). The study findings were similar to this preconception health promotion video whereby the group exposed to the intervention video showed greater knowledge, post intervention. Conijn et al. (2020) also found a difference between their two intervention groups regarding attitudes towards genetic carrier screening with the video group viewing it more favourably and stating greater intentions to participate in screening.

Their study supports the use of video interventions as a method of increasing knowledge of preconception health topics, and whilst Conijn et al. (2020) focuses on a specific health risk, the findings are comparable with the current study. Differences within the findings lay within attitudes and motivations to engage in the target behaviours. Conijn et al. (2020) found significant differences regarding intention to participate in carrier screening with those in the video condition having greater intentions. The current study did not measure intention to engage in preconception health promoting behaviours, however participants were presented with items measuring their motivations to prepare their health for pregnancy. This study found that the video group had greater motivation to prepare for pregnancy however this did not reach significance. Support from the literature appears to be centred around videos being

an effective method of increasing awareness and knowledge on preconception health topics. It is important to note that similar to IMB model measures in the current study, Conijn et al. (2020) measured intentions after participants had been exposed to interventions materials and inferences can only be made regarding short term effects of the video.

The findings from this study build on suggestions made by Scott et al. (2020) who carried out a qualitative interview study using the IMB model to explore influences on behaviour change before conception among women with overweight and obesity. Due to women in their study prioritising health during pregnancy rather than before conception, (Scott et al., 2020) suggested that providing information regarding the risks associated with overweight and obesity before conception may improve motivation. Findings from the study presented in this chapter suggest that an intervention video which provided information regarding the preconception period and the importance of being in good health before conception did not significantly increase motivation to prepare one's health for pregnancy. Whilst our study was carried out with a different population including different genders with weight status not being measured, it suggests that information provision may not be sufficient to improve motivation. Scott et al. (2020) reported that motivation is influenced by family members but also by a desire to fit societal expectations to have a particular aesthetic. Being motivated to engage in health promoting behaviours for aesthetic reasons was discussed in chapter four and was associated with those who were not actively planning to conceive. Whilst information provision is important to improve people's knowledge of why health before conception is important, more research is required to develop behaviour change interventions which build on the intervention tested in this chapter.

7.4.3 Future research

This study followed MRC guidance to assess the acceptability of a preconception health promotion video to improve understanding of preconception health and measured its effectiveness at doing so by basing the video content on the IMB model. Findings show that the video was acceptable to people of reproductive age and was effective at conveying key preconception health messages as measured by the IMB information construct and the acceptability measure of intervention effectiveness. Continuation of intervention development from the research outlined in this chapter are feasibility and implementation studies in accordance with MRC guidance. A feasibility study could address limitations with the design of the study, in this case the recruitment of men. Implementation research will also

build upon the findings presented in this chapter by assessing the impact of the intervention in a primary care setting, for example, in community pharmacy as introduced in chapter 6.

The preconception health promotion video did not reach significance regarding motivation and behavioural skills. Given that the primary aim of the intervention was to improve knowledge, these findings were not unexpected due to the varying influences on motivation and contextual factors which are associated with behavioural skills. More research is needed to improve both; however, intervention content will need to be specific to certain populations. As discussed in section 7.4.2, motivations to engage in health promoting behaviours varies across population groups. Evidence from chapter 4 suggested that motivations to engage in health promoting behaviours before conception differed depending on a person's life stage and pregnancy intentions. Highlighting the benefits of engaging in preconception health promoting behaviours may be effective at improving motivation among those planning to become pregnant in the near future, whereas for people who have no plans or long term plans, a different approach may be needed.

Regarding differing stages of pregnancy planning, a challenge faced by researchers within the field of preconception health is the frequency of unplanned pregnancies. It is difficult to target people planning a pregnancy to deliver focused preconception health promotion when a large proportion of the population have not planned their pregnancy. Therefore, efforts to increase motivation to engage in health promoting behaviours should be tailored to specific sub populations which fall under the umbrella of "preconception population".

Considering behavioural skills, the same approach described in the paragraph above should be taken whereby different sub populations will exist within the preconception population and their differing needs will require different approaches. Cooking skills have importance regarding dietary quality for example, with greater cooking skills being associated with lower intake of saturated fats (McGowan et al., 2016). Alongside this example, it must be acknowledged that other factors in an individual's life can affect their ability to eat healthily such as availability of healthy food, understanding of nutrition and personal finances. These external factors can also influence other behaviours such as physical activity. The built environment can influence an individual's ability to engage in physical activity, as evidenced by a systematic review which identified that accessibility of walking and cycling routes was associated with increased physical activity (Kärmeniemi, Lankila, Ikäheimo, Koivumaa-Honkanen, & Korpelainen, 2018). Therefore, this suggests there are multiple external factors

influencing a person's ability to engage in specific health behaviours and these must be considered in addition to increasing an individual's knowledge of the importance of engaging in specific health promoting behaviours.

7.4.4 Strengths and weaknesses of the study

This study is the first to test the effectiveness of an educational preconception health promotion tool which was co-designed with members of the target population. The use of co-design in the development process facilitated the development of a video which was appropriate and acceptable to the target audience. A strength to measuring the acceptability of the intervention using the TFA (Sekhon, Cartwright, & Francis, 2017) allowed a theory-based structure to be followed during data collection.

A strength to the study was the change in knowledge scores reaching significance, however a weakness is that the effect size was small. Whilst the significant difference between knowledge scores between the video and non-video group is promising initially, testing the intervention video on a larger scale is required.

Another strength to the study was the promising acceptability findings. To go further and ensure that the video is acceptable for specific sub-populations, testing on a larger scale is required. This will allow the addition of sub-group analyses which will provide more information of groups who are difficult to engage or who may be more at risk of not engaging in recommended health promoting behaviours such as men, people living in areas of socio-economic disadvantage and can allow comparisons to be made across age groups and stages of pregnancy planning.

A weakness to the study regarding acceptability measures however was the lack of qualitative measures which would allow more insight into why participants selected their chosen responses. For the ethicality measure, one participant selected disagree as their answer, implying that they found an element of the video offensive to them. The addition of a text box within the online survey would allow participants to expand on their reasoning and provide opportunities for the research team to consider if revisions should be made to specific video content. The study would further benefit from the addition of qualitative methods to aid in the translation of TFA components into direct questions within the context of the preconception video which can be expanded upon.

Recruiting men proved a challenge despite efforts to target men's sports teams. Of the responses that were excluded due to incomplete responses, six responses were from men indicating lack of response cannot be attributed to drop out and may be associated with lack of initial engagement. The study would benefit from a larger sample of men to draw inferences regarding any gender differences between acceptability measures and IMB constructs. Additionally, whilst efforts were made to recruit a varied target population, the study population was relatively well educated and this must be noted as a weakness which should be considered in subsequent research.

7.4.5 Conclusions

In conclusion, the educational preconception health video was deemed acceptable by people of reproductive age and was effective at improving knowledge of the preconception period and the importance of optimising health during this time. Motivation to engage in health promoting behaviours and the ability to acquire the necessary skills to perform those behaviours varies across different population groups and requires tailored interventions which target the needs of these different subpopulations.

CHAPTER 8: DISCUSSION

This thesis has presented the systematic development of a theory-based intervention designed using the MRC framework to improve knowledge of preconception and the importance of optimising health in preparation for pregnancy. The thesis had two objectives. Firstly, to develop an understanding of what behavioural recommendations were currently available for people planning a pregnancy, how often these behaviours are engaged in and what people know and believe about health before conception. Secondly, to develop a theory-based behaviour change intervention to optimise the health of people planning a pregnancy.

The aim of this final chapter is to outline: (i) a summary of the thesis findings, (ii) a comparison of the thesis findings with the wider literature, (iii) the implications of the thesis findings, (iv) thesis strengths and limitations, (v) reflections on PPI and (vi) conclusions and recommendations for future research.

8.1 Summary of thesis findings

The findings from the thesis are outlined below in terms of the two thesis objectives.

8.1.1 Objective 1: Develop an understanding of preconception health and care by reviewing recommendations and guidelines about preconception care, examine knowledge and beliefs about preconception health and examine behaviours performed prior to conception

Chapter 1 introduced the problem of childhood obesity, its implications for health, its causes and intervention efforts to prevent it. This provided a rationale for the research undertaken and introduced the preconception period as a key time for intervention to prevent childhood obesity and its associated co-morbidities. Chapter 2 presented a narrative review of preconception recommendations and policy within Scotland and the UK. Findings indicated that guidelines are consistent regarding the inclusion of folic acid supplementation, weight management, alcohol consumption and smoking. There was some variation in the specificity for all behaviours except for smoking and alcohol consumption where abstinence was recommended in all guidelines. Differences within preconception guidelines also arose regarding the lack of inclusion for men and partners whereby they were not included in any recommendations for physical activity and were only included by the Health Council of the Netherlands for alcohol consumption. Chapter 3 examined how the key preconception behaviours identified in chapters 1 and 2 are engaged in across Scotland. Findings indicated that there is low engagement in multiple health behaviours across the preconception

population however engagement was low particularly among non-planners and people living in areas of economic disadvantage. Chapter 4 (systematic review) provided more contextual information to develop an understanding of why people do or do not choose to engage in health promoting behaviours before conception, what knowledge they have of preconception health and their attitudes towards it. Findings showed that people lack knowledge of what preconception health is and why it is important. Stage of pregnancy planning influenced what motivated people to improve their health, with non-planners prioritising physical appearance and planners being more receptive to preconception health information. There was a preference for receiving information online with health professionals being considered when complications arise. Whilst key groups who would benefit from intervention were identified in chapter 3, chapter 4 evidenced that across the general preconception population, there is a lack of understanding of what preconception means and why it is important. These findings informed the next stage of the thesis which involved the development of a theory-based intervention to improve knowledge of the preconception period.

Ensuring that people are aware of a behaviour is important before engaging in research to help them improve their engagement in it. Various behaviour change models depend on the individual being aware of a behaviour and placing value upon their perceived outcomes associated with engagement in that behaviour. An example of this is the health belief model in which engagement in the target behaviour relies on an individual's perception of the outcomes of engaging in or abstaining from a particular health behaviour (Maiman & Becker, 1974). The model considers the individuals beliefs that engaging in a health behaviour will have a particular outcome and the value they place on that outcome. This is relevant in the area of preconception health and the evidence gathered in chapter 4 whereby the understanding of what preconception health is and the value of engaging in health promoting behaviours before conception is not understood. Raising awareness of the preconception period, why it is important and how to optimise health before conception is important to ensure that behaviour change interventions can build on this knowledge and consider the needs of specific groups within the preconception population.

8.1.2 Objective 2: Develop an evidence and theory based multiple behaviour change intervention to optimise health of people planning a pregnancy

Objective 2 was guided by the MRC framework guidance by involving continuous engagement with the PPI group. This ensured that appropriate measures were taken to develop an intervention which was appropriate for the target population and would be

acceptable to test in a real world context. This development in line with the MRC framework guided chapter 5 and 6, leading to testing effectiveness and acceptability in chapter 7.

Chapter 5 outlined the role of Patient and Public Involvement (PPI) in developing the intervention, mainly in terms of the FoD, from conceptualisation of how the intervention would be delivered to the script and animation details included in the final version of the intervention. Chapter 7 then presented the evidence from an experimental online survey which assessed the impact of the video on knowledge, motivation and behavioural skills along with its acceptability. Chapter 6 outlined the systematic process used to develop the theory based intervention. This includes the selection of an appropriate theory (IMB), the target population and the format of delivery (FoD) of an animated video. Chapter 6 outlined how the selected theory, the Information-Motivation-Behavioural Skills model, was used to create a script with supporting animation. The aim of the intervention video was to improve knowledge of what preconception health is and why it is important, alongside improving motivation and perceived behavioural skills which were secondary outcomes. Chapter 7 shows that the intervention video was deemed acceptable to people of reproductive age and was effective at improving knowledge of the preconception period. It also evidenced that whilst the intervention video was effective at improving knowledge, it did not improve motivation or perceived behavioural skills to a level that reached significance.

8.2 A comparison of the thesis findings with the wider literature

This section will relate key findings from each thesis objective to the wider literature to compare findings and evaluate what this thesis adds. From objective 1, the key findings which will be discussed are the identification of specific population groups which may be at risk of not engaging in health promoting behaviours before conception, the problem of limited knowledge and awareness of preconception health and the role of pregnancy planning and receptivity to preconception health information. From objective 2, the key findings which will be discussed are the acceptability of using an animated informational video and the effectiveness of the online intervention regarding knowledge improvement and the need for more tailored intervention to target motivation and behavioural skills required to engage in health promoting behaviours.

8.2.1 Identification of specific groups at risk of not engaging in health promoting behaviours

Findings from chapter 3 allowed the identification of subpopulations which may be at risk of not engaging in recommended health promoting behaviours before conception. The two

groups identified were people living in areas of socio-economic disadvantage and those not actively planning to become pregnant.

Findings which suggest that socio-economic disadvantage is a risk factor for less engagement in preconception health promoting behaviours, align with the wider literature. Economic disadvantage is associated with limited accessibility of healthy food and safe areas to engage in physical activity (Kramer et al., 2017) alongside complex biological processes associated with experiencing chronic stress due to financial instability (Cubbin, Kim, Vohra-Gupta, & Margerison, 2020). These findings relate to evidence presented in chapter 1 where parental obesity before conception is associated with obesity in children. Specifically, 1 in 4 children whose mother had obesity in the first trimester of pregnancy were obese themselves (Whitaker, 2004). Due to the associations between body composition before conception and childhood obesity, intervening among people living in areas of economic disadvantage should be prioritised. As introduced in chapter 1, 1 in 3 children living in areas of economic disadvantage are obese (Davies, Mytton, & Pawson, 2019). There are a myriad of factors which may influence engagement in health promoting behaviours among people living in areas of socio-economic disadvantage, and they must be identified and addressed in behaviour change interventions to reduce the risk of childhood obesity among this demographic.

Planning status was also associated with less engagement in health promoting behaviours whereby those actively planning to conceive were more likely to engage in health promoting behaviours such as folic acid supplementation, healthy eating and avoidance of smoking and alcohol consumption. It must be acknowledged that despite greater engagement in multiple health behaviour change among planners, the composite scores analysed in chapter 3 were low for both groups with the mean score for planners being 1.5 out of a possible 4. These findings align with the wider literature whereby engagement in health promoting behaviours was not any greater among people actively planning to conceive and those who were not with the exception of folic acid (Chuang, Hillemeier, Dyer, & Weisman, 2011). Similarly, a retrospective cohort study using data from the Southampton Women's Survey found little difference in engagement in health promoting behaviours between those who were planning a pregnancy and those who were not (Inskip et al., 2009). The survey included 12,445 women and measured engagement in folic acid supplementation, alcohol consumption, smoking, healthy eating and physical activity. Women who became pregnant within 3 months of survey completion were deemed as having planned pregnancy by the authors and engaged in these

behaviours with a similar frequency to women who did not become pregnant. The findings from chapter 3 and the wider literature can be considered within the context of the model of preconception action phases (Barker, Mary et al., 2018). People who were not actively planning to conceive did not prioritise their health and were more focused on other life goals such as achieving financial and relationship stability, which was echoed by findings in chapter 4.

8.2.2 Limited knowledge and awareness of preconception health and its importance

Chapter 4 provided contextual information which highlighted potential explanations for the lack of engagement in preconception health promoting behaviours described in chapter 3. One theme from the systematic review conducted in chapter 4 was that across people of reproductive age, there is limited knowledge of the preconception period. There appears to be some awareness of important behaviours such as refraining from smoking and alcohol consumption and increasing physical activity and having a healthy diet. Whilst there was an awareness of the importance of engaging in certain behaviours, such as healthy eating, there was a lack of understanding as to what a healthy diet should look like and limited understanding of micronutrient supplementation. There may be multiple explanations as to why there was greater awareness of certain behaviours, for example, smoking cessation and alcohol consumption. Evidence from chapter 3 shows that throughout preconception recommendations, smoking and alcohol consumption were the only behaviours for which guidance was consistent. Consistency within public health messaging is vital to avoid confusion regarding the safety of engaging in particular health behaviours. This was illustrated during the coronavirus pandemic in which a qualitative study using focus groups to explore attitudes to public health messaging found that inconsistencies in health messaging led to confusion regarding the health benefits of engaging in health protective behaviours such as mask wearing (Zhang, Young Leslie, Sharafaddin-Zadeh, Noels, & Lou, 2021). These findings can be applied to preconception health behaviours whereby consistent public health messaging which is focused and easy to understand can reduce confusion regarding the safety of engaging in specific health behaviours.

Regarding behaviours such as eating a healthy diet and supplementing with micronutrients, the specificity of guidelines presented in chapter 3 differed. Lack of clarity regarding what a healthy diet should consist of was acknowledged as a barrier to healthy eating in the general population in a systematic review and meta-ethnographic synthesis (Zorbas et al., 2018). The

review found that poor knowledge regarding nutrition and limited cooking skills presented a barrier to eating healthily, particularly amongst those living in areas of economic disadvantage. This lack of understanding of what a healthy diet looks like is reflected across the general population. Findings from a cross sectional analysis of a survey measuring consumption of food and intake of micronutrients in Germany indicated a lack of nutritional knowledge, particularly regarding the conceptualisation of a balanced diet and the benefits of eating fruits and vegetables (Koch, Hoffmann, & Claupein, 2021).

The limitations of knowledge regarding the preconception period extend to perception of health risks whereby this was often discussed in the context of pregnancy, suggesting limited awareness of the benefits of optimising health before conception. This relates to the wider literature whereby a lack of understanding regarding the health benefits of supplementing with folic acid before conception translated to a lack of engagement in the behaviour (Bayrami, Didarloo, & Asadinejad, 2020). When women understood the role of folic acid within the body and the potential to reduce the likelihood of NTDs they engaged more in supplementation, suggesting that information provision should be prioritised to improve understanding of why engaging in health promoting behaviours before conception is important (Zadarko-Domaradzka, Kruszyńska, & Zadarko, 2021). This evidence highlights the importance of providing focused health information to empower people to make decisions to optimise their health in preparation for pregnancy. Providing this information to the preconception population regardless of pregnancy planning status has the potential to improve engagement in the behaviour and aligns with recommendations from the life stage model whereby non-planners should still receive some preconception specific health information (Barker, Mary et al., 2018).

Whilst provision of health information regarding the benefits of engaging in health promoting behaviours is recommended, it is important that wider determinants of health are considered and that this work is not considered in isolation. Due regard should be paid to the environment a person lives in and the influence of their society. The social ecological model can be used to consider the external influences which impact a person's ability to engage in health promoting behaviours (Walker, Drakeley, & Boyle, 2021). These include the persons social networks, the environment they live in, the social norms and values of their community and public policies. Providing preconception health information is beneficial from the perspective of the broader environment, however information and interventions delivered should be tailored to consider influences such as a persons community, interpersonal

relationships and individual needs. Whilst people living in areas of economic disadvantage were recognised as an at risk group, the importance of improving peoples understanding of the importance of preconception health regardless of socio-economic status was prioritised. To ensure that health inequalities were not exacerbated whilst information provision for the preconception population was provided, the interventions co-design with people experiencing economic disadvantage was invaluable.

8.2.3 The role of pregnancy planning and receptivity to health information

Chapter 3 facilitated the identification of at-risk groups within the population regarding lack of engagement in health promoting behaviours, namely those not actively planning a pregnancy. However, these findings were expanded on in chapter 4 whereby planners and non-planners were found to prioritise different behaviours when thinking ahead to pregnancy. Those not actively planning a pregnancy prioritised financial and relationship stability whereas those who were actively planning a pregnancy were more likely to prioritise their health. These findings relate to the three defining attributes of the preconception population introduced in chapter 1 (Hill et al., 2020). For people planning to become pregnant there may be an opportunity to present focused health information to facilitate behaviour change and address some of the knowledge gaps identified in chapter 4 and outlined above in section 8.2.2. For people not planning a pregnancy, motivation to engage in health promoting behaviours was often centred around a desire to appear physically attractive and they were less interested in receiving preconception specific health advice despite agreeing that this information is important. These findings also adhere to the second stage of the model of preconception action phases where intervention efforts targeting an adult who has no immediate intention of achieving pregnancy should focus on promoting general good health whilst providing education regarding the importance of the preconception period.

