

CARDIFF UNIVERSITY

**The Role of Health-Related Cognitions in Willingness to Optimise
Health in the Fertility Context**

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I dedicate this thesis to my parents

Linda and Lyndon Fulford

and to my partner

Owen Williams

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Thesis Summary

Parenthood is a goal desired by the majority of men and women. People are far more likely to achieve their parenthood goals if they take steps to optimise fertility and pregnancy. Measures to optimise fertility and pregnancy reduce the risk of fertility problems, increase the chance of conceiving and, if a pregnancy is achieved, reduce the risk of pregnancy complications. Such measures include adopting a healthier lifestyle, seeking timely medical help when problems conceiving are encountered, and following medical health recommendations for people who are trying to conceive and/ or are pregnant (e.g., taking folic acid supplements). However, despite the importance placed on becoming parents, many people fail to take steps to safeguard fertility and pregnancy. The set of studies presented in this thesis aimed to examine the role of health-related cognitions in how willing people are to take action to optimise fertility and pregnancy and to identify targets for public health campaigns to promote informed decision-making about fertility and pregnancy.

The work presented in this thesis demonstrated that health-related cognitions play a key role in how likely people are to optimise fertility and pregnancy. Knowledge about fertility was poor (51.9% average correct score on fertility knowledge questions), which was associated with being less likely to take action to optimise fertility. However, a common result across studies was that even when people knew about factors that put fertility or pregnancy at risk, they often did not apply these factors to themselves because they had mental models that made them feel insusceptible to risk. Findings suggested that a personalised fertility risk awareness tool was acceptable and feasible among women and health professionals and may help women to understand the personal relevance of risks to fertility.

Overall, the findings of the current set of studies imply that timely education about fertility and pregnancy is needed to enable people to make informed decisions about optimising fertility and pregnancy. Further, personalised risk awareness interventions are required to help people understand their own susceptibility to risk and decide whether and what action to take to reduce their risk.

Publications

Papers

Chapter 2:

Fulford, B., Bunting, L., Tsibulsky, I., & Boivin, J. (2013). The role of knowledge and perceived susceptibility in intentions to optimize fertility: findings from the International Fertility Decision-Making Study (IFDMS). *Human Reproduction*, 28, 3253–3262. doi: 10.1093/humrep/det373.

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Talk

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Posters

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Fulford, B. and Boivin, J. (2013). Feeling immune to risk may explain poor adherence to periconceptional health guidelines. In: Program and abstracts of the 29th annual meeting of the European Society of Human Reproduction and Embryology. July 2013. London: *Human Reproduction*, 28 (Supplement 1). doi: 10.1093/humrep/det218.

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Glossary of Abbreviations

BMI.....	Body Mass Index
CFKS.....	Cardiff Fertility Knowledge Scale
CFS.....	Cardiff Fitness Survey
CUPPS.....	Cardiff University Parenthood Planning Survey
ELM.....	Elaboration Likelihood Model
ESHRE.....	European Society of Human Reproduction and Embryology
ESRC.....	Economic and Social Research Council
FertiSTAT.....	Fertility Status Awareness Tool
GP.....	General Practitioner
HBM.....	Health Belief Model
HIV.....	Human Immunodeficiency Virus
IFDMS.....	International Fertility Decision-Making Study
IPAQ.....	International Physical Activity Questionnaire
IVF.....	<i>in vitro</i> Fertilisation
MET.....	Metabolic Equivalent Minutes
MRC.....	Medical Research Council
NHS.....	National Health Service
NICE.....	National Institute for Health and Care Excellence
NTD.....	Neural Tube Defects
OF.....	Outdoor Fitness
ONS.....	Office for National Statistics
PANAS.....	Positive and Negative Affect Scale
PSS.....	Perceived Stress Scale
RCT.....	Randomised Controlled Trial
STI.....	Sexually Transmitted Infection
TPB.....	Theory of Planned Behaviour
WHO.....	World Health Organisation

Chapter 1: General Introduction and Thesis Overview

General Introduction

Population surveys show that parenthood is a goal desired by most people, with 93 to 97% of men and women saying they want a child someday (Berrington, 2004; Lampic, Svanberg, Karlström & Tydén et al., 2006; Testa & Toulemon, 2006). People are far more likely to achieve their parenthood goals if they take measures to optimise their fertility and pregnancy. Measures to optimise fertility reduce the risk of fertility problems and increase the chance of conceiving and include adopting a healthier lifestyle (e.g., quitting smoking, reducing alcohol intake; National Institute for Health and Care Excellence [NICE], 2008a, 2013) and seeking medical help when problems conceiving are encountered (NICE, 2013). If a couple conceives, the woman can optimise her pregnancy (i.e., reduce the risk of health complications for the mother and infant) by having a healthy lifestyle and following medical recommendations for pregnant women (e.g., taking folic acid supplements; NICE, 2008a). Many people who are trying to conceive or are pregnant fail to take steps to optimise their outcomes, which puts them at risk for fertility problems and/ or pregnancy-related complications and ultimately reduces their chance of achieving their parenthood goals. A range of practical factors may influence whether people take steps to improve their health, such as access to medical services or the cost of healthcare (e.g., folic acid supplements). However, theory and research suggest that health behaviour depends largely on health-related cognitions (e.g., beliefs and perceptions about a given health condition; Abraham & Sheeran, 2005; Rosenstock, 1990). The aim of the present thesis was to examine the role of health-related cognitions in the willingness to optimise fertility and pregnancy.

Infertility is defined as the inability to conceive after 12 months or more of regular unprotected intercourse (Zegers-Hochschild et al., 2009). An estimated 9% of people worldwide are infertile (Boivin, Bunting, Collins & Nygren, 2007). Recent research suggests that the prevalence of many risk factors for fertility problems is increasing. For example, the proportion of adults who are overweight or obese in the United Kingdom (UK) has increased to 66.6% in men and 57.2% in women (Health and Social Care Information Centre, 2014). In addition, whilst rates of smoking show a declining trend, 20% of men and 19% of women still smoke (Health and Social Care

Information Centre, 2013). These unhealthy lifestyle factors decrease the chance of conception naturally and through fertility treatment (e.g., Augood, Duckitt & Templeton, 1998; Hassan & Killick, 2004; Maheshwari, Stofberg & Bhattacharya, 2007).

In addition to unhealthy lifestyle habits, people are delaying childbearing to older ages. The average age at which women have their first birth is rising, being 28.1 years in 2012 compared with 26.8 years in 2002 (Office for National Statistics [ONS], 2013). This may jeopardise parenthood goals because age is the strongest risk factor for female infertility, with older women being less likely to get pregnant and those who do eventually have a pregnancy taking longer to conceive (Broekmans, Knauff, te Velde, Macklon & Fauser, 2007; Gindoff & Jewelewicz, 1986; Gnoth, Godehardt, Godehardt, Frank-Herrmann & Freundl, 2003). Further, older women who become pregnant are more likely to experience adverse pregnancy outcomes (e.g., hypertension; Utting & Bewley, 2011). The impact of postponing childbearing is reflected in an increase in the number of older women seeking fertility treatment to conceive (de Graaff, Land, Kessels & Evers, 2011), but fertility treatment cannot fully compensate for the age-related decline in fertility (Leridon, 2004).

People are generally not proactive at seeking help when they have problems conceiving, which makes it far less likely that they will eventually achieve a conception. Only 56% of couples consult a doctor when they have been trying unsuccessfully to conceive for a year (Boivin et al., 2007) and 20% delay seeking that help for more than two years (Bunting & Boivin, 2007). Delaying seeking help leaves people with less time to investigate relevant treatment options, as the efficacy of fertility treatment declines with age (van Noord-Zaadstra et al., 1991). Further, it delays people from receiving medical advice about modifying unhealthy lifestyle behaviours (e.g., smoking) that could be causal in their unsuccessful efforts to conceive. Even among pregnant women, many fail to adhere to medical recommendations that would optimise their pregnancy. For example, folic acid supplements are recommended to reduce the risk of the foetus developing infant neural tube defects (NTDs; MRC Vitamin Study Research Group, 1991). However, only around 30% of women take folic acid supplements as recommended from the point at which they begin trying to conceive until week 12 of pregnancy (Barbour, Macleod, Mires & Anderson, 2012).