It must be acknowledged that within those actively planning a pregnancy, whilst they are generally more receptive to preconception health information, this can be influenced by previous pregnancy experiences. This was reflected in findings presented in chapter 4 whereby one participant expressed regret after experiencing pregnancy complications during their unplanned pregnancy. Previous pregnancy experiences appraised in a positive way have been associated with less engagement in health promoting behaviours compared to those who had a negative experience in a previous pregnancy who then prioritised seeking information and preparing for pregnancy. Intervention opportunities for this population have been

identified in the prevention of post-natal weight gain and improving dietary habits (Oteng-Ntim et al., 2018).

8.2.4 The acceptability of an informational video to promote preconception health

Findings from chapter 7 support the use of an animated informational video to provide preconception health information. The informational video which was developed was found to be acceptable to people within the preconception population as a method of health promotion. Whilst, to our knowledge, this is the first informational preconception health video which has been developed and tested for acceptability among people of reproductive age, this method of information sharing has been deemed acceptable for other health topics. A study exploring the impact of an educational video on improving knowledge of skin cancer and intentions to engage in protective behaviours regarding sun exposure among young women in Australia found that it was deemed acceptable (Hughes-Barton, Hutchinson, Prichard, & Wilson, 2021). The video used to educate participants on the dangers of sun exposure was five minutes long and included melanoma survivors and friends and family of those who died from melanoma who spoke about risks associated with skin exposure. When the acceptability of the video was explored, participants stated that they learned key information they could use to protect their health and that they would share the video on social media because they felt the educational messages included were important. A criticism of the sun exposure video was the length, whereby participants felt that people may not feel motivated to watch the full video and could lose concentration. This limitation was considered in the development of the preconception health promotion video as evidence gathered in chapter 4 emphasised that an appeal of online information was the ease of which it could be accessed. To appeal to the preferences of the preconception population regarding information seeking, the preconception health promotion video was approximately 1 minute in length. Acceptability findings in chapter 7 showed that participants felt the video did not take too long to watch and was not viewed as a burden to watch.

Informational videos have also been used for behaviour change interventions regarding the provision of smoking cessation information for people experiencing mental illness (Sharma-Kumar, Puljević, Morphett, Meurk, & Gartner, 2022). Participants completed a survey measuring smoking cessation knowledge before watching six videos which provided information on smoking cessation and then completed surveys assessing their knowledge post videos and how acceptable they found the videos in terms of their content and quality. Videos

were deemed acceptable in terms of their relevance, ability to improve a viewer's self-efficacy and effectiveness at communicating the target health messages in a comprehensible way. These findings are similar again to those discussed in chapter 7 whereby the preconception health promotion video was deemed acceptable regarding the communication of health information in a comprehensible way that improved self-efficacy of the viewer to follow the advice provided.

Whilst there are no studies examining the acceptability of health promotion videos before conception with which the preconception health promotion video can be compared, the studies discussed in this section suggest that educational videos are deemed as an acceptable method of information provision. As discussed in chapters 6 and 7, lack of awareness of the importance of preconception health among the general population may influence engagement in time intensive behaviour change interventions. Providing health information in a video format that is easily accessible, focused and comprehensible whilst not requiring motivation to spend time and effort engaging with materials is a viable method of improving people's knowledge of preconception health regardless of their planning status or health literacy levels.

8.2.5 The effectiveness of an informational video to improve knowledge of preconception

As discussed in chapter 7, some research has been conducted to assess the impact of educational health promotion videos on the improvement of knowledge of health risks before conception. When knowledge of expanded carrier screening was tested after exposure to an educational video, study participants who viewed an educational video scored higher for knowledge improvement than those who were presented with the same information in text summary (Conijn et al., 2020). These findings are similar to the pilot study findings presented in chapter 7 whereby the use of an educational video was effective at improving participants knowledge of preconception health risks.

Alongside being deemed an acceptable method to provide preconception health information, the intervention video was found to be effective at improving knowledge of the preconception period and its importance. These findings relate to the wider literature as an online approach to preconception health promotion has been taken previously. A study which used an online conversational agent to identify individual's health risks and assist them in making behavioural changes to reduce their identified risks to health (Jack et al., 2020). The online conversational agent was found to be effective to assist people in changing their

behaviour to reduce their individual health risks over a 12 month period when compared to a control arm which provided health information in the form of a letter advising consultation with a health professional. Findings from this thesis can add to this work firstly by providing evidence that online intervention can be effective for the preconception population. However, findings from this thesis also add to the evidence that an online approach to health intervention before conception may provide opportunities to target different groups within the preconception population.

8.3 Implications of the thesis findings

The findings from this thesis which have been explored in section 8.2 have considerable implications for future research and preconception health promotion regarding (i) targeting specific populations using appropriate methods, (ii) the importance of a public health approach alongside more tailored individual approaches to developed interventions and (iii) the potential dissemination and use of the preconception health promotion video developed as part of this thesis.

8.3.1 Targeting specific populations using appropriate methods

The identification of differing priorities before conception between those who are actively planning a pregnancy and those who are not have implications for how behaviour change interventions should be delivered. Any intervention aiming to promote engagement in health promoting behaviours in the preconception population should have a clearly defined target population and consider their motivations and attitudes towards pregnancy preparation.

Findings from chapter 4 indicate a shared problem between planners and non-planners which is limited knowledge of the preconception period and its importance. There is a clearly identified need to educate people on the importance of optimising health during this time to reduce risks to health during pregnancy and after birth. However, due to the differing priorities of planners and non-planners, care should be taken regarding how this information is delivered. Chapter 3 evidenced that planners are more likely to engage in health promoting behaviours before conception and chapter 4 indicates that they are also more receptive to receiving health information that is centred around preparing health for pregnancy.

8.3.2 The importance of a public health approach alongside more tailored individual approaches to developed interventions

The preconception health promotion video was found to be effective when improving people's knowledge, however, it did not increase motivation or behavioural skills significantly in the intervention group compared to the control group. These findings can be attributed to multiple factors such as different motivators to engage in health promoting behaviours as stated in chapter 4, and also differences in behavioural skills which may be due to accessibility of healthy food and safe areas to exercise, personal finances and practical skills such as cooking ability. These differing skill requirements and motivations should be targeted in more tailored interventions which identify at risk populations and develop interventions which include relevant support to facilitate behaviour change.

The effectiveness of the preconception health promotion video at improving knowledge has implications for public health level interventions. Findings from chapter 4 suggested that there is a lack of knowledge across the preconception population and limited understanding of why it is important to engage in health promoting behaviours before conception as opposed to waiting until pregnancy. By disseminating the preconception health promotion video on social media or through educational websites, there is an opportunity to create an awareness of preconception health across the preconception population. As discussed in chapter 6, a population level approach can improve the preconception knowledge of those planning a pregnancy, however information can also reach people not actively planning and can inform future decision making (Lynch et al., 2014).

The findings from chapter 7 indicate that whilst the preconception health promotion video was effective at improving knowledge, it did not improve motivation or behavioural skills. This indicates that focused research is required to find methods of translating knowledge into action, which will require different approaches for the different groups within the preconception population. These findings have implications for research whereby more tailored interventions are required to address the motivations associated with different subpopulations within the preconception population which are introduced briefly in chapter 4. A potential method of developing these tailored interventions is to use efforts such as PPI to ensure that the developed interventions are relevant to the target population. For example, in chapter 4 findings suggested that non-planners are motivated to engage in health promoting behaviours to appear more physically attractive. However, they may also benefit from exposure to information about preconception health to inform future decision making should they start to plan to become pregnant. By involving a PPI group in the development of an intervention for this subpopulation, there may be scope to develop behaviour change

interventions which do not overwhelm non-planners with too much information related to preparing for pregnancy when this does not feel relevant to them. These interventions can aim to facilitate engagement in health promoting behaviours for the improvement of general health, whilst also beginning to introduce the concept of preparing for pregnancy as a social norm.

Findings from chapter 7 also indicate that improvement of the behavioural skills required to engage in health promoting behaviours before conception may require more tailored intervention efforts. Taking time to define the barriers to behaviour change faced by different groups within the preconception population can allow the development of behaviour change interventions which facilitate improvement of behaviour specific skills and can bridge the gap between knowledge and action. In chapter 4, a lack of understanding of what a healthy diet entails, with conflicting health messages causing overwhelm and disengagement. By including PPI groups in the development of interventions to improve health behaviours across different groups within the preconception population, the relevant skills requiring development can be identified and prioritised.

8.3.3 The potential dissemination and use of the preconception health promotion video developed as part of this thesis

The preconception health promotion video has the potential to be disseminated online which would appeal to information seeking preferences found in chapter 4. However, there are significant opportunities to target at risk populations identified in chapter 3 by incorporating the video into health promotion efforts within community pharmacy.

Regarding online dissemination, there is potential for the video to be shared widely on social media or embedded in informational websites offering advice and guidance for people planning a pregnancy. As introduced in chapter 6, a survey study exploring women's preconception information seeking behaviour using social media found that 32% of women surveyed used social media to find health information specifically for preconception (Skouteris & Savaglio, 2021). Within this study, none of the women were planning to conceive within the next year, with 73% having no plans to become pregnant and 27% planning to become pregnant within the next five years. These findings suggest a potential opportunity to disseminate the preconception video via social media as a means of reaching non-planners who have been identified in chapter 3 as being at risk of not engaging in health promoting behaviours.

In addition to online dissemination to promote preconception health, there are opportunities to use the informational video within the context of preconception care. The findings within this thesis suggest that across the population, people have limited knowledge and understanding of the importance of engaging in preconception health. Despite this lack of knowledge being prevalent across the population, at risk groups emerge as being less likely to engage in key health promoting behaviours. These were identified in chapter 3 as those not planning a pregnancy and those living in areas of economic disadvantage. A challenge in dissemination of the preconception health promotion video is to increase awareness of preconception health without exacerbating health inequalities. As introduced in chapter 6, an opportunity may lie in community pharmacy, with the potential to incorporate preconception care within locally commissioned services. Community pharmacies are a more accessible health service for at risk groups such as those living in economic disadvantage due to their increased prevalence in these areas, which may contribute to efforts to manage the impact of health inequalities (Finch, Wilson & Bibby, 2023).

Community pharmacies have the opportunity to reach population groups who may be at risk of experiencing adverse health outcomes due to health inequalities. As introduced in chapter 6, the availability of health care is inversely proportionate to the needs of the population and locally commissioned services within community pharmacies have been suggested as a means of providing health care to those most affected by health inequalities. Within the preconception population it has been identified that whilst knowledge of preconception health and its importance is limited among the general population, those living in areas of economic disadvantage and those not actively planning a pregnancy engage less in health promoting behaviours. Intervention within the context of community pharmacy has been suggested as a means of reaching at risk groups via sexual health and preconception care services (Mospan, 2019). A new service within community pharmacy aiming to increase contraception access and prevent unplanned pregnancies is the Bridging Contraception Service launched in November 2021. HW engaged in expert consultation with a practicing pharmacist also working within pharmacy research who identified this service as an opportunity to introduce the concept of preconception health to non-planners in an effort to raise awareness of preconception health and its importance.

Research has been carried out investigating the potential to provide preconception care within pharmacies in the U.S.A. and a survey study including 99 women aged between 18-44 found that many preconception care needs could be addressed in a pharmacy setting (Reidenbach,

Bade, Bright, Mager, & Ellis, 2019). Of the 99 women who completed the survey which included items measuring demographics, health status and pregnancy intentions, 53.5% of women were sexually active and not using a contraceptive which increases their risk of unplanned pregnancy. Preconception care needs identified within the survey that could be met by pharmacists included gaps in vaccination records (79% of survey participants), a need for smoking cessation services (17% of participants identified as smokers) and promotion of supplementation of folic acid (67% of participants did not take it). This research suggests that there may be opportunities to address preconception health risks in a pharmacy setting, through which the preconception health promotion video could be used to introduce the concept of preconception health and its importance to service users.

Whilst it can be seen that there may be opportunities to disseminate the preconception health promotion video within locally commissioned pharmaceutical services, it is important to consider how this could be done and whether intervention in a pharmacy setting would be acceptable to service users. A study conducted in the U.S.A. involving two independent pharmacies aimed to evaluate if screening for preconception health risks in a pharmacy setting could identify opportunities to provide preconception care and inform behaviour change interventions in a pharmacy setting (Luli, Tran, Ataya, & Rafie, 2020). Women aged between 18-50 were invited to complete a health screening form at each pharmacy and also at a community outreach event which aimed to promote the awareness of alcohol free pregnancies. The surveys measured risks to health in different categories, for example, smoking and alcohol cessation, folic acid supplementation, managing pre-existing illness, weight management and illicit drug use. Of the women who completed the survey, 98% had an identifiable risk to health which could be addressed by preconception care services in a pharmacy setting. Over half of participants (56%) expressed interest in preconception care services offered at local pharmacies however only 19% were in favour of attending an appointment. Whilst the interest in visiting these services is low in this study, it must be acknowledged that this study was conducted in the U.S.A. in which payment would have to be made to attend these services in cases when individuals did not have appropriate health insurance. This limitation would not be relevant in a UK population and therefore there may be scope to pursue preconception care services within locally commissioned services in the UK which could incorporate the preconception health promotion video to provide information to the general public.

8.4 Thesis strengths and limitations

This thesis has multiple strengths and weaknesses which span across the two objectives set out in chapter 1. They will be discussed in this section within the context of each objective.

8.4.1 Objective 1 Develop an understanding of preconception health and care by reviewing recommendations and guidelines about preconception care, examine knowledge and beliefs about preconception health and examine behaviours performed prior to conception

A strength of the thesis was the depth of contextual information gathered and analysed to aid in the selection of target behaviours and an appropriate target audience for the developed intervention. This substantial evidence base could then be presented to a PPI group to facilitate the development of a behaviour change intervention which would be acceptable and relevant to the target population.

A strength of conducting the research outlined in chapters 2 and 3 allowed contextual information to be gathered regarding which health behaviours are prioritised and recommended in preconception health guidelines within the UK and across European and western international countries. This allowed identification of key health behaviours, which engagement in could be measured in chapter 3 to develop an understanding of how they are engaged in simultaneously. A weakness of the secondary analysis conducted in chapter 3 is the lack of baseline information regarding how the women included engaged in the target health behaviours prior to the months preceding conception. This had implications regarding inferences being made for behaviours such as smoking and alcohol consumption which were measured in the original survey by asking participants if they had stopped smoking or stopped/reduced their alcohol intake whereby participants who stated no received a score of zero. This would have resulted in a lower score, indicating lack of behaviour change for women who perhaps did not smoke or drink alcohol to begin with.

Another strength to the research carried out to achieve objective 1 was the systematic review of qualitative studies presented in chapter 4. The findings provided contextual information which allowed knowledge improvement to be identified as a key aim for the developed behaviour change intervention. In addition, information was gathered regarding the importance of including men in preconception research to improve their health, but also to reduce stigmatisation of women by ensuring they are not carrying the sole responsibility to protect the health of their future child. These findings allowed decisions to be made regarding the inclusion of men in the study presented in chapter 7, but also for the exclusive inclusion of women in the PPI group to ensure women felt comfortable and empowered by the content

of the intervention. Whilst identification of men's views were a strength of the qualitative review, a weakness is the lack of studies exploring the views of same sex couples and the views of non-binary people.

8.4.2 Objective 2: Develop an evidence and theory based multiple behaviour change intervention to optimise health of people planning a pregnancy

A strength of this thesis was the inclusion of the PPI group in the development of the intervention. Findings from chapter 4 indicated that lack of knowledge of preconception health was apparent across the population, however despite this, at risk groups were identified in chapter 3 as non-planners and people living in areas of socio-economic disadvantage. This resulted in the recruitment of PPI members occurring in areas of disadvantage to ensure that the preconception health promotion video could improve knowledge across the population without contributing to health inequalities.

Whilst the inclusion of a PPI group strengthens the study, a weakness to be acknowledged was that men's views could not be captured. Initially, men had been considered during recruitment. However, as the original plans for the PPI group included conducting focus groups, there were concerns amongst the research team that this may limit the input received from women. Due to the nature of the subject area and the infancy of the area, a decision was made to create an environment in which women could feel comfortable discussing the sensitive topic of reproductive health and their experiences. To build on the work of this thesis, PPI should continue to inform future behaviour change interventions but should involve men's views.

The decision to focus the intervention development on raising awareness of preconception health is both a strength and a weakness to the thesis. This decision was based on evidence gathered in chapter 4. Whilst at risk groups for lack of engagement in preconception health promoting behaviours were identified in chapter 3, the underlying deficit of knowledge and understanding across the preconception population evidenced in chapter 4 and the wider literature led the decision making process, strengthening the research conducted in this thesis. Whilst the development of the intervention being led by the literature strengthens the thesis, a weakness which must be acknowledged is that a behaviour change intervention could not be developed. Due to the infancy of the research area it is important that the research presented in this thesis was conducted to build a foundation for future behaviour change interventions to continue on from.

Regarding the pilot study presented in chapter 7, a strength was the inclusion of acceptability measures. Acceptability is recognised as an important factor in the adherence to clinical intervention (Sekhon, Cartwright, & Francis, 2017). By including acceptability measures in the pilot testing of the preconception health promotion video it was possible to determine that the health messages were comprehensible, inoffensive and were delivered in a format that the target audience would engage with. Weaknesses within the pilot study presented in chapter 7 is the lack of participation from men despite efforts to target organisations in which men exclusively belonged to. This meant that inferences could not be made regarding gender differences regarding acceptability of using an informational video as a means of preconception health promotion or in assessing its effectiveness and improving knowledge.

The lack of participation from men could be addressed by further testing of the intervention video in different contexts. This aligns with suggestions made within the MRC framework whereby evaluation of an intervention should consider different contexts and how they may influence outcomes and implementation (Skivington et al., 2021). This has been discussed in section 8.3.3 regarding the potential involvement of locally commissioned services in community pharmacies. By conducting face to face recruitment in local pharmacies there may be more opportunities to speak to men directly and build up a rapport before inviting them to participate in the survey. Through testing the preconception health promotion video in a practical setting in which it is intended to be disseminated in, there is an opportunity to speak to more men and make inferences regarding the acceptability and effectiveness of the video in a real world setting.

8.5 A reflection on the use of Patient and Public Involvement (PPI) in the development of the intervention

The use of PPI greatly benefitted the development of the intervention video, specifically regarding the format of delivery. The original thesis plan involved greater involvement through volunteering at food banks in deprived areas of Glasgow and Stirling to develop a rapport with people who are part of the target population for the PPI group. This had been anticipated as being an ongoing commitment throughout the project which would allow networking, rapport building with the target population, aid the development of the intervention and pilot study recruitment. However due to the impact of the COVID-19 pandemic this was no longer possible due to national lockdowns and social distancing measures within the UK.

Recruiting remotely in response to the pandemic provided challenges as there were not opportunities to build rapport and trust with potential PPI members and therefore the time taken to recruit was lengthened. This also required adaptation to methods of interaction with the group. In person group meetings had been planned originally whereby all group members could come together with the research team to discuss the project and work collaboratively however this was no longer possible with social distancing measures. To adapt to these challenges and ensure the project progressed, women were invited for an informal chat with HW on the phone. By speaking to women individually as they were recruited, it was possible to start collating their opinions and begin conceptualising the format of the delivery that the intervention could have. Speaking to women individually and explaining the purpose of the project and the rationale for the PhD allowed for rapport to be built and as a consequence, the women offered to share the advertisement in their own social circles which aided in recruitment.

Maintaining the interest of PPI members was challenging when working remotely. Informal communication was the most effective method with this group of women who all had young children and explained that they often found it difficult to commit to specific meeting times and find time to review materials. PPI members who preferred the use of informal methods of communication like Whatsapp were more engaged and could exchange short messages at a time that suited them. The flexibility of using Whatsapp helped to address some of PPI members needs as communication was not time intensive and could be changed to suit the needs of each member. Those who communicated with HW through email were challenging to retain and did not respond to the emails inviting them to participate in the second stage of PPI. To improve retention of PPI members for future projects, a potential method could be to send more frequent updates to PPI members to keep them involved with the intervention development.

An additional challenge with regards to the PPI was the infancy of the research area. At the beginning of the project it was envisioned that a behaviour change intervention would be developed which would be designed alongside people from the target population. However, evidence from phase 1 of the project revealed a need for awareness to be raised regarding the concept of preconception health and its importance among the general preconception population before additional research could begin with at risk groups. This resulted in the work with the PPI group ensuring that the format of delivery of the awareness raising intervention allowed the content to be understood easily and presented in a format that would

be deemed acceptable. Research which builds on that conducted within this thesis can focus on taking forward evidence which identified at risk groups and co-develop more tailored interventions with people from those specific populations.

8.6 Recommendations

Recommendations based on the thesis findings are presented below.

- (i) There is limited understanding of how and why to improve health before conception is limited among the general population. Public health bodies should prioritise the promotion of preconception health to the general population to inform both public health and more tailored intervention efforts.
- (ii) At risk groups include people living in areas of economic disadvantage and those not planning to become pregnant. Health psychologists should target these groups in the development of tailored interventions which address their social norms and motivations.
- (iii) Future research should focus on understanding men's attitudes towards preconception health and their motivations to engage in health promoting behaviours.
- (iv) The inclusion of PPI to inform interventions is essential to ensure the needs and priorities of subgroups within the preconception population are considered in the development of tailored interventions.
- (v) Public health campaigns and behaviour change interventions at the population level should consider using an online approach to reach a large audience at a low cost.
- (vi) Whilst online health promotion efforts are effective at improving knowledge of the preconception period and its importance, future research should focus on identifying the motivators to engage in health promoting behaviours and prioritise them in the delivery of behaviour change interventions.

8.7 Conclusions

This thesis presents the systematic development of a behaviour change intervention designed to improve preconception knowledge, motivation and behavioural skills among people of reproductive age within the UK. It provides an example of how PPI can be used to enhance the development of behaviour change interventions to ensure they are relevant to the target population. The findings present the foundation work for health promotion before conception

by identifying and addressing an important barrier to engagement with preconception care which is lack of awareness that it is beneficial. The use of a preconception health promotion video has been deemed acceptable by the preconception population and has the potential to be used in online health promotion and through locally commissioned services within community pharmacy. Future research should continue to ensure participants understand the importance of improving their health before conception before providing tailored interventions which address the motivations and skill levels of their target population.

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APPENDIX 1: RECOMMENDATIONS FROM REVIEW DOCUMENTS

	Where are specific guidelines found?	Recommendations and guidelines
Maternal age and Interpregnancy	NHS Scotland -Dumfries & Galloway	Highlights risks associated with advanced maternal age (35+) and risks with teenage pregnancy on the developing body if an

intervals (completed pregnancies)		adolescent. Advises 18 month interpregnancy intervals.
	NICE Guidelines	Advise that women over 35 have an increased risk of miscarriage, obstetric conditions and chromosomal abnormalities Pregnancy intervals of 18-59 months with exception on specific circumstances e.g. women of advanced maternal age
	Health Council of the Netherlands	Advises that mothers and fathers over the age of 40 are at greater risk of congenital abnormalities
	Public Health Agency of Canada	18-24 month inter-pregnancy intervals are recommended and advanced maternal age is described as being over 35
Physical Activity	NHS Scotland -Greater Glasgow & Clyde -Dumfries & Galloway	Advise to start regular physical activity before becoming pregnant
	NHS UK website	NHS advice is to walk often, with information on the website regarding suitable activities and strength programmes
	Germany – The Healthy Start – Young Family Network	At least 30 minutes of moderate physical activity 5 days a week
	Public Health Agency of Canada	150 minutes per week of moderate to vigorous physical activity
	Australia – Queensland Government	Advises that women follow the Australian Physical Activity Guidelines of muscle strengthening activity 2 days each week along

		with either 2.5 - 5 hours of moderate intensity physical activity each week or 1.25-2.5 hours vigorous intensity physical activity each week.
Diet	NHS Scotland	
	-Greater Glasgow & Clyde	Greater Glasgow & Clyde and Lanarkshire advise to have a nutritious diet (no specific detail)
	-Dumfries & Galloway	Dumfries & Galloway suggested a diet rich in fruit, vegetables and wholegrains
	-Lanarkshire	
	NHS UK Website	Balanced diet including vitamin C, D, calcium and iron. Those with coeliac disease, a vegan or vegetarian diet should consult their GP.
	NICE Guidelines	Balanced diet based on wholegrain starchy foods, high fibre, 5 portions of fruit and vegetables daily, to limit high fat and sugar foods, eat breakfast and to be aware of portion sizes of meals and snacks and how often they eat.
	Germany Healthy Start	Balanced and varied diet based on general recommendations for adults. Plant based foods and calorie free drinks to constitute the main part of the diet, with moderate consumption of animal-based foods including dairy and to minimise consumption of foods with a high fat/sugar content.
	Health Council of the Netherlands	A varied diet is advised, avoiding liver products to ensure there is no vitamin A excess in the diet
	Public Health Agency of Canada	A diet including fruit and vegetables, meat/meat alternatives, low fat milk, fish and unsaturated oils with limited consumption of processed foods high in salt and sugar. An awareness of cultural differences is advised, as indigenous

communities and those who live in Atlantic provinces in particular are more at risk of food insecurity. It is also advised that diet can be influenced by personal or religious beliefs, cultural practices or health conditions. Health professionals are advised to help women improve their nutrition whilst considering individual needs and circumstances.

Australia – Queensland Government	References the Australian Dietary Guidelines. Daily, women should consume: -5 portions of vegetables (1 portion equates to half a cup of cooked vegetables) -2 portions of fruit (1 portion equates to 1 medium sized piece of fruit) -6 portions of wholegrain/high fibre foods (1 portion equates to ½ cup of cooked rice/pasta) -2.5 portions of lean meat/poultry/fish/eggs/tofu/nuts/seeds/beans/legumes (1 portion equates to 2 eggs/65-80g cooked meat or poultry) -2.5 portions of dairy products (1 portion is equivalent to a cup of milk/1 tub of yoghurt)
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Folic Acid and micronutrient supplementation	NHS Scotland -Dumfries & Galloway -Forth Valley -Greater Glasgow & Clyde -Lanarkshire	All (except Greater Glasgow & Clyde) advise to take 400mcg folic acid daily with differing starting points. -Dumfries & Galloway: 3 months before conception until 13 weeks pregnant -Forth Valley: once contraception is stopped -Greater Glasgow and Clyde: not specified -Lanarkshire: one month before conception until 12 weeks pregnant
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	<p>Micronutrient supplementation: Dumfries & Galloway, Forth Valley and Greater Glasgow and Clyde recommend vitamin D supplementation after a discussion with a health care professional.</p>
NHS UK Website	<p>400mcg folic acid daily, from one month before conception until 12 weeks pregnant. Higher dosages (5mg) required for women deemed high risk for NTDs.</p> <p>A link is provided to further information on appropriate vitamins and supplements. Advice given is to ensure that if taking multivitamins, they should not include vitamin A. The importance of vitamin D is stressed. A link is also provided for website users to determine if they are eligible for free vitamins through the healthy start scheme.</p>
NICE Guidelines	<p>400mcg daily, from one month before conception until 12 weeks pregnant. Higher dosages (5mg) required for women deemed high risk for NTDs</p>
Germany Healthy Start	<p>400mcg daily, from one month before conception until 12 weeks pregnant. Higher dosages (5mg) required for women deemed high risk for NTDs</p> <p>Vitamin D was highlighted as important in pregnancy specific context. The importance of iodine was stressed and the use of iodised salt and inclusion of dairy products and sea food in the diet were recommended. Iron supplements were only recommended to be taken after a medical diagnosis of an iron deficiency.</p>

	Health Council of the Netherlands	400mcg folic acid daily, beginning 4 weeks prior to conception and to be continued until 8 weeks pregnant. Sufficient vitamin D intake should be discussed, particularly for women with very little exposure to sun.
	Public Health Agency of Canada	400mcg folic acid daily starting 3 months before conception
	Australia – Queensland Government	400mcg folic acid daily, beginning 12 weeks before conception and to be continued until 12 weeks pregnant. Women should also be encouraged to eat folate rich foods alongside supplementation such as broccoli, avocado, oranges and leafy green vegetables. Iodine supplementation of 150mcg daily should begin prior to conception (time unspecified) and be continued during pregnancy and breastfeeding. Foods containing iodine such as dairy products and seafood should be consumed alongside supplementation. Women with any pre-existing thyroid conditions should seek advice from their GP before taking any supplementation.
Weight	NHS Scotland	
	-Dumfries & Galloway	-Dumfries and Galloway: highlights risks of A BMI below 18.5kg/m ² and above 30kg/m ²
	-Forth Valley	-Forth Valley: Suggested BMI of between 18.5-25kg/m ²
	-Greater Glasgow & Clyde	-Greater Glasgow & Clyde: advised to follow a nutritious diet to achieve and maintain a healthy weight (not specified)
	-Lanarkshire	-Lanarkshire: advised to maintain a healthy weight (not specified)

NHS UK Website	Highlights risks of overweight and suggests consulting GP about weight before conception
NICE Guidelines	BMI between 18.5-24.9 kg/m ² reduces risk of pregnancy complications. Specific risks and advice for both over/underweight provided.
Germany Healthy Start	Weight should be consistent with national/international guidelines. Risks associated with over/underweight should be explained to patient.
Health Council of the Netherlands	Any existing anorexia or cases of overweight/obesity should be discussed with a health practitioner
Public Health Agency of Canada	Advises working towards a healthy weight with a BMI above 18.5kg/m ² and below 25kg/m ²
Australia – Queensland Government	A BMI between 18.5-24.9 kg/m ² is suggested as being healthy. Additional information is provided as BMI may be inappropriate for Aboriginal women or Torres Strait Islanders. Alternative BMI ranges may be considered for these women and BMI should be considered alongside other measures such as diet and lifestyle information.
Chronic disease management	NHS Scotland
-Dumfries & Galloway	Dumfries & Galloway: consult GP or specialist prior to conception to discuss pregnancy

-Greater Glasgow & Clyde	intentions Greater Glasgow & Clyde: Discuss any medical conditions with GP or specialist when planning pregnancy
NHS UK Website	Provided links to advice for asthma, diabetes, epilepsy, heart disease and congenital heart defects, mental health problems and obesity. Screening tests can be requested for couples who may be a carrier of sickle cell anaemia or thalassaemia.
Health Council of the Netherlands	Women with diabetes should have controlled blood sugar levels prior to conception. For women with epilepsy, monotherapy should be considered. If episode free, it may be possible to phase medication out under supervision of a healthcare professional.
Public Health Agency of Canada	Health professionals to help stabilise chronic medical conditions before conception. Care and support to be tailored to the individuals needs whilst working to ensure the condition is stable.
Immunisations/ medication	NHS Scotland
-Dumfries & Galloway	Dumfries & Galloway: Immunisations should be up to date for hepatitis B, HPV, influenza, measles, mumps, rubella (MMR), tetanus and diphtheria.
-Greater Glasgow & Clyde	Greater Glasgow & Clyde: Advice is to consult the GP to ensure vaccinations are up to date
-Lanarkshire	Lanarkshire: Advice to those planning a pregnancy is to check that they are vaccinated against rubella

NHS UK Website	Vaccination history should be checked for 2 doses of MMR vaccine and pregnancy should be avoided for 1 month after receiving the MMR vaccine. Links are provided to information regarding other infections in pregnancy which could harm a baby and what can be done to reduce risk of getting them.
NICE Guidelines	Women should be vaccinated against rubella. However, the MMR vaccine should not be given to immunocompromised women or those already pregnant. Pregnancy should be avoided for 1 month after receiving the vaccine. Immunity to varicella should be determined. If the woman is eligible and found to be without the varicella zoster antibody, then immunisation should be offered. Hepatitis B vaccinations should be offered to those at high risk of contracting the disease.
Germany Healthy Start	Vaccination status should be assessed and any gaps should be addressed. The MMR vaccine is particularly important along with that against pertussis (whooping cough).
Health Council of the Netherlands	The importance of a rubella vaccination is stressed. It is advised that booster injections should be given if necessary, before conception.
Public Health Agency of Canada	Immunisations should be up to date. This should be checked using immunisation history or serological testing for general vaccines and those deemed important for pregnancy. These should include hepatitis B, influenza, varicella, pertussis, tetanus, diphtheria and MMR. Any medications should be checked for safety of use during pregnancy with dosages adjusted if

		required. Referral to specialist services should be considered if deemed beneficial.
Sexually Transmitted Infections (STIs)	NHS Scotland	
	-Dumfries & Galloway	Dumfries and Galloway: testing and early treatment suggested
	-Greater Glasgow & Clyde	Greater Glasgow & Clyde: advised to stop risking exposure to STIs
	-Lanarkshire	Lanarkshire: advised to practice safe sex with the intention of avoiding STIs and unintended pregnancy
	Health Council of the Netherlands	Any existing STIs should be treated before conception. For those who are HIV seropositive, medication should be discussed with the health care professional.
	Public Health Agency of Canada	Women should be screened for STIs before conception. All patients should be advised to practice safe sex to reduce the risk of exposure to STIs and unintended pregnancies.
Abuse	NHS Scotland	
	-Dumfries & Galloway	-Dumfries & Galloway: Health Care Professionals should advise that abuse can begin/worsen during pregnancy and highlight the risks of remaining in an abusive relationship.
	-Greater Glasgow & Clyde	-Greater Glasgow & Clyde: Patients should be advised to stop any relationships which are abusive.
	-Lanarkshire*	*Whilst NHS Lanarkshire's website provides information about the importance of healthy relationships, no recommendations are provided.
	Public Health Agency of Canada	Health Care Professionals should explore the support offered by partners or family members,

including any financial or housing support. Any fear of, or actual, harm (physical, psychological or financial) should be discussed. If deemed appropriate, question should be posed regarding patient safety and information should be provided about appropriate services.

Smoking/Illicit drugs	NHS Scotland	<p>-Dumfries & Galloway</p> <p>-Dumfries & Galloway: HCPs to highlight risks of smoking and that illicit drugs can negatively influence pregnancy outcomes</p> <p>-Forth Valley</p> <p>-Forth Valley: Both partners advised to be smoke free with links to smoking cessation services provided.</p> <p>-Greater Glasgow & Clyde</p> <p>-Greater Glasgow & Clyde: To stop smoking and the use of illicit substances, including “legal highs”</p> <p>-Lanarkshire</p> <p>-Lanarkshire: Both partners should stop smoking. Highlights that no illicit drugs are deemed safe for use when pregnant or planning pregnancy.</p>
	NHS UK Website	<p>Links are provided to smoking cessation services. It is recommended that the partner, friends and family do not smoke around the woman planning pregnancy.</p> <p>No specific advice regarding illicit drugs.</p>
	NICE Guidelines	<p>All women should be advised to stop smoking and referral to a smoking cessation service should be offered. Nicotine Replacement Therapy to be offered to those with a history of unsuccessful attempts at smoking cessation.</p>

		For illicit drugs, offer referral to specialist services to those unable to stop without assistance. Testing for Hepatitis B, C and HIV should be offered to those injecting illicit drugs.
Germany Healthy Start		Couples should be smoke free and avoid being around those who are smoking. No specific advice regarding illicit drugs.
Health Council of the Netherlands		Both prospective parents should be smoke free. Advised that both parents abstain from taking any illicit drugs.
Public Health Agency of Canada		Advise women of the health consequences of smoking along with those specific to pregnancy. Referrals to specialist services should be offered for those actively planning to become pregnant. NRT can be offered prior to pregnancy if deemed appropriate. Partners should be encouraged to also be smoke free. Regarding illicit drug use, contraceptive options should be discussed with those with a problematic history. The HCP should advise the women about the effects of illicit substances on pregnancy and foetal outcomes. Women should be referred to addiction services which include mental health care.
Australia – Queensland Government		Smoking and illicit drug use (defined as illegal drugs or prescription drugs belonging to someone else) is not recommended and women should be advised to speak to a health care professional for advice and assistance to avoid smoking or illicit drugs.
Alcohol	NHS Scotland	
		-Dumfries & Galloway: alcohol consumption

-Dumfries & Galloway	risks included in the context of pregnancy
-Forth Valley	-Forth Valley – Advises not to drink alcohol when trying to become pregnant
-Greater Glasgow & Clyde	-Greater Glasgow & Clyde: advises to stop alcohol consumption from trying to achieve pregnancy until birth
-Lanarkshire	-Lanarkshire- advise not to drink any alcohol to minimise risks
NHS UK Website	Advises not to drink any alcohol when trying to achieve pregnancy
NICE Guidelines	Women planning a pregnancy should avoid drinking alcohol. Those unable to reduce their alcohol consumption without support should be referred to specialist services.
Germany Healthy Start	Alcohol should be avoided completely by women planning a pregnancy/pregnant
Health Council of the Netherlands	Both prospective parents should refrain from consuming alcohol
Public Health Agency of Canada	Complete avoidance of alcohol consumption is recommended for women trying to achieve pregnancy.
Australia – Queensland Government	Refers to the Australian Government’s alcohol guidelines and advises that alcohol consumption should be avoided by women planning a pregnancy.
Caffeine	
NHS Scotland -Forth Valley	A 200mg daily allowance is recommended and risks of excessive caffeine intake are explained. Guidance is provided regarding food and drinks in which caffeine can be found.
Germany Healthy Start	A 200mg daily limit is suggested. Guidance is specific to pregnancy.

Cervical Screening	NHS Scotland	
	-Dumfries & Galloway	Dumfries & Galloway and Forth Valley: Advised to continue with regular cervical screening appointments
	-Forth Valley	
	NICE Guidelines	All women planning a pregnancy should attend their cervical screening appointment if they are due before becoming pregnant.
	Public Health Agency of Canada	Advice to health care practitioners to perform cervical cancer screening with women of reproductive age
Zika Virus Exposure to hazardous substances and radiation	NHS Scotland	
	-Dumfries & Galloway	-Dumfries & Galloway: Women should avoid pregnancy when travelling in an area with active zika transmission and for 8 weeks upon returning home. Men should use condoms to reduce the risk of transmission when travelling abroad and for 8 weeks after, or 6 months if symptoms are compatible with the zika infection.
	-Forth Valley	-Forth Valley: Recommended for women to avoid becoming pregnant if you have travelled to an area with active transmission for 8 weeks and for men, 6 months.
	-Greater Glasgow & Clyde	-Greater Glasgow & Clyde: Advised not to risk infection.
	NICE Guidelines	Advised to avoid becoming pregnant when travelling in an area with active zika transmission and advice is provided on avoiding mosquito bites. Women should avoid pregnancy for 8 weeks upon returning to the UK from an

		area with active zika transmission if their male partner did not travel, and 6 months if her male partner travelled also.
	Health Council of the Netherlands	The health professional should discuss any occupational exposure to chemicals. Compliance with health and safety recommendations is recommended to reduce risk.
	Public Health Agency of Canada	Health care professionals should assess chemical and physical exposure risk in the workplace. Common toxins which may be encountered that are detrimental to reproductive health are mercury, lead, contaminated soil and water, organic solvents (paint stripper, non-latex paints), pesticides, radiation and anaesthetic gases.
Mental Health	NHS Scotland	
	-Dumfries & Galloway	-Dumfries & Galloway: Advises that health care professionals assist in addressing any underlying causes of poor mental health and treat mental health conditions prior to pregnancy.
	-Greater Glasgow & Clyde	-Greater Glasgow & Clyde: Women advised to discuss mental health with the GP when assessing if it is the right time to become pregnant
	-Lanarkshire	-Lanarkshire: states that positive mental wellbeing is important when considering pregnancy
	Health Council of the Netherlands	Mental health is discussed with regards to medication. Antidepressants should be adjusted before conception and if the patient is symptom free, it may be appropriate to consider phasing medication out under supervision of a healthcare professional.

	Public Health Agency of Canada	Health care practitioners should explore certain topic areas with patients when assessing if there may be a mental health concern. These topics include, support provided by friends, family and the partner (including housing and financial support), any history of/current psychological problems with the patient or their close family. Lastly, any current/past tobacco use or alcohol/substance use should be discussed.
Oral and Dental Hygiene	Germany Healthy Start	Advises that women planning a pregnancy should attend a dental check-up and undergo any necessary treatments
	Public Health Agency of Canada	Men and women should be advised on appropriate dental hygiene by health professionals. Particular attention should be paid to women with the goal of avoiding periodontal (gum) disease in pregnancy.



Scottish Government Maternal and Infant Nutrition Survey

Investigating your diet and health choices for pregnancy

This is a survey about your choices and experiences in pregnancy.

The information you provide will help us to understand more about the choices people make when they are expecting a baby and help health care professionals to better support expectant parents. **All of the answers you provide will be entirely confidential.**

Please read the enclosed letter for more information about this survey.

Instructions

The survey takes around 10-15 minutes to complete. Please answer all questions, unless the instructions ask you to skip a question.