The fact that people fail to take steps to optimise fertility and/ or pregnancy is perhaps especially concerning given that only moderate behavioural changes are needed

to achieve health benefits. For example, as low as a 5% reduction in body weight leads to significant improvements in menstrual cyclicity and restoration of ovulation in overweight women (Clark, Thornley, Tomlinson, Galletley & Norman, 1998; Huber-Buchholz, Carey & Norman, 1999; Moran, Noakes, Clifton, Tomlinson & Norman, 2003). Ex-smokers have a chance of conceiving similar to that of individuals who have never smoked, even for ex-smokers who quit within one year of starting to try to conceive (Curtis, Savitz & Arbuckle, 1997). A main aim of the studies in the present thesis was to examine the factors that make people more likely to take steps to optimise fertility and pregnancy.

The Role of Health-Related Cognitions

Theory and previous research suggest that cognitions about health influence whether individuals will take steps to optimise their health and reduce their risk for adverse health outcomes (Abraham & Sheeran, 2005; Rosenstock, 1990). Cognition refers to conscious mental activities including thinking, understanding, learning and remembering (Merriam-Webster's online dictionary, n.d.) and can be thought of as the process by which individuals acquire knowledge. Across various health contexts, when people are knowledgeable about a health problem they are more likely to take steps to optimise their health and reduce their risk. For example, people with higher disease-related knowledge are more likely to perform disease screening practices (e.g., breast cancer screening; Dünder et al., 2006; Parsa, Kandiah, Mohd Zulkefli & Rahman, 2008), avoid unhealthy lifestyle habits (e.g., smoking; Yu, Chen, Kim & Abdulrahim, 2002), adopt healthy lifestyles (e.g., decrease dietary fat intake and increase fibre intake; Patterson, Kristal & White, 1996), and seek medical help when they experience symptoms of illness (e.g., heart attack symptoms; Bleeker et al., 1995).

Research shows that people generally have poor knowledge about factors that affect their fertility and how best to reduce their chance of fertility problems. For example, less than 50% of people correctly identify age as the strongest risk factor for female infertility (Bretherick, Fairbrother, Avila, Harbord & Robinson, 2010) and even though people recognise risks to their fertility (e.g., smoking) they are not aware of the critical thresholds for when these factors are likely to affect fertility (Bunting & Boivin, 2008). People tend to overestimate the likelihood of pregnancy at the time of ovulation and the chance of conceiving through fertility treatment (Lampic et al., 2006). Further,

people have erroneous beliefs in myths about fertility, such as the myth that being healthy equates to being fertile (Blenner, 1990; Bunting & Boivin, 2008) or that having already had a child means that one could not subsequently develop fertility problems (Dyer, Abrahams, Mokoena & van der Spuy, 2004). One of the aims of the research in the present thesis was to provide a greater understanding of the impact of fertility knowledge on fertility-optimising behaviour.

Theory and empirical work suggest that, as well as knowledge about disease, how people perceive their risk, or susceptibility, to disease is crucial in understanding whether they will take action to reduce their risk. How susceptible a person feels to disease refers to how likely they believe it is that they could develop the disease (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990; Stretcher & Rosenstock, 1997). A person who feels susceptible to fertility problems believes that they could develop fertility problems, whereas a person who feels insusceptible feels that there is little chance that they could develop fertility problems. The Health Belief Model (HBM; Rosenstock, 1990), which is a cognitive theory of health behaviour, argues that a person's background characteristics (e.g., age, education) predict their beliefs about a health problem, including how susceptible the individual feels to the health problem, how severe they perceive the health problem to be, and perceived benefits and barriers to preventive health action. Beliefs about the health problem influence the likelihood that the individual will take action to reduce their risk for the health problem and optimise their health outcomes (Rosenstock, 1990). According to the HBM, having knowledge about fertility and/ or pregnancy is important but not sufficient for people to optimise their outcomes. If people do not also feel susceptible to the health consequences of their behaviour, the HBM would predict that they are unlikely to take action to reduce their risk and optimise their fertility and/ or pregnancy (Rosenstock, 1990). Indeed in a range of health contexts, people who do not feel susceptible to poor health outcomes are less likely to take action to reduce their risk, for example by undergoing cancer screening (Kim et al., 2008), quitting smoking (Norman, Conner & Bell, 1999), and using condoms during sexual encounters (Bryan, Aiken & West, 1997).