For most questions, you will be asked to put a tick in the box next to the statement which most applies to you. For example, if your answer is yes, write in a tick as below:

<input checked="" type="checkbox"/>	Yes
<input type="checkbox"/>	No

Don't worry if you make a mistake; just cross it out and tick the correct answer.

Sometimes you will be asked to write in a number. Please enter numbers as figures rather than words. For example:

<input type="text" value="2"/>	<input type="text" value="2"/>	Weeks
--------------------------------	--------------------------------	-------

If you prefer, you can complete this survey online at: survey.natcen.ac.uk/MINS9

You will be asked to enter the User Code that can be found on the letter that came with this survey.

Alternatively, you can give your answers by calling the FREEPHONE survey helpline on **0800 652 4568**. The helpline is open Monday to Friday - 9am to 5pm.

Please return the survey in the pre-paid envelope provided,
or to: NatCen Social Research, 103-105 Kings Road,
Brentwood, Essex CM14 4LX.

This pregnancy and previous pregnancies

We would like to ask you some general questions about this pregnancy and any previous pregnancies.

1. How many weeks pregnant are you (to the nearest whole week)?

Weeks

3031-3032

or

Please tick this box if you have already given birth

3030

2. Is this your first pregnancy?

3033

- Yes → Go to Q.5
 No → Go to Q.3

3. How many children do you have?

(Please exclude any stepchildren, adopted or foster children that you have)

3034-3035

4. Have you had a **previous** pregnancy where any of these situations applied?

(Please tick all that apply)

3036-3051

- 01 A baby who weighed 4.5kg (9lb and 14oz) **or more** at birth
 02 A baby who was **not premature**, but weighed 2.5kgs (5lb and 8oz) **or less** at birth.
 03 A baby who was born prematurely (before 37 weeks)
 04 A baby who was born with a cleft lip and/or palate
 05 A baby who had a bowel, gut or diaphragm problem that needed surgery (such as gastroschisis, exomphalos or diaphragmatic hernia)
 06 A pregnancy or baby diagnosed with spina bifida or anencephaly
 07 A baby who was born with a heart defect (not including heart murmurs that did not require surgery)

or

08 No, none of the above

Becoming pregnant

Below are some questions that ask about your circumstances and feelings around the time you became pregnant. Please think of your current (or most recent) pregnancy when answering the questions below.

5. In the month that I became pregnant.....

(Please tick the statement which **most** applies to you)

3052

- 1 I/we were not using contraception
- 2 I/we were using contraception, but not on every occasion
- 3 I/we always used contraception, but knew that the method had failed (i.e. broke, moved, came off, came out, not worked etc.) at least once
- 4 I/we always used contraception

6. In terms of becoming a mother (first time or again), I feel that my pregnancy happened at the.....

(Please tick the statement which **most** applies to you)

3053

- 1 right time
- 2 ok, but not quite right time
- 3 wrong time

7. Just **before** I became pregnant.....

(Please tick the statement which **most** applies to you)

3054

- 1 I intended to get pregnant
- 2 my intentions kept changing
- 3 I did not intend to get pregnant

8. Just **before** I became pregnant....

(Please tick the statement which **most** applies to you)

3055

- 1 I wanted to have a baby
- 2 I had mixed feelings about having a baby
- 3 I did not want to have a baby

In the next question, we ask about your partner - this might be (or have been) your husband, a partner you live with, a boyfriend, or someone you've had sex with once or twice.

9. **Before** I became pregnant.....

(Please tick the statement which **most** applies to you)

3056

- 1 my partner and I had agreed that we would like me to be pregnant
- 2 my partner and I had discussed having children together, but hadn't agreed for me to get pregnant
- 3 we never discussed having children together

10. **Before** you became pregnant, did you do anything to improve your health **in preparation for pregnancy?**

(Please tick all that apply)

3057-3063

- 1 Took folic acid
2 Stopped or cut down smoking
3 Stopped or cut down drinking alcohol
4 Ate more healthily
5 Sought medical/health advice
6 Took some other action, please describe _____
or
7 I did not do any of the above before my pregnancy

3064

SPACE COLUMNS: 3065-3069

Vitamins before and during your pregnancy

The following questions ask about vitamins that you may have taken before and/or during your pregnancy.

11. Did you take any multi-vitamin supplements **before** you became pregnant?

(Please tick one box only)

3070

- 1 Yes, I began taking multi-vitamin more than 3 months before I became pregnant
2 Yes, I began taking multi-vitamin between 1 and 3 months before I became pregnant
3 Yes, I began taking multi-vitamin less than 1 month before I became pregnant
4 Yes, but I can't remember when I began taking multi-vitamin
5 No, but I began taking multi-vitamin as soon as I knew I was pregnant
6 No, I did not take any multi-vitamin before I became pregnant or in the first month of pregnancy
7 I'm not sure what multi-vitamin are

12. Did you take folic acid **before** you became pregnant?

(Please tick one box only)

3071

- 1 Yes, I began taking folic acid more than 3 months before I became pregnant → Go to Q.13
2 Yes, I began taking folic acid between 1 and 3 months before I became pregnant → Go to Q.13
3 Yes, I began taking folic acid less than 1 month before I became pregnant → Go to Q.13
4 Yes, but I can't remember when I began taking folic acid → Go to Q.13
5 No, but I began taking folic acid as soon as I knew I was pregnant → Go to Q.13
6 No, I did not take folic acid before I became pregnant or in the first month of pregnancy → Go to Q.13
7 I'm not sure what folic acid is → Go to Q.14

13. Some mothers with medical or pregnancy conditions are prescribed with a larger dose of folic acid by their doctor. Were you prescribed a higher dose (5mg) of folic acid **just before** pregnancy **or in early** pregnancy (the first 12 weeks)?

(Please tick one box only)

3072

- 1 No, I was not prescribed a higher dose of folic acid
- 2 Yes, I was prescribed a higher dose of folic acid, but I did not take it.
- 3 Yes, I was prescribed a higher dose of folic acid and began taking it before I became pregnant
- 4 Yes, I was prescribed a higher dose of folic acid and began taking it after I became pregnant

14. Are you **currently** taking any single vitamin, mineral or multi-vitamin supplements (such as Healthy Start vitamins, Pregnacare, iron tablets or folic acid)?

3073

- 1 Yes → Go to Q.15
- 2 No → Go to Q.17

15. What type of vitamin or mineral supplements are you taking? You may have been given Healthy Start vitamins or decided to take another commercial brand.

(Please tick all that apply)

3074-3079

- 1 Healthy Start vitamins
- 2 Another brand that contains Vitamin D or Vitamin D with calcium
- 3 Another brand of multi-vitamin **specifically** for pregnancy (such as Pregnacare)
- 4 Another brand of multi-vitamin, **not specifically** for pregnancy
- 5 I'm not sure what type I'm taking
- 6 Other single vitamin or mineral (such as Vitamin C or zinc), please specify _____

3080

SPARE COLUMNS: 3081-3089

16. How often do you take these vitamin or mineral supplements?

(Please tick one box only)

3090

- 1 Every day
- 2 Most days
- 3 A few days a week
- 4 Only occasionally

Diet and weight before and during your pregnancy

The following questions ask about your weight, diet and your food and alcohol intake before and/or during your pregnancy.

17. What was your Body Mass Index (BMI) at your maternity booking visit?

Your BMI is related to your height and weight. Your BMI at your maternity booking visit should be recorded in the bottom right hand corner of page 5 of your hand held maternity record. (If your hospital has moved to the new electronic record you may need to ask your midwife)

BMI:

3092-3093

or

Please tick this box if your BMI is not recorded in your maternity record

3091

18. How would you describe your weight before you became pregnant?

(Please tick one box only)

3094

- 1 Very underweight
- 2 Slightly underweight
- 3 Normal
- 4 Slightly overweight
- 5 Very overweight / obese

19. Did you try to change your weight before you became pregnant? This includes trying to lose weight or to gain weight.

(Please tick one box only)

3095

- 1 Yes, I tried to lose weight
- 2 Yes, I tried to gain weight
- 3 No, my weight was okay so I didn't need to lose or gain weight
- 4 No, even though I knew I was overweight, I didn't try to lose weight before getting pregnant
- 5 No, even though I knew I was under weight, I didn't try to gain weight before getting pregnant

20. Did you get any information about adapting your diet, taking vitamins, or stopping smoking and drinking alcohol **before becoming pregnant**?

3096

- 1 Yes → Go to Q.21
- 2 No → Go to Q.22

21. Where did you get this information from?

(Please tick all that apply)

3097-3112

- 01 A health professional (e.g. nurse, doctor, midwife or health visitor)
- 02 A pharmacist or other staff member in the pharmacy / chemist
- 03 My partner, friend and/or relative
- 04 Previous experience with an earlier pregnancy
- 05 Books / leaflets / magazines
- 06 Television / radio
- 07 Internet / web based resources
- 08 Somewhere / someone else, please specify _____

3113

SPARE COLUMNS: 3114-3119

22. Did you get any information about adapting your diet, taking vitamins, or stopping smoking and drinking alcohol **during pregnancy**?

3120

- 1 Yes → Go to Q.23
- 2 No → Go to Q.24

23. Where did you get this information from?

(Please tick all that apply)

3121-3138

- 01 A health professional (e.g. nurse, doctor, midwife or health visitor)
02 A pharmacist or other staff member in the pharmacy / chemist
03 My partner, friend and/or relative
04 Previous experience with an earlier pregnancy
05 Ready Steady Baby Book
06 Other books / leaflets / magazines
07 Television / radio
08 Internet / web based resources
09 Somewhere / someone else, please specify _____

3139

SPARE COLUMNS: 3140-3149

24. How often did you eat the recommended 5-a-day or more fruit and vegetables in the last week?

(Please tick one box only)

3150

- 1 Every day
2 On 3 – 6 days
3 On 1 or 2 days
4 On no days

25. During this pregnancy, are you eating more, less or the same amount of fruit and/or vegetables than before you were pregnant?

(a) Fruit

(Please tick one box only)

(b) Vegetables

3151 (Please tick one box only)

3152

- 1 A lot more
2 Some more
3 About the same amount as before
4 I'm eating less
5 I now eat none at all

- 1 A lot more
2 Some more
3 About the same amount as before
4 I'm eating less
5 I now eat none at all

26. Are you vegetarian, pescetarian or vegan?

(Please tick one box only)

3153

- 1 Yes, I am vegetarian (I avoid all meat and fish)
2 Yes, I am pescetarian (I avoid meat, but eat fish)
3 Yes, I am vegan (I avoid meat, fish, dairy and all animal products)
4 No, I eat meat, fish and animal products
5 No, I'm not vegetarian, pescetarian or vegan but I avoid other foods:
please specify _____

3154

SPARE COLUMNS: 3155-3159

27. Which statement best describes your cooking skills?

(Please tick one box only)

3160

- 1 I can cook most meals from scratch
- 2 I can cook some meals from scratch
- 3 I only have basic cooking skills (for example: cook pasta or rice and add a ready-made sauce)
- 4 I can't really cook any meals

28. In general, how often did you have a drink containing alcohol before this pregnancy?

(Please tick one box only)

3161

- 1 Never → Go to Q.30
- 2 Monthly or less → Go to Q.29
- 3 Two to four times a month → Go to Q.29
- 4 Two or three times a week → Go to Q.29
- 5 Four or more times a week → Go to Q.29

29. Did you stop drinking alcohol **before** you became pregnant (regardless of whether this pregnancy was planned or not)?

(Please tick one box only)

3162

- 1 Yes, I stopped drinking alcohol more than 3 months before I became pregnant
- 2 Yes, I stopped drinking alcohol 1-3 months before I became pregnant
- 3 Yes, I stopped drinking alcohol less than 1 month I became pregnant
- 4 Yes, I stopped drinking alcohol before I became pregnant, but I can't remember when
- 5 No, I did not stop drinking alcohol, but I cut down the amount I was drinking
- 6 No, I did not stop drinking alcohol or cut down the amount I was drinking

30. How often have you had a drink containing alcohol **since** you realised you were pregnant?

(Please tick one box only)

3163

- 1 Never
- 2 Monthly or less
- 3 Two to four times a month
- 4 Two or three times a week
- 5 Four or more times a week

31. Do you think you drank any alcohol while you were pregnant, but before you realised you were pregnant?

(Please tick one box only)

3164

- 1 No, never
- 2 Yes, monthly or less
- 3 Yes, two to four times a month
- 4 Yes, two or three times a week
- 5 Yes, four or more times a week

SPARE COLUMNS: 3165-3169

Your health

32. Did you have a history of any of the following health conditions **before this** pregnancy?

(Please tick all that apply)

3170-3175

- 1 Diabetes (with insulin)
2 Diabetes (no insulin)
3 Diabetes, but only in a previous pregnancy
4 Epilepsy
5 High blood pressure
or
6 No, none of the above

33. Have you ever had breast surgery?

(Please tick all that apply)

3176-3179

- 1 Breast implants
2 Breast reduction
3 Other breast surgery
or
4 No, none of the above

The Healthy Start Scheme

The Healthy Start scheme provides pregnant women and children under 4 years old with vouchers which can be spent on milk, infant formula, fresh and frozen fruit or vegetables

(<https://www.healthystart.nhs.uk/>).

You qualify for the scheme if you or your family receive **one** of the following:

- I. Income Support
- II. Income-based Job Seeker's Allowance
- III. Income-related Employment and Support Allowance
- IV. Universal Credit (with a family take home pay of £408 or less per month)
- V. Child Tax Credit, without working Tax Credit (except Working Tax run-on) **and** an annual family income of £16,190 or less
- VI. Or if you are pregnant and under 18 years of age

34. Were you aware of the Healthy Start scheme before reading the description above?

3180

- 1 Yes → Go to Q.35
2 No → Go to Q.36

35. How did you find out about the Healthy Start scheme?

(Please tick all that apply)

3181-3185

- 1 Midwife
- 2 Health Visitor
- 3 Ready Steady Baby Book
- 4 Family or friend
- 5 Other, please specify _____

3186

SPARE COLUMNS: 3187-3189

36. Based on the list above, do you think you qualify for the Healthy Start scheme?

(Please tick one box only)

3190

- 1 Yes, I already get Healthy Start vouchers → Go to Q.37
- 2 Yes, I have applied for it, but I haven't received my Healthy Start vouchers yet → Go to Q.40
- 3 Yes, but I haven't applied for it → Go to Q.40
- 4 No, I don't think I qualify → Go to Q.40
- 5 I don't know if I qualify → Go to Q.40

37. Have you used your Healthy Start vouchers?

3191

- 1 Yes → Go to Q.38
- 2 No → Go to Q.39

38. What did you buy with your Healthy Start vouchers?

(Please tick all that apply)

3192-3196

- 1 Infant formula → Go to Q.40
- 2 Cow's milk → Go to Q.40
- 3 Fresh or frozen fruit → Go to Q.40
- 4 Fresh or frozen vegetables → Go to Q.40
- 5 Something else, please specify _____ → Go to Q.40

3197

SPARE COLUMNS: 3198-3209

39. Why haven't you spent your Healthy Start vouchers?

(Please tick all that apply)

3210-3225

- 01 I'm uncomfortable using the vouchers
- 02 I can't use the vouchers in the shops I go to
- 03 I can't use the vouchers for the sort of food I would choose to buy
- 04 I get my food from a food bank
- 05 I don't need Healthy Start vouchers
- 06 I keep forgetting to use the vouchers
- 07 I have lost the vouchers
- 08 Other reason, please specify _____

3226

SPARE COLUMNS: 3227-3229

About You

40. What is your full postcode? (e.g. G77 6DP)

We are asking you to provide your postcode so that we can analyse the results of this survey for different areas of Scotland and for different groups of pregnant women. We will not pass your postcode on to anyone else, and we will not use it to identify you or use it to contact you.

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3230-3237

41. What age were you on your last birthday?

(Please tick one box only)

3238

- 1 19 or under
2 20-24
3 25-29
4 30-34
5 35 or over

42. What is your ethnic group?

(Please tick one box that best describes your ethnic group)

3239-3240

- White**
- 01 White Scottish
02 White Other British
03 White Irish
04 White Gypsy/Traveller
05 White Polish
06 Other White
- Mixed or multiple ethnic groups**
- 07 Any mixed or multiple ethnic groups
- Asian, Asian Scottish or Asian British**
- 08 Pakistani, Pakistani Scottish or Pakistani British
09 Indian, Indian Scottish or Indian British
10 Bangladeshi, Bangladeshi Scottish or Bangladeshi British
11 Chinese, Chinese Scottish or Chinese British
12 Other Asian
- African**
- 13 African, African Scottish or African British
14 Other African
- Caribbean or Black**
- 15 Caribbean, Caribbean Scottish or Caribbean British
16 Black, Black Scottish or Black British
17 Other Caribbean or Black
- Other ethnic groups**
- 18 Arab, Arab Scottish or Arab British
19 Other ethnic group
20 Prefer not to answer

We would like your permission to add your survey responses to other information held about your health and care by NHS Scotland (for example the weight of your baby at birth). Your information will be used only for research and we will never give out your contact details. If you give your permission to add your survey responses to other health and care information held about you it will not be shared with the people who look after you and will not affect your current or future treatment or care.

43. Do you give your permission for NHS Scotland Statisticians to add your survey responses to other information about your health and care for the purpose of further research? 3241

- 1 Yes → Go to Q.44
- 2 No → You have now finished this survey

44. What is your date of birth?

We are asking you to provide your date of birth so that we can add your survey responses to other information held about your health and care by NHS Scotland. Your date of birth will not be shared with anyone and it will not be possible for anyone to identify you in the survey results.

D	D	M	M	Y	Y	Y	Y

3242-3243
3244-3245
3246-3249

45. What is your Community Health Index (CHI) number?

We are asking you to provide your CHI number so that we can add your survey responses to other information held about your health and care by NHS Scotland. Everyone who is registered with a Scottish GP practice has their own unique CHI number. Please note that your CHI number also contains your date of birth. This number uniquely identifies you within NHS Scotland and is attached to all of your health records. Your CHI number will not be shared with anyone and it will not be possible for anyone to identify you in the survey results.

Your CHI number is 10 digits long and should be printed on the front page of your maternity record or on your hospital appointment cards.

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3250-3259

Thank you for taking the time to complete this survey



Serial number: {SN}{CkLet}

SERIAL NUMBER: 1-8
CHECKLETTER: 9
CARD NUMBER (03): 10-11
VERSION (D): 12
BATCH NUMBER: 13-17
SPARE COLUMNS: 18-29

APPENDIX 3: SEARCH STRATEGY (ALL DATABASES) AND RESULTS

Results from searches

- MEDLINE: 790
- PsycINFO: 175
- CINAHL: 717
- EMBASE: 1,623
- Total results: 3305
- Duplicates removed: 1321
- De-duped results (Endnote): 1984

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to February 11/20

Search conducted on Feb. 11/20

#	Query	Results
1	Preconception Care/	2198
2	((pregnan* or conception) adj3 (pre or prior or before or prepar* or plan* or intent*)).ab,ti.	25580
3	"preconception".ab,ti.	3428
4	"pre-conception".ab,ti.	506
5	"prepregnan*".ab,ti.	3353
6	"pre-pregnan*".ab,ti.	3796
7	(trying adj2 conceive).ab,ti.	408
8	"reproductive age".ab,ti.	12650
9	"childbearing age".ab,ti	5769
10	1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9	48345
11	exp Attitude to Health/	407158
12	exp Health Behavior/	310144
13	exp Health Education/	239506
14	Adaptation, Psychological/	92687

15	"Quality of Life"/	188047
16	exp Self Care/	53592
17	exp Life Style/	90547
18	exp Motivation/	166272
19	Attitude/	46629
20	Information Seeking Behavior/	2252
21	Awareness/	19731
22	Choice Behavior/	31837
23	(health adj3 (behavio\$r* or attitude* or belie* or practice or plan* or education or know* or advice or aware* or information* or view* or opinion* or perception* or perspective or influence* or determinant* or barrier* or facilitator* or motiv* or choice* or action or adopt* or litera*)).ab,ti.	243033
24	(lifestyle adj3 (change* or intervention)).ab,ti.	14668
25	"knowledge gap* ".ab,ti.	10076
26	11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25	1319663
27	((("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide) adj2 (interview* or discussion* or questionnaire*))). tw , kw or (focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant"). ab,ti. or interviews as topic / or focus groups / or narration / or qualitative research /	373348
28	10 AND 26 AND 27	1079
29	Limit 28 to (english language and yr="2009 -Current")	790

PsycINFO (EBSCO), search conducted on Feb. 11/20

Final results with Academic journals limit – 175

#	Query	Limiters/Expanders	Results
S33	S18 AND S25 AND S29	Limiters - Publication Year: 2009-2020 Expanders - Apply	227

		related words; Apply equivalent subjects Narrow by Language: - english Search modes - Find all my search terms	
S32	S18 AND S25 AND S29	Limiters - Publication Year: 2009-2020 Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	231
S31		Limiters - Publication Year: 2009-2019 Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,600,582
S30	S18 AND S25 AND S29	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	304
S29	S26 OR S27 OR S28	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	311,989
S28	DE "Qualitative Methods" OR DE "Focus Group" OR DE "Grounded Theory" OR DE "Interpretative Phenomenological Analysis" OR DE "Narrative Analysis" OR DE "Semi-Structured Interview" OR DE "Thematic Analysis"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	14,452
S27	TI ((focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant")) OR	Expanders - Apply related words; Apply	246,239

	AB ((focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant"))	equivalent subjects Search modes - Find all my search terms	
S26	TI (("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide) N3 (interview* or discussion* or questionnaire*)) OR AB (("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide) N3 (interview* or discussion* or questionnaire*))	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	102,194
S25	S1 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	6,620
S24	TI trying N2 conceive OR AB trying N2 conceive	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	84
S23	TI "childbearing age" OR AB "childbearing age"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	680
S22	TI "reproductive age" OR AB "reproductive age"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,068
S21	TI "preconception" OR AB "preconception"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	689

S20	TI "preconception care" OR AB "preconception care"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	106
S19	TI prepregnan* OR AB prepregnan*	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	436
S18	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	485,589
S17	TI aware* OR AB aware*	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	122,684
S16	TI (health N3 (behavio\$r* or attitude* or belie* or practice or plan* or education or know* or advice or aware* or information* or view* or opinion* or perception* or perspective or influence* or determinant* or barrier* or facilitator* or motiv* or choice* or action or adopt* or litera*)) OR AB (health N3 (behavio\$r* or attitude* or belie* or practice or plan* or education or know* or advice or aware* or information* or view* or opinion* or perception* or perspective or influence* or determinant* or barrier* or facilitator* or motiv* or choice* or action or adopt* or litera*))	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	102,679
S15	DE "Intention" OR DE "Behavioral Intention"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	19,059

S14	DE "Preferences" OR DE "Aesthetic Preferences" OR DE "Brand Preferences" OR DE "Food Preferences" OR DE "Occupational Preference"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	32,125
S13	DE "Planned Behavior" OR DE "Behavioral Intention"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	4,331
S12	DE "Behavior Change" OR DE "Readiness to Change" OR DE "Stages of Change"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	13,610
S11	DE "Lifestyle" OR DE "Active Living" OR DE "Lifestyle Changes"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	11,557
S10	DE "Choice Behavior"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	29,712
S9	DE "Quality of Life"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	54,580
S8	DE "Awareness"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	20,638
S7	DE "Motivation"	Expanders - Apply related words; Apply	72,649

		equivalent subjects Search modes - Find all my search terms	
S6	DE "Health Education"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	19,723
S5	DE "Health Behavior"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	37,755
S4	DE "Health Knowledge"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	7,572
S3	DE "Attitudes"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	26,475
S2	DE "Health Attitudes"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	10,141
S1	TI ((pregnan* or conception) N3 (pre or prior or before or prepar* or plan* or intent*)) OR AB ((pregnan* or conception) N3 (pre or prior or before or prepar* or plan* or intent*))	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	4,217

Final results with Academic journals limit – 717

#	Query	Limiters/Expanders	Results
S25	S10 AND S18 AND S22	Limiters - Published Date: 20090101-20201231 Expanders - Apply related words; Apply equivalent subjects Narrow by Language: - english Search modes - Find all my search terms	739
S24	S10 AND S18 AND S22	Limiters - Published Date: 20090101-20201231 Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	764
S23	S10 AND S18 AND S22	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	993
S22	S19 OR S20 OR S21	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	249,108
S21	(MH "Qualitative Studies+")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	134,597
S20	TI ((focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant")) OR AB ((focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant"))	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	157,392
S19	TI (("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	75,743

	structured or guide) N3 (interview* or discussion* or questionnaire*)) OR AB ("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide) N3 (interview* or discussion* or questionnaire*))		
S18	S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	16,996
S17	TI "reproductive age" OR AB "reproductive age"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	3,458
S16	TI "childbearing age" OR AB "childbearing age"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,698
S15	TI trying N2 conceive OR AB trying N2 conceive	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	180
S14	TI "preconception" OR AB "preconception"	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,748
S13	TI prepregnan* OR AB prepregnan*	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,612
S12	TI ((pregnan* or conception) N3 (pre or prior or before or prepar* or plan* or intent*)) OR AB ((pregnan* or	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	9,275

	conception) N3 (pre or prior or before or prepar* or plan* or intent*))		
S11	(MH "Pregpregnancy Care")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,801
S10	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	1,192,094
S9	TI aware* OR AB aware*	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	89,754
S8	TI (health N3 (behavio\$r* or attitude* or belie* or practice or plan* or education or know* or advice or aware* or information* or view* or opinion* or perception* or perspective or influence* or determinant* or barrier* or facilitator* or motiv* or choice* or action or adopt* or litera*)) OR AB (health N3 (behavio\$r* or attitude* or belie* or practice or plan* or education or know* or advice or aware* or information* or view* or opinion* or perception* or perspective or influence* or determinant* or barrier* or facilitator* or motiv*	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	151,259

	or choice* or action or adopt* or litera*))		
S7	(MH "Life Style+")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	203,249
S6	(MH "Health Education+")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	115,937
S5	(MH "Health Information+")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	26,221
S4	(MH "Behavior+")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	893,611
S3	(MH "Health Knowledge")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	27,138
S2	(MH "Attitude")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	14,733
S1	(MH "Attitude to Health+")	Expanders - Apply related words; Apply equivalent subjects Search modes - Find all my search terms	145,065

Embase (Elsevier), search conducted on Feb. 11/20

o.

Query

Results

1,623

#21

#7 AND #15 AND #19 AND [english]/lim AND [2009-2020]/py

1,944

#20

#7 AND #15 AND #19

425,793

#19

#16 OR #17 OR #18

71,582

#18

'qualitative research'/exp

315,224

#17

**'focus group*':ab,ti OR qualitative:ab,ti OR ethnograph*:ab,ti OR fieldwork:ab,ti
OR 'field work':ab,ti OR 'key informant':ab,ti**

154,880

#16

**(('semi-structured' OR semistructured OR unstructured OR informal OR 'in-
depth' OR indepth OR 'face-to-face' OR structured OR guide) NEAR/3
(interview* OR discussion* OR questionnaire*)):ab,ti**

69,237

#15

#8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14

753

#14

(trying NEAR/2 conceive):ab,ti

17,921

#13

'reproductive age':ab,ti

7,729

#12

'childbearing age':ab,ti

4,872

#11

preconception:ab,ti

4,415

#10

prepregnan*:ab,ti

37,799

#9

((pregnan* OR conception) NEAR/3

(pre OR prior OR before OR prepar* OR plan* OR intent*)):ab,ti

1,590

#8

'prepregnancy care'/de

4,442,453

#7

#1 OR #2 OR #3 OR #4 OR #5 OR #6

199,044

#6

awareness:ab,ti

302,904

#5

(health NEAR/3 (behavio\$r*

OR attitude* OR belie* OR practice OR plan* OR education OR know* OR advice OR aware* OR information* OR view* OR opinion* OR perception* OR perspective OR influence* OR determinant* OR barrier* OR facilitator* OR motiv* OR choice* OR action OR adopt* OR litera*)):ab,ti

79,161

#4

'awareness'/de

36,534

#3

'lifestyle modification'/exp

319,432

#2

'health education'/exp

4,038,732

#1

'behavior'/exp

APPENDIX 4: CASP SCORING TABLES

Lewis et al. (2013)

CASP Question	Text upon which the decision was made	First reviewer score (HW)	Second reviewer score (SD)
Was there a clear statement of the aims of the research?	To provide insight into couples' notions about PCH given the potential significance of pregnancy planning and couple-level behavior change for PCH, we sought to answer the following research questions centered on the four social marketing P's	yes	yes
Is a qualitative methodology appropriate?	Questions about "product" explored behaviors that couples felt were important... Questions about "price" explored the circumstances or situations that may make it easy or challenging for couples to discuss preconception behaviors, the roles each couple member could play in the behaviors as well as what they could do together, and the primary reasons they would or would not choose to engage in preconception behaviors. Discussions about "promotion" explored messages couples would recommend using to promote PCH. "Place" questions examined couples' trusted sources and channels for health information or where they might likely read or see health information. Each couple member was asked to respond to the discussion questions.	yes	yes
Was the research design appropriate to address the aim of the research?	The interviews followed a semi-structured guide based on the four social marketing P's. At the time of screening, women identified their pregnancy plans within the next year, and if and when they had children. Responses were used to assign couples into one of five audience segments. Table 1 shows the definition of each segment and displays the total number of participating couples by segment. The five segments were selected from a literature review and secondary analyses by using data from the 2007 Health Styles survey	Yes	yes
Was the recruitment strategy	Inclusion criteria were being 18 to 44 years of age, English speaking, not currently pregnant, and not having a condition or having had undergone a	yes	yes

appropriate to the aims of the research?	sterilization procedure that would make the woman unable to get pregnant. Because the risks of poor birth outcomes are greater among women with lower socioeconomic status (SES), ^{17–20} this study focused on couples with an annual income no greater than \$75,000. Couples with a higher annual income were not eligible. We chose this upper income bound to balance the challenges in recruiting couples, project resources allotted for recruitment, and number of couples needed for analysis.		
Was the data collected in a way that addressed the research issue?	The interviews followed a semi-structured guide based on the four social marketing P's. Each couple member was asked to respond to the discussion questions. Interviewers were instructed to probe each partner for his or her opinion to ensure that both members' opinions were represented and to determine agreement between partners on the main study questions	yes	yes
Has the relationship between researcher and participants been adequately considered?	No information	no	Can't tell
Have ethical issues been taken into consideration?	Before the discussion, all participants were sent a consent form....consent was obtained verbally at the beginning of the call....RTI International and CDC obtained all required ethical and administrative approvals before conducting the research	yes	yes
Was the data analysis sufficiently rigorous?	Coding was done by a team of five interviewers who were trained by using the study codebook....The interrater reliability (Cohen kappa) was .97 or greater across codes, with the exception of one code that was .90....	yes	yes
Is there a clear	Across the planning, nonplanning, and interconception couples, PCH can be seen as rooted in relationships, as evidenced by the emphasis couples placed on PCH being related to	yes	yes

statement of findings?	a healthy baby, mother, and family relationships. The couple-related themes that emerged across the segments and the discussion of the four social marketing P's emphasized communication, support, and relationship quality as important factors that would enhance PCH in couples.... this case, the health of the mother, baby, and family could be a force motivating couples to engage in PCH behaviors. Despite previous analyses that demonstrated demographic and behavioral differences underlying our audience segmentation approach (see Squiers et al.22), there were more similarities than differences across the segments for many of the four social marketing P's.		
How valuable is the research?	Framing messages for PCH that focus on couples' relationships and family health could be effective, according to the couples we interviewed, especially if couples are planning a pregnancy....Couples may be an important target audience when considering social marketing approaches for PCH. Many couples in this study perceived the relevance of the issue to important aspects of their lives, such as health, family, and their relationships	yes	yes

Liu (2014)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	The literature shows that the language surrounding the concept of preconception health and care is mainly focused on risk factors and often confined within the biomedicine-oriented risk reduction framework. This study aimed to define preconception health and care from reproductive-aged women's perspectives in rural China.	yes	yes
Is a qualitative methodology appropriate?	Although the presence of Chinese traditional medicine is still strong in China, little attention has been paid to whether such nonbiomedicine-oriented beliefs have been applied to preconception health conceptualization.	Yes	yes

	This was a critical discourse analysis (CDA) study. Preconception health and care were investigated as a socioculturally constructed phenomenon, and the preconception language was examined as inseparable from social practices.		
Was the research design appropriate to address the aim of the research?	This was a critical discourse analysis (CDA) study. Preconception health and care were investigated as a socioculturally constructed phenomenon, and the preconception language was examined as inseparable from social practices. CDA is not a unified methodological framework with clearly defined boundaries; rather, it is a form of inquiry with different methodological approaches.	Yes	yes
Was the recruitment strategy appropriate to the aims of the research?	A total of 40 reproductive-aged women were interviewed. The age range was 20-29.	Cant tell	Can't tell
Was the data collected in a way that addressed the research issue?	The semi-structured, in-depth interviews were conducted in Mandarin Chinese. The interviews were tape-recorded and transcribed verbatim.	Yes	yes
Has the relationship between researcher and participants been adequately considered?	Nothing mentioned	no	Can't tell
Have ethical issues been taken into consideration?	Ethical approval to conduct the study was provided by the university's Institutional Review Board. Written consent was obtained before each interview.	yes	yes
Was the data analysis	This study adapted Fairclough's (2003) CDA approach in analyzing the texts.	yes	yes

sufficiently rigorous?	Data analysis was conducted in the language of Mandarin Chinese to preserve the original and contextual meanings. To enhance the study's rigor, a variety of techniques were used, including validating the researcher's interpretations by a diverse group of experienced health professionals and member-checking the researcher's interpretation of the data.		
Is there a clear statement of findings?	All women verbalized that keeping healthy was important to both women and men before pregnancy. When asked to define preconception health and care, participants drew from individual, family, and societal levels of social practices to form the four main discourses of the concept, as presented below. The findings from this study reveal that, for these Chinese rural women, preconception health and care were anchored to both biomedicine (Western) and non-biomedicine (non-western) perspectives.	yes	yes
How valuable is the research?	Consistent with the beliefs and practices of women who primarily use the practices of Western medicine in the United States, with respect to preconception care, the beliefs and practices of the women in this study described similar behaviors. These women, however, also engaged in culturally unique strategies to promote their own preconception health. While more studies are needed to document the effect of these traditional Chinese medicine beliefs and practices on pregnancy outcomes, healthcare providers should respect these cultural beliefs and practices while educating couples about other preconception health promotion information.	yes	yes

Ware et al. (2019)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
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Was there a clear statement of the aims of the research?	However, none focused specifically on young women before their first pregnancy; investigated the range of social, environmental, and structural factors that influence everyday health behaviors; or explicitly interpreted their findings within a theoretical behavior change framework to inform intervention strategies. Therefore, this study examined young, nulliparous South African women's perceptions of health and the contextual factors influencing health behavior using a qualitative approach.	yes	yes
Is a qualitative methodology appropriate?	The aims of the interviews were to find information about perceived barriers and facilitators to healthy living in the local context, to seek young women's perceptions regarding what and who could best support young women to make healthier choices in this context, and to obtain young women's perspectives regarding a proposed intervention within the community.	yes	yes
Was the research design appropriate to address the aim of the research?	Four focus group discussions with 6–10 participants/group were conducted between April and May, 2018 in a private room at the research unit.	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	...recruited from Soweto, a large urban township in Johannesburg, South Africa. Participants were recruited using informative pamphlets handed out at the South African Medical Research Council Developmental Pathways for Health Research Unit, located at the Chris Hani Baragwanath Academic Hospital in Soweto. This was followed by a snowball recruitment sampling strategy, which is frequently used for qualitative studies in vulnerable populations	yes	yes
Was the data collected in a way that addressed the research issue?	Two trained research assistants who were of the same gender, approximate age, and ethnicity as the participants and were fluent in participants' languages facilitated the groups, 1 as a note taker. A topic guide (Table 1) provided a flexible framework for discussion. Data saturation was achieved for 4 focus groups(29 young women) when after the data	yes	yes

	were thematically coded, moderators and researchers con-firmed that no new information was presented		
Has the relationship between researcher and participants been adequately considered?	Four focus group discussions with 6–10 participants/group were conducted between April and May, 2018 in a private room at the research unit. Observation by researchers ensured that the moderators displayed appropriate skills as outlined by Krueger and Casey. The moderators had no personal relations with focus group participants. The discussions were conducted in English with flexibility for participants to use vernacular languages.	can't tell	Can't tell
Have ethical issues been taken into consideration?	The University of the Witwatersrand Human Research Ethics Committee granted ethical approval for the study (M171066) and the research was conducted in accordance with the Declaration of Helsinki principles for research involving human participants. All participants gave written consent before taking part in the research.	yes	yes
Was the data analysis sufficiently rigorous?	After the researchers were familiarized with the transcripts, they developed initial in vivo codes (codes based on participants' own words). Then, open coding and constant com-parison ³⁴ resulted in merging and splitting of themes with general good agreement between researchers. Reliability of extracted themes was assessed by discussion between investigators (L.JW. and A.P.) and moderation by a third researcher (E.B.) who independently coded the transcripts before comparing emergent themes with the first 2 researchers.	yes	yes
Is there a clear statement of findings?	Findings suggested that in this urban African township, young women under-stood the importance of a healthy diet and physical activity but lacked knowledge about the impact of over-weight and obesity on health and disease. The findings of this study were based on discussions with a small group of young women from Soweto to inform a subsequent intervention within Soweto; thus, findings cannot necessarily be generalized to other populations of young women. How-ever, there were some consistencies	yes	yes

	between these findings and those from research in other countries with young women at increased risk for obesity.		
How valuable is the research?	To the authors' knowledge, this is the first study in the region to examine the impact of the broader social and structural environment on young women's health choices before conception from an emic perspective. These gender-based experiences described by the women spoke to the social opportunity outlined in the COM-B model. These lived experiences also sat within the broader economic, legal, and political organization of their social world, which perpetuates inequalities among different groups to cause harm, often referred to as structural violence. Previous work in this community supported these findings	yes	yes

McGowan et al. (2020)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	Given the significant gap regarding public views on preconception health and PCC in the UK, from a male and female perspective, this study aimed to explore the knowledge, attitudes and beliefs surrounding preconception health in men and women in the childbearing years, including those with and without children already.	yes	yes
Is a qualitative methodology appropriate?	A descriptive qualitative focus group methodology was chosen due to the exploratory nature of the research question.	yes	Yes
Was the research design appropriate to address the aim of the research?	Five focus groups were recruited: two rural and three urban, conducted across Northern Ireland (NI), UK, to ensure a broad range of views. Groups were also organized to represent a range of views (see table 1)	yes	yes
Was the recruitment	Participants were recruited using: (1) recruitment posters displayed in public areas in both urban	yes	yes

strategy appropriate to the aims of the research?	and rural locations, and, (2) via email circulars to all levels of University staff and students. Interested participants contacted the project researcher to express their interest in taking part. If interested in participating, they were screened for suitability according to the inclusion and exclusion criteria and their availability to attend a focus group.		
Was the data collected in a way that addressed the research issue?	Il five focus groups were conducted by two females(LM and ELC) and varied in terms of timing, e.g. after-noon or evening and location, University setting (urban location) or community hall (rural location). The lead facilitator (LM) was trained and experienced in qualitative methods. A semi-structured topic guide included: understanding/knowledge of preconception health, personal health status, learning about preconception health, seeking preconception help and learning about it in the future The focus groups were recorded and transcribed verbatim by a professional transcription company into Microsoft Word and verified by the research team	yes	yes
Has the relationship between researcher and participants been adequately considered?	...difficulties recruiting participants for focus groups, especially male-only groups and those without children. The framing of this type of research and where participants are sought should therefore be considered in future studies to negate this	Can't tell	Cant tell
Have ethical issues been taken into consideration?	Full ethical approval was granted from the Queen's University Belfast, School of Biological Sciences Research Ethics Committee. Interested participants contacted the project researcher to express their interest in taking part. They were sent an information sheet and contacted again in 48 h. Prior to beginning each focus group participants completed an informed consent process	yes	yes
Was the data analysis	all transcripts being double coded by at least two researchers, and two of the five transcripts coded	yes	yes

sufficiently rigorous?	by all three researchers (LM,ELC, and CC).....Codes, themes and sub-themes were compiled predominantly by ELC and discussed in detail with LM and CC regularly, and agreed in a process of tri-angulation (LM, ELC, and CC). The study was conducted and reported in line with the consolidated criteria for reporting qualitative research (COREQ) guidelines.		
Is there a clear statement of findings?	Key findings illustrated a lack of awareness of guidelines surrounding preconception health (for both sexes) and disparity between males and females regarding sources of support for preconception health. It highlighted that young adults do not feel comfortable consulting a doctor for general preconception advice, and illustrated a lack of awareness regarding the importance of male involvement in PCC behaviors. Codes, themes and sub-themes were compiled predominantly by ELC and discussed in detail with LM and CC regularly, and agreed in a process of tri-angulation	yes	yes
How valuable is the research?	This study highlights the need to improve awareness of preconception health amongst males and females of childbearing age in the UK. The research also indicated a need to consider the most appropriate preconception educational strategies and the timing of these based on life-stages, in order to facilitate the development of a culture which values preparation for pregnancy, amongst males and females.	Yes	yes