Relatively little is known about the role of perceived susceptibility in fertility and pregnancy-optimising behaviour and whether perceived susceptibility interacts with other health cognitions such as knowledge. A central aim of the present thesis was to establish whether beliefs about susceptibility affect how likely people are to take action to optimise fertility and pregnancy (e.g., by making lifestyle modifications, help-

seeking, adhering to medical recommendations). Other cognitive models known to be important in health behaviour were also tested in the present thesis. For example, the Theory of Planned Behaviour (TPB; Ajzen, 1991) has been used to understand adherence to health recommendations in a variety of contexts (Godin & Kok, 1996). According to the TPB, to understand a person's engagement in health behaviour it is necessary to measure their attitudes towards the behaviour, whether they believe significant others such as friends and family would want them to engage in the behaviour (subjective norms), the amount of control they feel they have in relation to performing the behaviour (perceived behavioural control), and their intention to engage in the behaviour. Attitudes, subjective norms and perceived behavioural control are argued to predict intention to perform the behaviour and intention directly affects the likelihood that the individual will perform the behaviour (Ajzen, 1991). Perceived behavioural control is argued to also reflect actual behavioural control (e.g., opportunity, resources) and is thus postulated to have a direct effect on behaviour (Ajzen, 1991; Ajzen, 2002). There is particularly strong empirical support for using the TPB to explain certain behaviours that optimise fertility and pregnancy, such as physical activity (McEachan, Conner, Taylor & Lawton, 2011).

This was a mixed-methods thesis that drew on various methodological approaches in order to examine the role of cognitions about health in how ready people are to optimise fertility and pregnancy. Cross-sectional and prospective designs were used to examine the relationship between health-related cognitions and behaviour. To build a richer picture of why people behave in a certain way in relation to fertility and pregnancy and their feelings about their actions, qualitative methods were also employed. Qualitative methods are particularly useful in health research to examine the cognitions (beliefs, perceptions) underpinning theoretical constructs, why associations among variables exist, and how acceptable interventions to improve health behaviour are among the target audience (Green & Thorogood, 2014).

The work presented in this thesis was funded by an interdisciplinary PhD studentship from the Economic and Social Research Council (ESRC) and the Medical Research Council (MRC) (ES/1031790/1). The author of the present thesis (B Fulford) conceptualised, designed and carried out a set of five studies aimed at identifying the cognitive factors associated with decision-making in the fertility context. The studies were designed to achieve three main broad aims outlined in the studentship proposal. Firstly, the aim was to identify the psychological factors most important in fertility

decision-making (i.e., whether to optimise chances of conceiving by making lifestyle changes and/or seeking medical help; adherence to health recommendations linked to improved fertility and pregnancy outcomes). Secondly, the work aimed to examine how cognitive factors related to fertility decision-making develop, using prospective research. The third and final aim was to evaluate a tailored intervention designed to give people information about their risk for fertility problems and recommended actions to reduce their risk. The role of the Cardiff Fertility Studies research team is acknowledged in assisting with data collection (Chapter 2, Chapter 5 and Chapter 6). The following sections present an overview of the studies conducted in the present thesis.