Kretowicz et al. (2018)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	The primary aim of the study was to explore barriers and enablers to following a Mediterranean style diet in women of childbearing age in the U.K.	yes	yes
Is a qualitative	This method was chosen because participants were able to give their own thoughts and build on	yes	yes

methodology appropriate?	the views of others, thus generating broad and in-depth discussions. This method has been used in a wide range of health research, including to assess attitudes relating to lifestyle change, to identify health needs in specific populations, to investigate the feasibility and acceptability of behavioural interventions, and to also explore experiences of health interventions, as it is essential that a thorough understanding of the target population is gained.		
Was the research design appropriate to address the aim of the research?	This method was chosen because participants were able to give their own thoughts and build on the views of others, thus generating broad and in-depth discussions.	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	The study utilized a convenience sample of university students and employed women identified through a snowballing approach. Women aged 18–49 years old, who were U.K. residents, nulliparous, had low to medium MD adherence, and did not study or have an occupation directly related to nutrition were eligible to participate in the study. Participants were recruited via posters, social media, email, and in person. participants were sent a document containing detailed information about the study and a link to a two-part online questionnaire which was used to confirm eligibility....The range of possible scores for MDPS is 0–14, and those who had a high adherence would not be eligible for participation as they were not considered to be inclusive in the target population.	yes	yes
Was the data collected in a way that addressed the research issue?	The focus groups were led by a facilitator and conducted in a private room. A semi-structured focus group guide was used with open-ended questions and probes allowing for the exploration of possible barriers to following an MD, with indicative topics including awareness of MD, motivations and eating behaviors, practicalities and social perception, and source preferences. The digital audiotapes were transcribed verbatim	yes	yes

	by the facilitator (H.K.) after each focus group. Data collection and analysis co-occurred to assess when data collection could be concluded once emerging themes had reached saturation.		
Has the relationship between researcher and participants been adequately considered?	The sample of women recruited for this study were well-educated, with all women educated to age 18 at a minimum and those who were not university students were employed in professional roles. This is, therefore, not representative of the wider population, and it is possible that individuals with other educational or socioeconomic backgrounds may have generated different data.	no	Can't tell
Have ethical issues been taken into consideration?	The research was undertaken between May and June 2017 and was approved by the Bournemouth University Research Ethics Committee. Prior to focus group participation, participants were sent a document containing detailed information about the study and a link to a two-part online questionnaire which was used to confirm eligibility. Participants were given the opportunity to add or raise any additional points before concluding the focus groups	yes	yes
Was the data analysis sufficiently rigorous?	Focus group transcripts were analyzed using the process of inductive thematic analysis, as described by Braun and Clarke. After the initial analysis, a second researcher (F.T.) reviewed the transcripts and independently coded for themes. Any discrepancies were resolved through discussion and additional review of the transcripts. The study identified five core themes encompassing perceived barriers and enabling factors to following a MD and include: MD features, perceived benefits, existing dietary behavior and knowledge, practical factors, and information source. Themes are illustrated with representative verbatim quotations from participants, represented numerically to protect anonymity, followed by participant age (e.g., (P. (n)/age (years)))	Yes	yes

Is there a clear statement of findings?	Our findings suggest that in order to achieve behavioral change there would need to be reframing of ideas about diet, removal of barriers to change, and motivational buy-in.	Yes	yes
How valuable is the research?	<p>This study identified five core themes including barriers and enablers, which should be addressed in the development of an intervention to effectively promote an encourage adherence to an MD.</p> <p>The insights gained from this formative research will be useful to assist in the development of a novel MD intervention for trial in a broad sample of women of childbearing age for the promotion of health prior to pregnancy.</p> <p>Future research with different populations would be useful to identify whether barriers and facilitators differ in lower socioeconomic groups and other cultural contexts.</p>	yes	yes

Mazza and Chapman (2010)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	As part of a larger study to develop and evaluate an intervention to improve the delivery of preconception care, our aim was to determine women's views of the barriers and enablers to the uptake of preconception care and periconceptional folate supplementation.	yes	yes
Is a qualitative methodology appropriate?	..there has been little published regarding women's views or any exploration of barriers and enablers to the delivery and uptake of preconception care and periconceptional folate supplementation. By ignoring these views we may neglect aspects of care provision which are important from the perspective of consumers of health care.	yes	yes
Was the research design appropriate to address the	<p>The total number of focus groups was limited, as their primary aim was to inform the next phase of the study and to complement focus groups undertaken with GPs.</p> <p>We used the Index of Relative Socioeconomic</p>	Can't tell	Can't tell

aim of the research?	Disadvantage to determine postcodes in the lowest and highest quartiles of the index and recruited women residing at these postcodes through advertisements in local newspapers.		
Was the recruitment strategy appropriate to the aims of the research?	We used the Index of Relative Socioeconomic Disadvantage to determine postcodes in the lowest and highest quartiles of the index and recruited women residing at these postcodes through advertisements in local newspapers.	Yes	yes
Was the data collected in a way that addressed the research issue?	To maintain consistency, all focus groups were conducted by the same facilitator (DM) in a conversation-like manner and followed a schedule of guiding questions (Table 1). Data from the focus groups were audio-taped, transcribed verbatim and entered into NVIVO 7 software	yes	yes
Has the relationship between researcher and participants been adequately considered?	To maintain consistency, all focus groups were conducted by the same facilitator in a conversation-like manner and followed a schedule of guiding questions	no	Can't tell
Have ethical issues been taken into consideration?	The study was approved by the Monash University Standing Committee on Ethics in Research Involving Humans. The objectives and format of the focus groups were explained to participants before commencement, and their anonymity was assured. Participants gave written consent to participate.	yes	yes
Was the data analysis sufficiently rigorous?	Initially, transcripts were read and re-read by both authors in order to familiarise themselves with the data. To increase rigour, each transcript was independently coded line by line by both authors. An inductive process of thematic analysis, as described by Braun and Clarke [15], was employed to identify key issues and themes within the data. For areas where coding differed, agreement of interpretation was reached through meetings	yes	yes

	<p>between both authors. The thematic results were then presented to the project advisory group (which included content and methodological experts) for discussion and further interpretation. Quotes representing typical views expressed by the women were extracted from the transcripts and are presented in the results to illustrate the themes identified.</p>		
Is there a clear statement of findings?	<p>Four major barriers to the uptake of preconception care were found and one barrier to the uptake of periconceptional folate supplementation was consistently identified. With the exception of service provider issues, all barriers identified were consistent across groups. Two major thematic areas were identified in relation to enablers to the uptake of preconception care and periconceptional folate supplementation.</p> <p>In contrast to our results, a small study ...found that despite generally subscribing to the value of preventive behaviours and a healthy lifestyle, women perceived themselves as having sufficient knowledge of preconception care issues and/or not being at risk.</p>	yes	yes
How valuable is the research?	<p>We suggest that these findings might be relevant to the implementation of other forms of prevention, and that patient perceptions of the role of GPs in prevention requires further exploration. Having identified the views of women and the fact that multiple barriers and enablers to the uptake of preconception care and periconceptional folate supplementation exist, we believe that further research is needed to identify which of these are the most important and amenable to change.</p>	Yes	yes
Tuomainen et al. (2013)			
CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of	However, there is a paucity of relevant qualitative evidence, particularly from minority ethnic communities who might form priorities for	yes	yes

the aims of the research?	targeting. In this study, we explored perceptions about preconception health and care among women from diverse ethnic backgrounds. We wished to identify opportunities and challenges for preconception care in primary care in the UK to inform intervention development and implementation		
Is a qualitative methodology appropriate?	<p>A topic guide was developed from literature review and two pilot group discussions with GPs and practice nurses, to include:</p> <ul style="list-style-type: none"> ▸ Previous experience of preconception health advice; ▸ Awareness of, and attitudes towards preconception health; ▸ Views on when and how preconception care might occur; ▸ Showing women areas of preconception health assessment (PHA) such as lifestyle, medical/family history, infectious disease and fetal exposure on a draft questionnaire 	yes	yes
Was the research design appropriate to address the aim of the research?	Audio-recorded focus groups were convened at a location and time convenient to participants and each facilitated by two of three field researchers (HT, MB and LCB), all of whom were women, including from Muslim and Punjabi/Urdu speaking Sikh backgrounds, with one moderating the discussion and the other taking notes	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	We recruited and purposefully sampled from pre-existing social groups of women of reproductive age(18–45), such as parent and toddler and faith-based groups, in ethnically diverse and deprived inner city and rural localities of the Midlands, with Indices of Multiple Deprivation in the lowest quintile (most deprived 20%)for the UK. These ‘naturally occurring’ groups were chosen given that health issues may be routinely dis-cussed and shared by women more familiar with each other.	yes	yes
Was the data collected in a way that addressed the	Audio-recorded focus groups were convened at a location and time convenient to participants and each facilitated by two of three field researchers	yes	yes

research issue?	<p>A topic guide was developed from literature review and two pilot group discussions with GPs and practice nurses.</p> <p>Participants were encouraged to freely discuss their experiences and views, with exploration evolving to accommodate emerging themes in the groups.</p> <p>All women from the groups were invited to participate in follow-up semi-structured one-to-one telephone interviews, and those who wished to do so were interviewed. These were undertaken to consider themes from the group or areas the individual may not have contributed to during earlier group discussion, for example, because of shyness or being inhibited by the group context.</p>		
Has the relationship between researcher and participants been adequately considered?	<p>facilitated by two of three field researchers (HT, MB and LCB), all of whom were women, including from Muslim and Punjabi/Urdu speaking Sikh backgrounds, with one moderating the discussion and the other taking notes.</p> <p>A topic guide was developed from literature review</p> <p>Emerging themes were agreed jointly in parallel discussions with the wider clinical research team.</p>	yes	yes
Have ethical issues been taken into consideration?	<p>Prior to the group discussions, participants completed consent forms and a brief demographic questionnaire.</p> <p>All women from the groups were invited to participate in follow-up semi-structured one-to-one telephone interviews, and those who wished to do so were interviewed.</p> <p>Although we included women who had been pregnant as teenagers, study ethics approval limited inclusion to those aged over 18 years.</p>	yes	yes
Was the data analysis sufficiently rigorous?	<p>We analysed data from focus groups and telephone interviews using qualitative research principles. Group discussions were transcribed verbatim, and telephone interviews summarised for pertinent themes. All transcripts were checked against the recording for accuracy</p> <p>Data were analysed using thematic analysis and constant comparison, and the focus of analysis was both the individual and the group. Emerging</p>	yes	yes

	themes were agreed jointly in parallel discussions with the wider clinical research team.		
Is there a clear statement of findings?	<p>Women in this study had limited awareness of preconception health but perceived offering preconception care more routinely in general practice as appropriate, particularly if raised within a range of clinically ‘relevant’ consultations or when opportune for individuals in their social context.</p> <p>The findings may not be typical of other women, and must be interpreted with regard to the sample described.</p> <p>Our findings suggest that even if pregnancy is ‘planned’, discussing or seeking preconception care maybe hampered by women’s ability and willingness to be open about their aspirations or plans with others, including health professionals. This may be compounded by stigma associated with infertility and this was high-lighted by women in our sample.</p>	yes	yes
How valuable is the research?	<p>However, this study suggests that raising preconception health more proactively may most promisingly occur when this assumes heightened individual relevance for women. This could include clinical contexts such as when attending for contraception, difficulty conceiving, treatment or disease review, or as part of other routine health promotion such as cervical screening.</p> <p>Further research with younger teenagers and the perspectives of men on preconception health are still needed</p>	yes	yes

M’hamdi et al. (2018)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	Therefore, the aim of this study was to explore perceptions of pregnancy preparation of women with a relatively low educational attainment and the role they attribute to healthcare professionals. We aimed at achieving this by interviewing	yes	yes

	women with a desire to conceive, of which a subgroup had received PCC		
Is a qualitative methodology appropriate?	Assessing the perceptions of women with a relatively low educational background, with and without PCC experience, will provide insights into why and how these women prepare for pregnancy and whether this includes consulting a healthcare professional for PCC. These insights are valuable for the improvement of periconception health,	yes	yes
Was the research design appropriate to address the aim of the research?	...we had a final sample of 28 participants. Our aim was to have a sample with a variation in participant's characteristics such as age, ethnic background and prior experiences with pregnancy. The semi-structured interviews were conducted using a two-part topic list. The first part focused on perceptions and behaviour with regard to pregnancy preparation. The second part listed questions on perceptions concerning healthcare needs prior to pregnancy. For the PCC-group, this second part included questions about their experience with PCC.	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	The recruitment strategy included an invitational letter for PCC from a general practitioner (GP) and/or from the municipality. Women aged 18 to 41 years who applied for a PCC consultation with their GP or midwife were asked to participate in a cohort study. For our study, a selection of eligible participants was made based on the following criteria: consent to be contacted for an additional study, having received a PCC consultation in 2014, and an indication for having a low to middle SES based on a low or intermediate educational attainment (International Standard Classification of Education up to and including level 4).	yes	yes
Was the data collected in a way that addressed the	We aimed at interviewing fifteen participants (thirty in sum) in both the PCC-group and the non-PCC-group, as we expected to reach saturation of responses at that number. Semi-structured interviews were conducted in the spring of 2015 by four researchers in close	yes	yes

research issue?	collaboration. The interviews were carried out at the Erasmus MC, at participant's homes, or by telephone if preferred. The semi-structured interviews were conducted using a two-part topic list.		
Has the relationship between researcher and participants been adequately considered?	Semi-structured interviews were conducted in the spring of 2015 by four researchers in close collaboration. The interviews were carried out at the Erasmus MC, at participant's homes, or by telephone if preferred.	no	Can't tell
Have ethical issues been taken into consideration?	Women aged 18 to 41 years who applied for a PCC consultation with their GP or midwife were asked to participate in a cohort study. The other subgroup, the non-PCC-group, was recruited using a professional recruitment service specialized in finding suitable participants for scientific research. This service has a database of people willing to participate in scientific research. This study was approved by the Medical Ethics Committee of the Erasmus MC. Written informed consent was obtained from all participants.	yes	yes
Was the data analysis sufficiently rigorous?	We used an inductive process of thematic analysis as described by Braun and Clarke to identify the key themes of perceptions in the transcriptions (28). Firstly, we familiarised ourselves with the data and generated an initial coding scheme. Together, two researchers with experience in qualitative research adjusted the coding scheme through an iterative process of analysing the transcripts. We used NVivo10 software (QSR International, 2012) for the analysis. Subsequently, based on our coded fragments, themes and sub-themes were mapped in Excel. The two researchers performed this step together to discuss and refine the themes during the process. Representative citations were selected and translated to English. Participants could also have been influenced in	yes	yes

	their responses by the different interview settings (i.e. on site, at home, and via telephone), yet we have not been able to detect such differences.		
Is there a clear statement of findings?	<p>We identified three themes of pregnancy preparation perceptions in both groups which are perceptions about: (1) how to prepare for pregnancy? (2) why prepare for pregnancy? (3) barriers and facilitators regarding pregnancy preparation. We described one more perception theme in the PCC-group: (4) the added value of PCC</p> <p>In addition, participants of the PCC-group were included in the broader HP4ALL-study. This may have increased the possibility of participants giving socially desirable answers. However, given that most participants felt unhindered to express only a modest but relevant added value of the PCC-consultation, we assume that participants felt free to give their own opinion during the interview.</p>	yes	yes
How valuable is the research?	<p>Based on our results, we recommend the proactive offering of custom-made PCC including information on fertility.</p> <p>In addition, more research needs to be done about how women can be motivated to prepare for pregnancy as knowledge about pregnancy preparation alone does not necessarily lead to actual pregnancy preparation. Special attention needs to be given to whether and if so, how low-health literacy influences pregnancy preparation.</p>	yes	yes

Lang et al. (2019)

CASP Question	Text upon which the decision was made	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	In order to inform the development of tailored interventions to increase access and engagement of migrant women within preventive healthcare services this qualitative study explored pregnancy planning, preconception lifestyles, awareness, experiences and healthcare needs of reproductive	yes	yes

	aged migrant women residing in a large metropolitan city in Australia.		
Is a qualitative methodology appropriate?	Given the exploratory nature of this study, qualitative methods were employed, embedded within a broader mixed-methods study. Qualitative methods were chosen because they are more conducive to exploring women's experience and understanding their health and information needs.	yes	yes
Was the research design appropriate to address the aim of the research?	Qualitative methods were chosen because they are more conducive to exploring women's experience and understanding their health and information needs. Semi-structured interviews and focus groups enhanced understanding and enabled in-depth exploration of the perspectives, experiences, social and cultural influences and meanings surrounding pregnancy preparation. Focus group discussions enabled cultural differences and commonalities to emerge, while interviews facilitated deeper probing and validation of focus group findings.	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	A community advisory group established prior to the study's commencement comprised key stakeholders including women from migrant and refugee backgrounds and representatives from community-based organisations and health services that work with local migrant women. The group met face-to-face five times and also communicated over email. The community advisory group recommended a qualitative study design approach, ensured the methods were practically and culturally appropriate and were involved in the co-development and refinement of interview and focus group questions. This group also advised on participant engagement, recruitment and dissemination of findings.	yes	yes
Was the data collected in a way that addressed the research issue?	The community advisory group recommended a qualitative study design approach, ensured the methods were practically and culturally appropriate and were involved in the co-development and refinement of interview and focus group questions. This group also advised on participant engagement, recruitment and	yes	yes

dissemination of findings.

Interview and focus group discussions explored thoughts, experiences and meaning surrounding pregnancy planning and awareness or uptake of any recommended PCH behaviour. Interviews were scheduled at convenient times chosen by women, in discussion with the researcher, and took place in meeting rooms at local community organisations or Monash Medical Centre as appropriate. Two focus groups were held in community settings where women were invited to take part.

Sessions were audio-recorded, de-identified, transcribed verbatim by a professional transcription company and checked for accuracy by the lead researcher. Interviews and focus groups were conducted until saturation, where no new themes emerged

Has the relationship between researcher and participants been adequately considered?	An independent researcher who had not been involved in the development of the study attended the first focus group and provided feedback on the running of the session and preliminary interpretation. To meet confirmability, a reflexive journal was kept by the lead researcher detailing notes and pertinent thoughts throughout the process of data collection and analysis. Triangulation of investigators was also conducted by a second researcher (co-author R.B.) who had not been involved in data collection and who independently analysed the de-identified data to enhance trustworthiness and credibility	yes	yes
Have ethical issues been taken into consideration?	Human Research Ethics Committee's approvals were obtained from Monash University and Monash Health Women were provided with verbal explanations and information sheets in English, detailing the voluntary nature of the study prior to their consent, and before self-completing a brief demographic information form. Women could request an interpreter to assist with this process or the researcher would assist women to read and understand the information as needed.	yes	yes

Was the data analysis sufficiently rigorous?	<p>Content and thematic analysis of interviews and focus groups was undertaken to extract key themes, first manually and subsequently using NVivo11 software. Steps were taken throughout the study to ensure rigour and trustworthiness. An independent researcher who had not been involved in the development of the study attended the first focus group and provided feedback on the running of the session and preliminary interpretation. To meet confirmability, a reflexive journal was kept by the lead researcher detailing notes and pertinent thoughts throughout the process of data collection and analysis.</p> <p>Triangulation of investigators was also conducted by a second researcher (co-author R.B.) who had not been involved in data collection and who independently analysed the de-identified data to enhance trustworthiness and credibility</p>	yes	yes
Is there a clear statement of findings?	<p>The following four themes emerged: pregnancy planning experiences and perspectives; PCH message awareness and behaviours; social and cultural influences on pregnancy planning; and health information needs and preferences</p> <p>Findings from this study are largely consistent with concerns raised by women in the general population, however, it is evident that migrant women face significantly more barriers to accessing culturally relevant preconception and health information.</p> <p>Triangulation of investigators was also conducted by a second researcher (co-author R.B.) who had not been involved in data collection and who independently analysed the de-identified data to enhance trustworthiness and credibility</p>	yes	yes
How valuable is the research?	<p>Varied experiences and perspectives of women in this study demonstrate the need for a unique approach to a topic that is universally under-recognised within this cohort and the Australian-born population.</p> <p>Further research with migrant communities experiencing high-level disadvantage, low English proficiency, with known health barriers and poorer health outcomes is critical, as well as studies including men.</p>	yes	yes

Quayyum and Dombrowski (2021)

CASP item	Sample from text	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	This study examined barriers to nutritional preparation for pregnancy and perceived support needs of women and men of childbearing age	yes	Yes
Is a qualitative methodology appropriate?	No qualitative study has comprehensively examined barriers to nutritional pregnancy preparation and support needs in Canadian adults of childbearing age	yes	yes
Was the research design appropriate to address the aims of the research?	This descriptive qualitative research, using semi-structured interviews, was based on the Theoretical Domains Framework (TDF). ¹¹ The TDF provides a comprehensive list of theory-based explanations of behaviour, which can be used to examine factors that might impede the performance of behaviours.	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	Individuals were included if they were aged 19 years or older, lived in New Brunswick, Canada, did not have children but considered having future children, and could use online instant messenger	yes	yes
Was the data collected in a way that addressed the research issue?	A semi-structured topic guide was created based on the theoretical domains in addition to questions about support needs perceptions The interviews were conducted remotely through an online instant messaging service provided as part of the social media platform Facebook.	yes	yes
Has the relationship between researcher	A trained female researcher (undergraduate student) conducted semi-structured interviews and received ongoing supervision by an academic Health Psychologist (S.U.D.)	Can't tell	Can't tell

and participants been adequately considered?	Participants typed their answers in the chat window, and submitted these to the chat once they considered their reply to be complete. Replies could be submitted Quayyum and Dombrowski 3 in one block of text, or several sentences and chunks of writing		
Have ethical issues been taken into consideration?	This study received approval from the University of New Brunswick Research Ethics Board (#2020-045)	yes	yes
Was the data analysis sufficiently rigorous?	Transcripts were first coded by the first author (F.Q.) using a deductive approach based on the domains listed in the TDF.11 Additional codes were generated to identify suggestions participants made for health interventions, as well as whenever participants discussed preconception experiences and support needs for men. Coding of transcripts involved familiarization followed by line-by-line coding to identify key domains and subthemes.	yes	yes
Is there a clear statement of findings?	The study explored barriers and support needs in relation to nutritional pregnancy preparation in women and men. Based on the TDF,11 key theoretical domains were as follows: knowledge, beliefs about capabilities, environmental context and resources, social influences, and social role and identity. Participants demonstrated a general understanding of the benefits of nutritional pregnancy preparation before conception, but few knew about specific nutritional recommendations for this period	yes	yes
How valuable is the research?	This study might inform behaviour change interventions to support women and men to prepare nutritionally for pregnancy.	yes	yes

Yiga et al. (2020)

CASP item	Sample from text	First reviewer score	Second reviewer score
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Was there a clear statement of the aims of the research?	The study qualitatively explored the determinants of dietary and physical activity behaviours among WRA in urban Uganda to guide interventions.	yes	yes
Is a qualitative methodology appropriate?	In SSA, dietary decisions are made by mostly women and they directly influence the family's dietary behaviours(17–20). Hence, understanding determinants of dietary and physical activity decisions in women is vital	yes	yes
Was the research design appropriate to address the aims of the research?	A modified theoretical framework (Fig. 1) was used to guide the development of FGD. The basis of the framework was the theory of planned behaviour(23) complemented with specific constructs from social cognitive theory(24), health belief model(25), precaution adoption process model(26) and social support theory(27). Complementarity was important since no theory explains behaviour independently	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	. Participants were recruited through institutional religious women groups. A collaboration was established with Our Lady of Africa Parish, Mbuya and Beauty for Ashes International Rescuing Ministries. The two institutions were selected owing to their established social networks and community outreach across Kampala	yes	yes
Was the data collected in a way that addressed the research issue?	Semi-structured questioning routes for both behaviours were developed (see online supplementary material, Supplemental Tables 1 and 2), pre-tested on undergraduate female students of Kyambogo University, Uganda, and then refined. The FGD were audio-recorded and lasted between 60 and 90 min. Before the start of each FGD, a debriefing on the goal of study was held and the participants consent to participate was requested	yes	yes
Has the relationship between researcher and participants	A researcher with experience in qualitative research moderated FGD with a trained silent observer who took notes on non-verbal behaviour and group interactions(36). The FGD were conducted in English or Luganda	Can't tell	Can't tell

been adequately considered?	depending on language preference by participants.		
Have ethical issues been taken into consideration?	This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving research study participants were approved by Human Research Ethics committee of Clarke International University (reference number IHSU-REC/0117) and Uganda National Council for Science and Technology (reference number HS290ES). Participants signed a written informed consent for their participation in the study.	yes	yes
Was the data analysis sufficiently rigorous?	Data were analysed following inductive thematic content analysis approach (37,38). Open coding was conducted independently by two researchers to generate an initial coding framework. The two researchers discussed the generated frameworks for contrasts and similarities. Generated codes from all transcripts were then organised together into a second coding framework. Codes with overlapping content were grouped into categories	yes	yes
Is there a clear statement of findings?	Dietary and physical activity behaviours are determined by intra-individual, socio-cultural and environmental interrelated factors. The findings are peculiar to WRA as defined in the current study. The study identified twenty-one factors influencing dietary behaviour	yes	yes
How valuable is the research?	This study highlights potential determinants amenable to change through policy and programming	yes	yes

Walker, Drakely & Boyle (2020)

CASP item	Sample from text	First reviewer score	Second reviewer score
Was there a clear statement of the aims of the research?	aims of this study were to describe how preconception women prioritise their preconception health and gather their perspectives of how to increase their	yes	yes

	<p>awareness and uptake of healthy lifestyle behaviours in the preconception period. The outcomes of the secondary aims are reported here, along with a synthesis of key considerations for the future planning and development of interventions to engage women in preventive actions that optimise their preconception health.</p>		
Is a qualitative methodology appropriate?	A descriptive qualitative approach was used to achieve the primary and secondary aims	yes	yes
Was the research design appropriate to address the aims of the research?	A descriptive qualitative approach was used to achieve the primary and secondary aims. The full method is reported elsewhere, along with the outcomes of the primary aims	yes	yes
Was the recruitment strategy appropriate to the aims of the research?	Nonpregnant, nulliparous and parous English speaking women aged 18-45 years were purposively recruited from a community setting via flyers and social media. Participants were remunerated with a \$50 gift voucher	yes	yes
Was the data collected in a way that addressed the research issue?	Seven focus groups ran in metropolitan and regional Victoria, Australia in July and August 2019. The female focus group facilitators were experienced qualitative researchers: (a) RW, a postdoctoral clinician-researcher; and (b) SD, a public health Masters student n. At the focus group sites (secure university tutorial rooms, school library), participants were given the opportunity to interact with Gabby for approximately 50 minutes before a focus group to discuss their experiences. Focus groups ran for 40-50 minutes immediately after participants interacted with Gabby	yes	yes
Has the relationship between researcher and participants been adequately considered?	The facilitators had no prior relationship with any of the metropolitan participant	yes	yes

Have ethical issues been taken into consideration?	Ethics approval was obtained from Monash University Human Research Ethics Committee (Ref: 20341).	yes	yes
Was the data analysis sufficiently rigorous?	All transcripts were coded by two researchers (RW, SD) who met regularly throughout the analyses. An inductive process was used to categorise codes into themes with input from a third researcher (JB). Data analysis was supported by NVivo 9 analytical software.	yes	yes
Is there a clear statement of findings?	This research provides insight into how preconception women prioritise nutrition, physical activity and mental health over preconception health. While our participants considered preconception health to be important for all women, they admitted to engaging with health professionals only when sick and not considering preconception health to be relevant to them personally, if they were not planning a pregnancy	yes	yes
How valuable is the research?	Our data highlighted that women trust health professionals. Participants suggested that they were likely to use the Gabby system as a source of preliminary information before seeking advice from a health professional. This suggests that the Gabby system could be targeted primarily towards awareness raising for use in schools or alongside health services. This is consistent with the recommendation that preconception interventions should make use of existing models of care.	yes	yes

APPENDIX 5 SCRIPT FOR VIDEO

Thinking of having a baby?

There were lots of things we had to do to prepare for baby's arrival, but what about preparing for pregnancy?

Pre-conception is the time before you become pregnant and is a great time for you and your partner to start thinking about your own health.

The health of mums and their partners before pregnancy can affect the health of the baby as they grow during pregnancy and after they're born.

So taking the time to improve our health in the months before becoming pregnant can help our bodies prepare for the changes we go through during pregnancy, but it also benefits our baby's health before we've even become pregnant with them.

Some of the things both mums and partners can do to improve their health before becoming pregnant are:

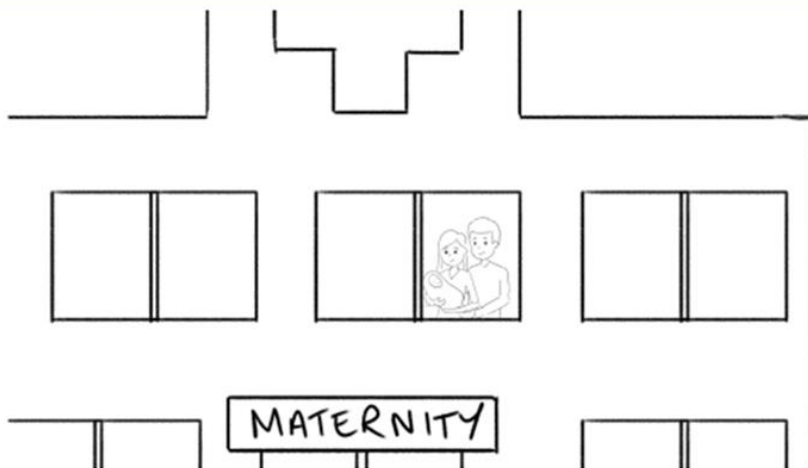
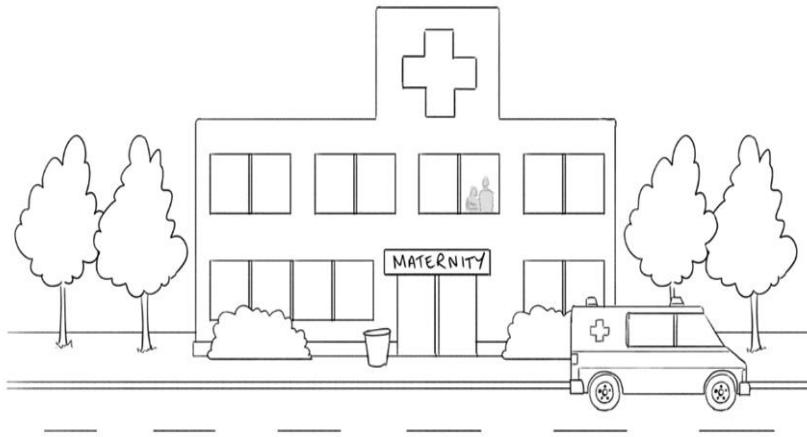
Having a healthy diet with lots of fruits and vegetables

Regular physical activity

Avoiding smoking cigarettes and drinking alcohol

And for women, taking supplements like folic acid, help the baby's brain to develop safely in those first few weeks, often before we even find out we're pregnant. So whether you're actively planning a pregnancy or not, it's always good to look after your health.

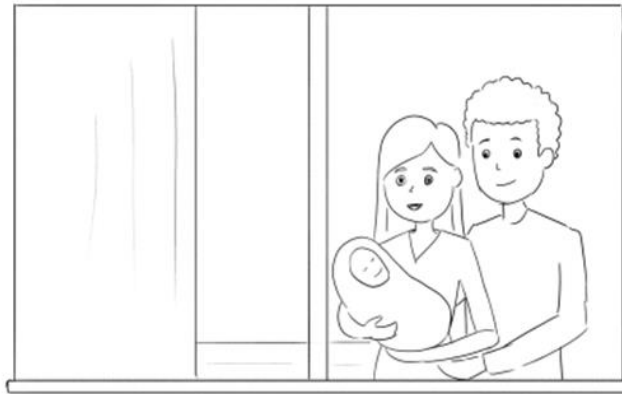
APPENDIX 6 STORYBOARD



SCRIPT
└─┘

Zoom into the window to see parents with a newborn baby

NOTES
└─┘



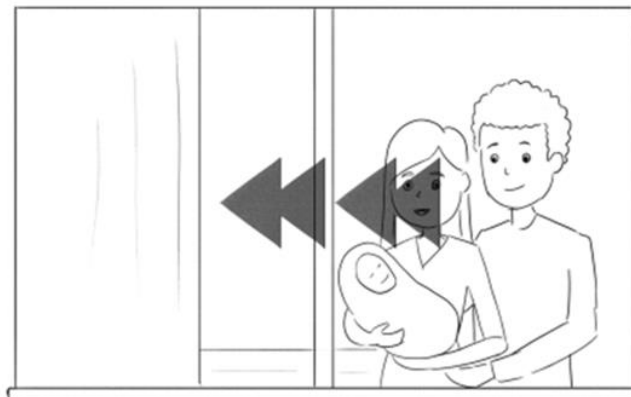
SCRIPT



Thinking of having a baby? There were lots of things we had to do to prepare for baby's arrival, but what about preparing for pregnancy?

Mother talks to camera

NOTES



SCRIPT



Rewind.

NOTES



PRE CONCEPTION



SCRIPT



We end in the couples living room, before the pregnancy

NOTES



PRE CONCEPTION



SCRIPT



Pre-conception is the time before you become pregnant ...

Arrows come out of the words PRE and CONCEPTION to explain the concept clearly

NOTES





SCRIPT



... and is a great time for you and your partner to start thinking about your own physical health.

Thought bubbles bob up as they each think about their own physical health.

NOTES



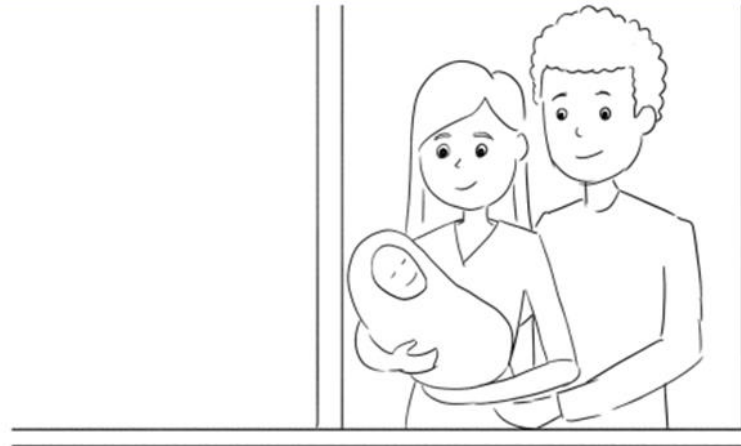


SCRIPT

... can affect the health of the baby as they grow during pregnancy ...

As we zoom, we see that she is now pregnant.

NOTES



SCRIPT

... and after they're born.

We fade to after the baby is born.

NOTES





SCRIPT



So taking time to make changes to improve our health in the months before becoming pregnant ...

We begin to see a few scenes of the couple improving their health.

They are out for a walk in the park.

NOTES





SCRIPT

... can help our bodies prepare for the changes we go through during pregnancy ...

They are eating healthy food.

NOTES



SCRIPT

but it also benefits our baby's health before we've even become pregnant with them.

And they are getting some good rest.

NOTES



Some of the things both mums and dads can do:

SCRIPT

Some of the things both mums and dads can do to improve their health before becoming pregnant are:

Title slide.

Mum talking to camera.

NOTES





SCRIPT



•Having a healthy diet with lots of fruits and vegetables

We see a Nigerian family cooking healthy together

NOTES



SCRIPT



•Regular physical activity

We see a same sex couple doing some yoga at home in their living room.

NOTES





SCRIPT

• Avoiding smoking cigarettes and drinking alcohol

We see a couple at a party saying no to alcohol and cigarettes.

NOTES

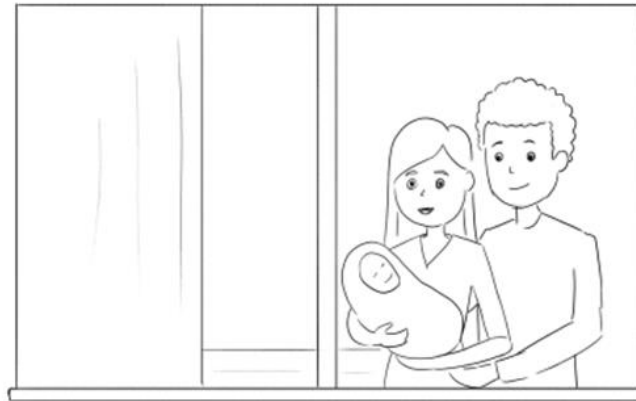


SCRIPT

• And for women, taking supplements like folic acid, help the baby's brain to develop safely in those first weeks, often before we even find out we're pregnant!

We see a muslim couple looking at folic acid supplements

NOTES



SCRIPT

So whether you are actively planning a pregnancy or not, it's always good to look after your health.

Back to mum in the hospital.

NOTES

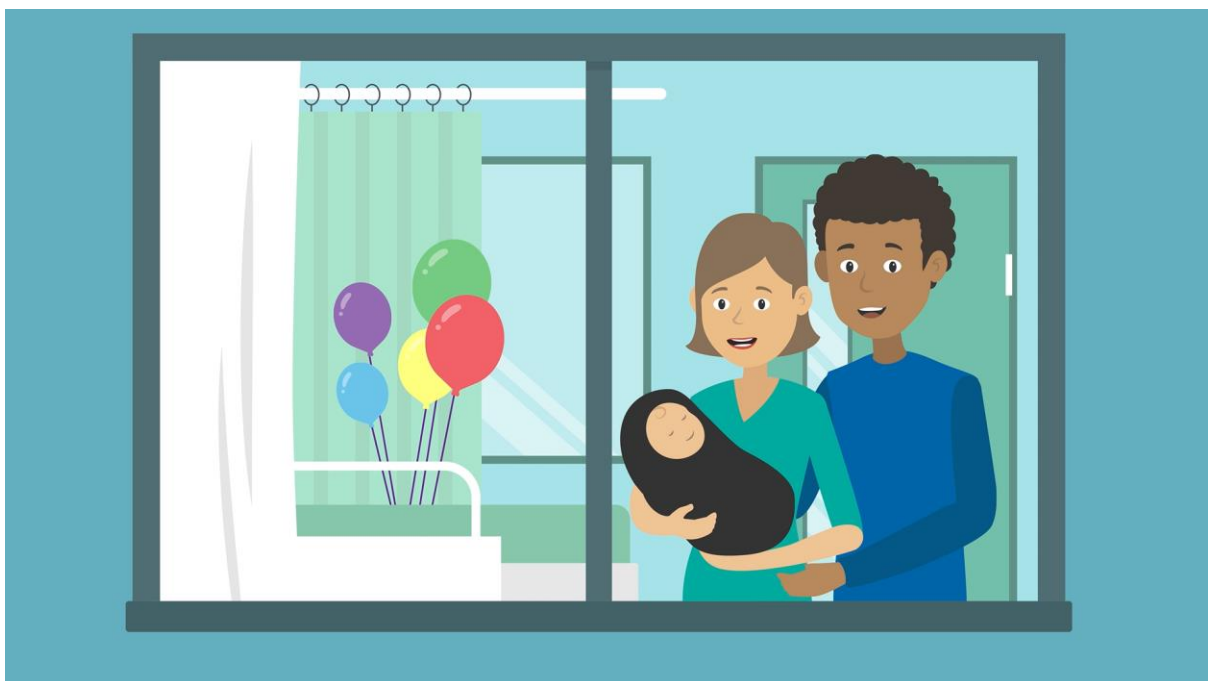


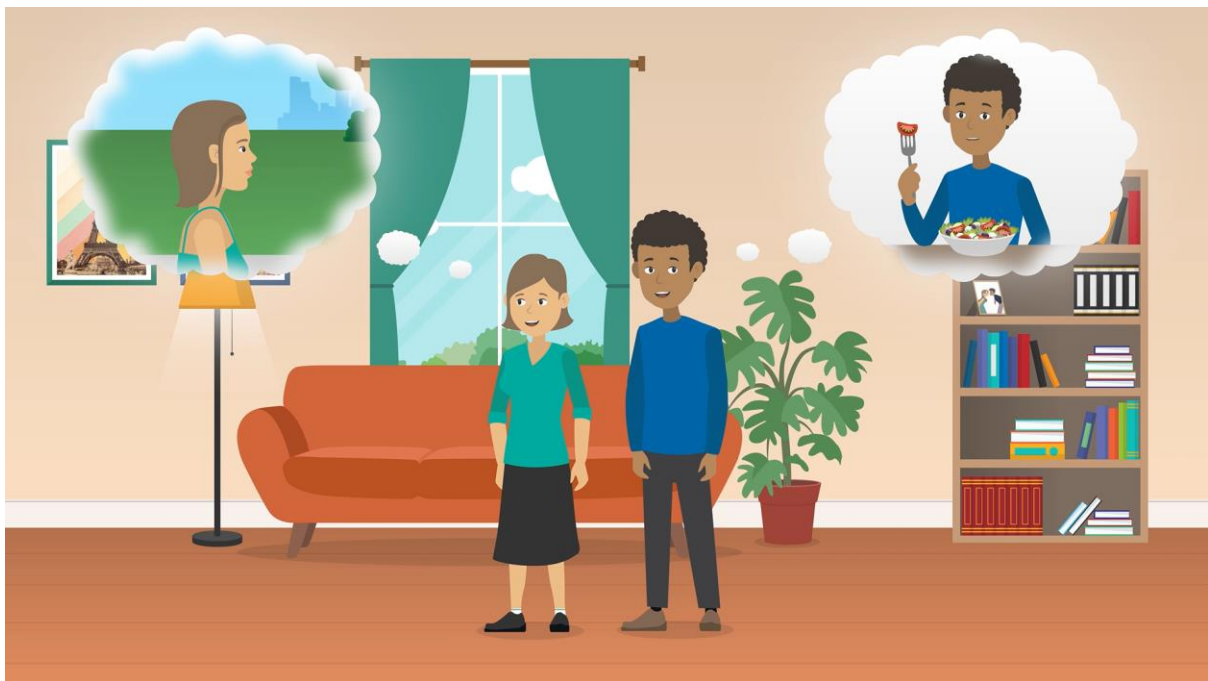
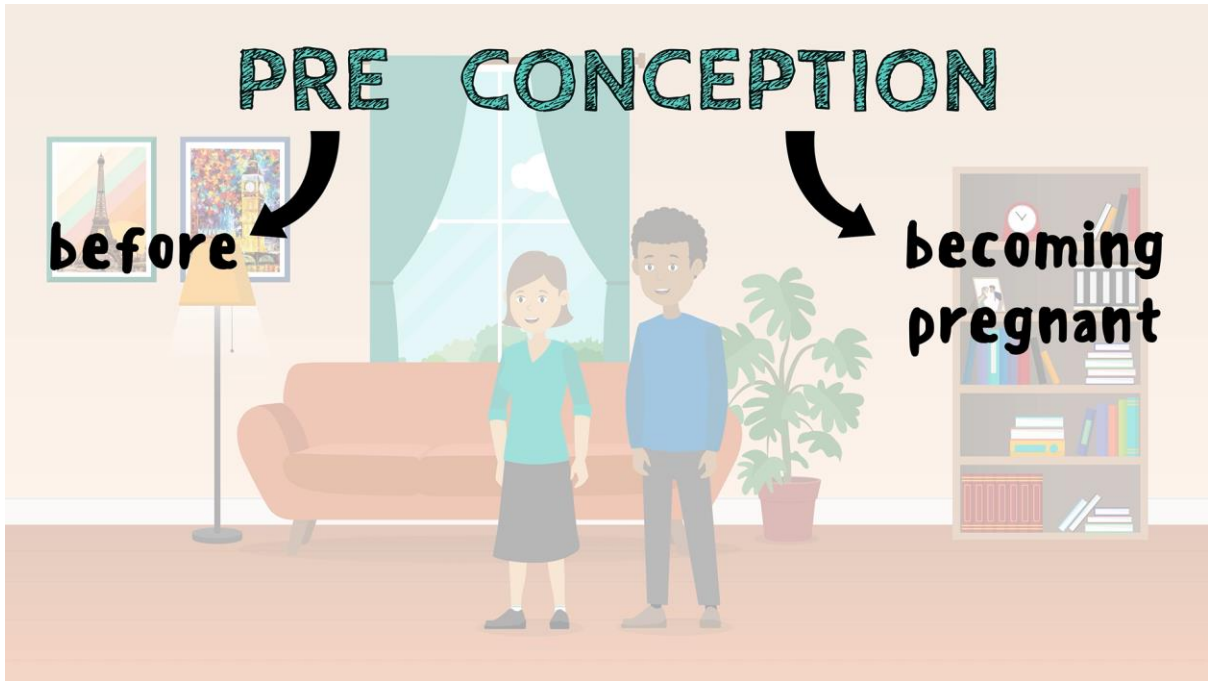
SCRIPT

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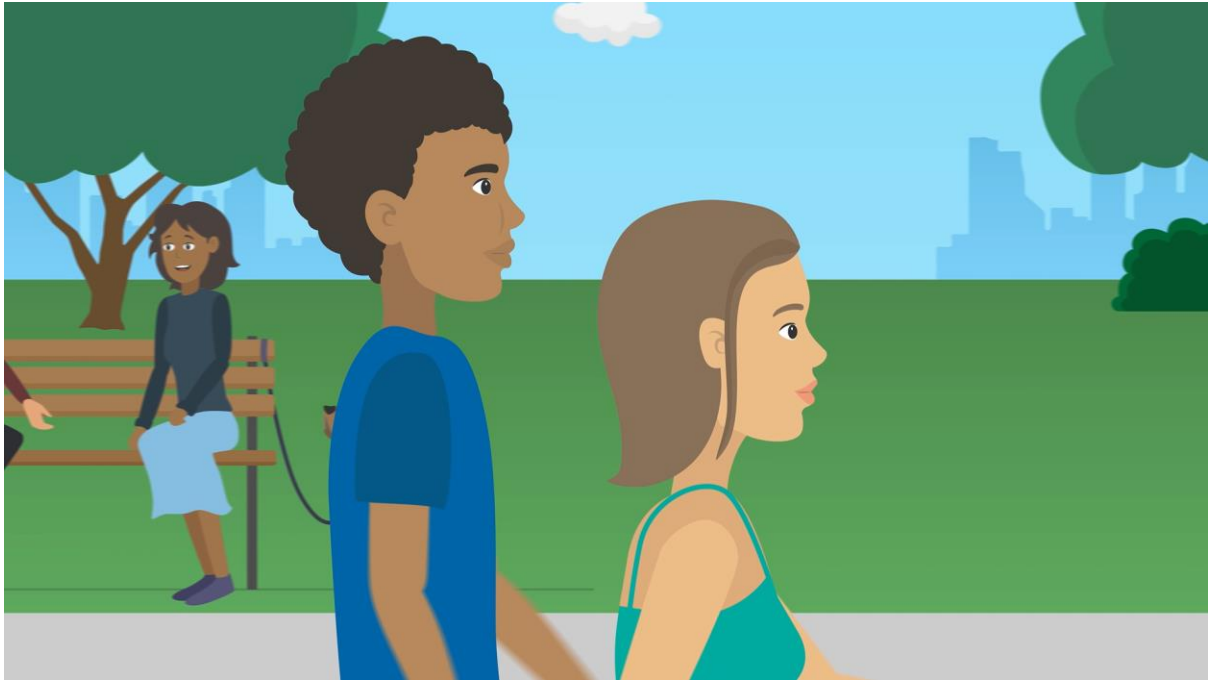
NOTES

APPENDIX 7: ANIMATED VIDEO FRAMES



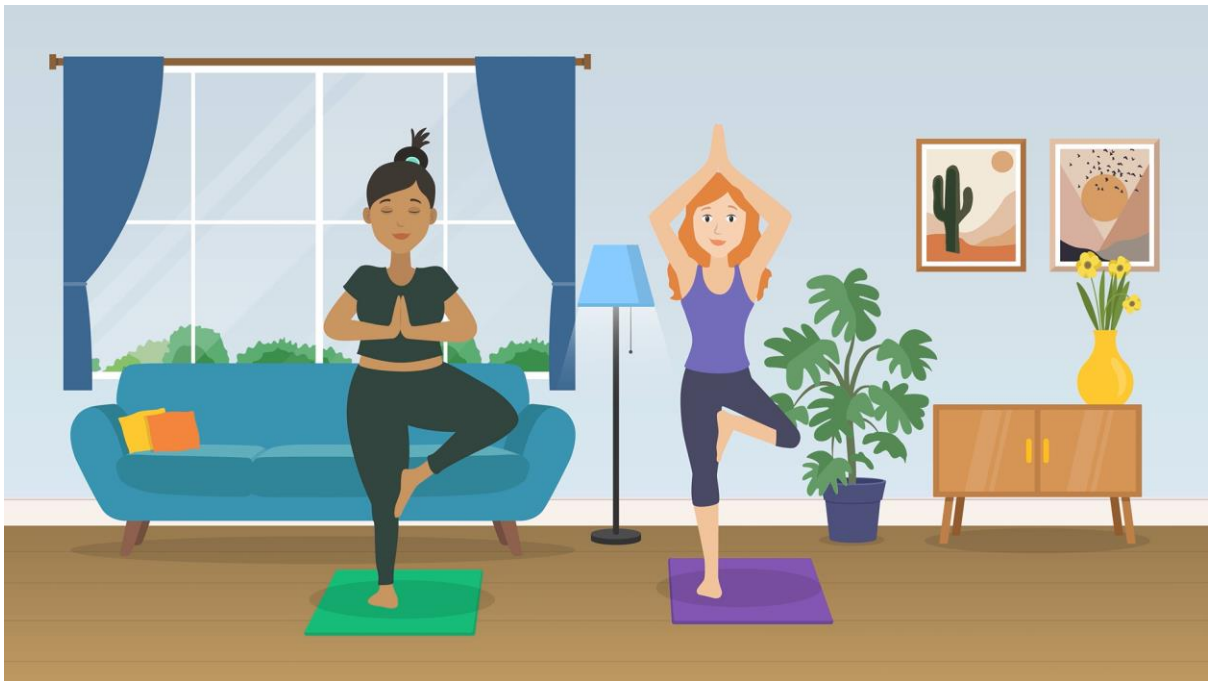


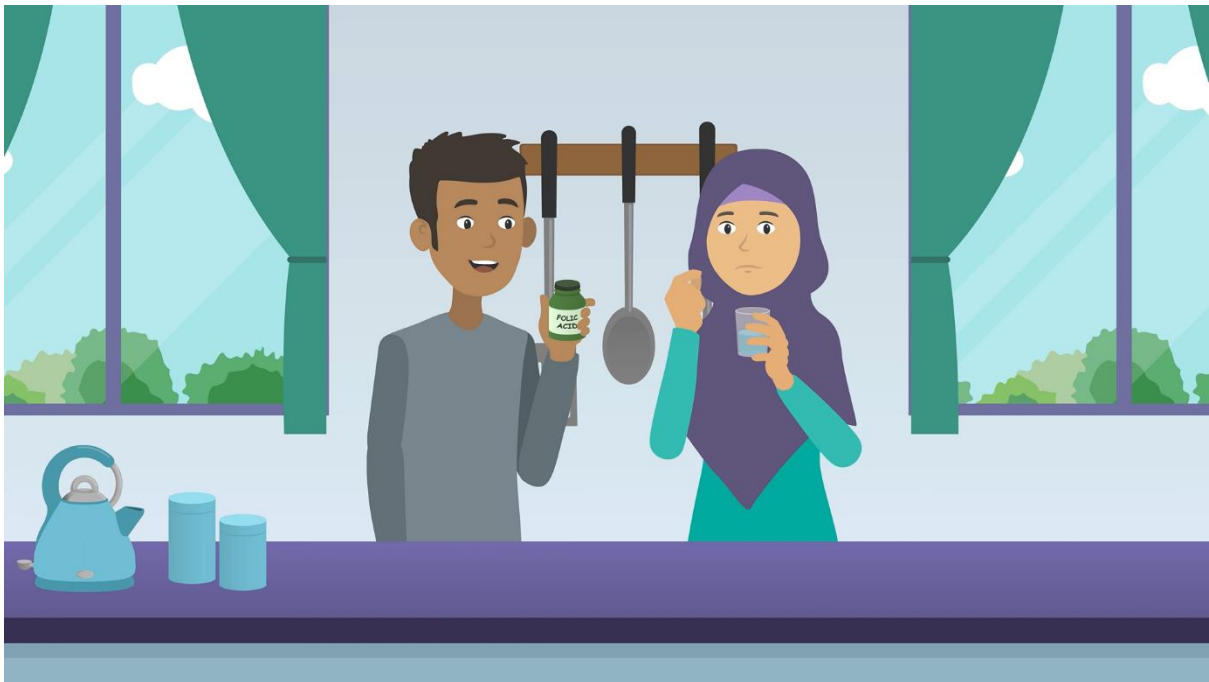


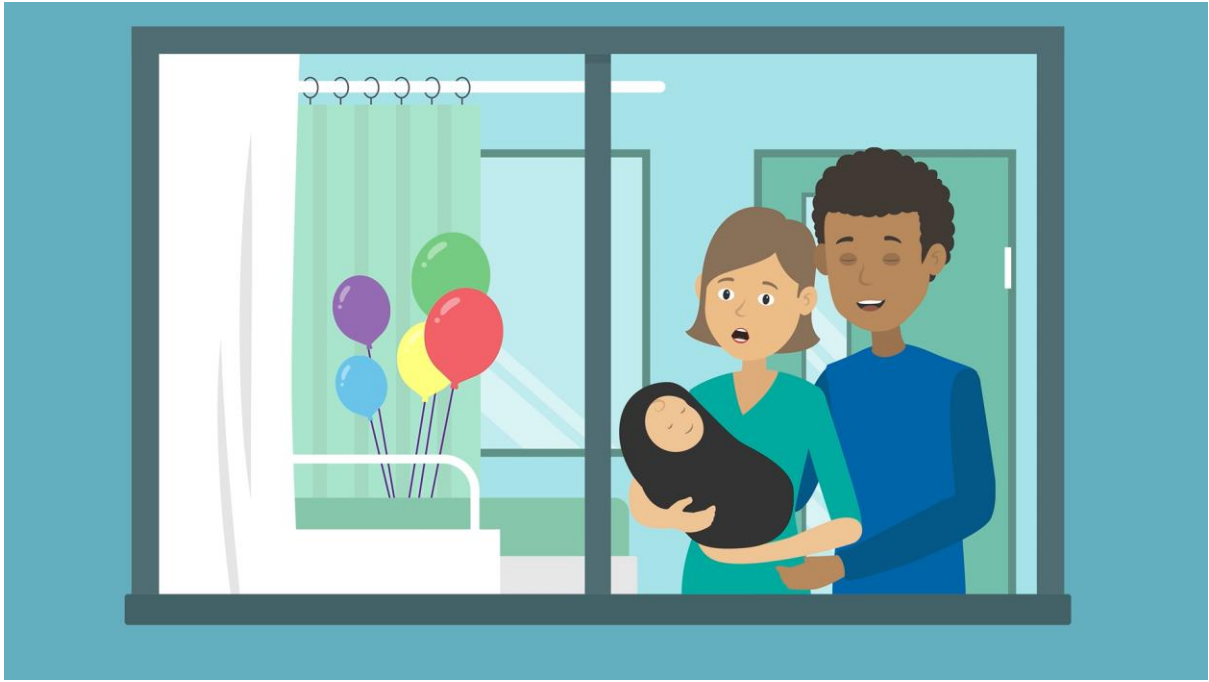




Some of the things both
mums and partners can do:







funded by:



APPENDIX 8: ETHICAL APPROVAL



University of Stirling
Cottrell 3B1
Stirling
FK9 4LA

09/08/2022

Dear Hannah

Ethics Application Form : [Preconception pilot study 8204](#)

Thank you for your submission of the above ethics application.

The ethical approaches of this project have been approved and you can now proceed with your project.

Please note that should any of your proposal change, a further amendment submission will be necessary.

If you have any further queries, please do not hesitate to contact the Panel by email to ethics@stir.ac.uk

Yours sincerely,

General University Ethics Panel

APPENDIX 9 SURVEY ADVERTISEMENT

Participant Recruitment Guidance

An intervention to raise awareness of preconception health among adults in the UK using the Information-Motivation-Behavioural Skills model: A cross sectional pilot and acceptability study

Interested in taking part in research? If you are a UK resident between the ages of 18-45 you are invited to take part in an online study about preparing to become a parent.

This study is recruiting during July 2022. Participation should take no longer than 10 minutes and no payment is being offered for taking part. Please contact Hannah Welshman, Faculty of Natural Sciences at the University of Stirling, hannah.welshman1@stir.ac.uk or Prof. Vivien Swanson, Faculty of Natural Sciences, University of Stirling, vivien.swanson@stir.ac.uk if you have any queries.

The ethical approaches of this project have been approved through the University of Stirling General University Ethics Panel. Ethics approval reference: (will be provided upon approval)

To take part, please click on the link below to the online survey.

APPENDIX 10: PILOT STUDY SURVEY

Section 1 – Demographic information

1. Please enter your age *box to type*

2. Please select your gender: (male, female, non-binary, other, prefer not to say)

3. What is your relationship status:

-Single/not married

-Married

-Living with a partner

-Separated

-Divorced

-Widowed

- Other

-Prefer not to say

4. What is your highest educational qualification:

-none

-GCSE, standard grade or equivalent

-A levels, Highers/Advanced highers

-Higher National Diploma or equivalent

-University Degree or above

5. Do you have any biological children?

-Yes

-No

6. What are your plans about becoming a parent?

-No plans at current time

-Currently trying

-Considering in the next 1-2 years

-Considering in the next 3-5 years

-Have tried, unable to become a parent biologically

7. Have you ever sought information from a health professional about improving health in preparation to becoming a parent?

-Yes

-No

8. Have you ever searched for information online about improving your health before becoming a parent?

-Yes

-No

Section 2 – Information motivation behavioural skills

You will now be asked to indicate how much you agree with the following statements. Please select from the scale where 1 is strongly agree and 5 is strongly disagree.

Item	
The health of the mother/birthing parent before becoming pregnant can affect their health during pregnancy	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
The health of the mother/birthing parent before becoming pregnant can affect their baby's health during pregnancy	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
The health of the mother/birthing parent before pregnancy can affect their baby's health after they are born	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree

The health of the father/non-birthing parent before pregnancy can affect the health of their baby during pregnancy	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree
The health of the father/non-birthing parent can affect the health of the baby after they are born	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree

The following questions ask you about preparing for pregnancy, and are relevant for both men and women. By preparing for pregnancy we mean engaging in the following behaviours before becoming pregnant:

Eating a nutritious and balanced diet

Being physically active

Taking folic acid (women only)

Not smoking tobacco

Not drinking alcohol

Please select how much you agree with the following statements from the scale where 1 is strongly agree and 5 is strongly disagree.

Item	
Preparing for pregnancy would be a good thing to do	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree
I believe that preparing for pregnancy is important	1 – strongly agree 2 – agree 3 – don't know

	4- disagree
	5- strongly disagree
Preparing for pregnancy is something most people do	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
I feel that preparing for pregnancy is something I should do	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
It would be easy for me to prepare for pregnancy	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
I believe that I would be able to start preparing for pregnancy	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
I believe that I would be able to continue preparing for pregnancy for a few months	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
I believe that I would be able to prepare for pregnancy even if I found it difficult	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree

Section 3 - Acceptability questions

When answering the questions below, please think about the video as a whole and select the number that best represents your views.

Item	
The video was enjoyable to watch	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree
The video clearly explains what preconception health is	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree
The information in the video made sense to me	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree
I was not offended by the messages in the video	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree
Watching the video was easy for me to do	1 – strongly agree 2 – agree 3 – don't know 4- disagree 5- strongly disagree

I am confident I would be able to follow the advice mentioned in the video	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree

Watching the video did not take up too much of my time	1 – strongly agree
	2 – agree
	3 – don't know
	4- disagree
	5- strongly disagree