Thesis Overview

The Role of Knowledge and Perceived Susceptibility in Intentions to Optimise Fertility (Chapter 2)

One might expect people who are trying to conceive to take steps to optimise their chance of conceiving. However, evidence suggests that people continue to engage in unhealthy lifestyle behaviours and avoid seeking medical help even when their efforts to conceive are unsuccessful. These behaviours make it less likely that people will achieve their parenthood goals. Suboptimal fertility health behaviour among those trying to conceive may be contributed to by lack of knowledge about fertility (e.g., Bretherick et al., 2010; Bunting & Boivin, 2008). However, according to the HBM, having knowledge alone is not enough to initiate behaviour change; people also need to feel susceptible to fertility problems in order to take steps to optimise their fertility (Rosenstock, 1990). Accordingly, it would be expected that fertility knowledge and perceived susceptibility are jointly associated with the likelihood of optimising fertility. The aim of Chapter 2 was to investigate whether knowledge, perceived susceptibility and actual infertility risk status were related to people's intentions to optimise their fertility (i.e. adopt healthier lifestyles, seek timely medical help) when they are trying to conceive. Data were drawn from a cross-sectional international dataset of people trying to conceive (the International Fertility Decision-Making Study; IFDMS).

Barriers to Participating in Health-Optimising Interventions in the Context of Physical Activity (Chapter 3)

Physical activity is an effective way to optimise fertility and pregnancy as well as general health (e.g., reduced risk of cardiovascular disease; Shaw, Gennat, O'Rourke & Del Mar, 2006). Regular physical activity is recommended to people who are trying to conceive to optimise the chance of conception naturally and/ or via fertility treatment, and also to pregnant women to optimise maternal and infant health (NICE, 2010; 2013). However, participation in physical activity is low, with around 80% of people dropping out from physical activity programmes (Gidlow, Johnston, Crone & James, 2005) and most people not meeting government recommendations for physical activity (World Health Organisation [WHO] 2011). There are usually various stages involved in implementing health changes such as becoming more physically active, from agreeing to make health changes to actually completing recommended health interventions. This gives people several opportunities to drop out. The aim of Chapter 3 was to investigate reasons for drop-out at various stages of a physical activity intervention. The theoretical framework employed was the TPB (Ajzen, 1991), as the predictive utility of the TPB over physical activity behaviour is empirically supported (Godin & Kok, 1996; McEachan et al., 2011) and the TPB is one of the most widely applied models in the domain of physical activity (Buchan, Ollis, Thomas & Baker, 2012). The predictive utility of intentions to become more physically active was examined for participation in the physical activity programme at various stages from registering an interest to actually completing the programme. The study of dropout was investigated in the context of a randomised controlled trial (RCT) evaluating the benefits of a physical activity programme, following the Medical Research Council (MRC) framework for developing and evaluating complex interventions (Campbell et al, 2000; Craig et al, 2008).

Beliefs About Susceptibility May Explain Low Adherence to Folic Acid Supplementation Recommendations (Chapter 4)

Only around 30% of women take folic acid supplements as recommended from the point at which they begin trying to conceive until week 12 of pregnancy (Barbour et al., 2012). Improving adherence to folic acid supplementation recommendations is a key priority for the government to optimise pregnancy, given that 72% of cases of infant

NTDs are prevented by appropriate folic acid supplementation. Public health campaigns and interventions aimed at improving adherence to folic acid supplementation guidelines have largely focused on improving women's knowledge about the health benefits of folic acid supplementation. However, such an approach results in supplementation compliance rates of no higher than 40-50% (Ray, Singh & Burrows, 2004; Robbins et al., 2005; Stockley & Lund, 2008). According to the HBM, to make progress on understanding adherence to folic acid supplementation guidelines, it may be necessary to investigate how susceptible women feel to the health-related consequences (i.e., infant NTDs) of not taking folic acid supplements (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990). Perceived susceptibility may be particularly relevant to compliance with folic acid supplementation recommendations given the low base rate of NTDs (around 0.086% of births; De Wals et al., 2007). Low prevalence of NTDs may make it especially possible for women to pay minimal attention to the risk of their child developing NTDs. Therefore the aim of Chapter 4 was to examine the role of perceived susceptibility in adherence to folic acid supplementation guidelines. A cross-sectional international survey of women trying to conceive or women within the first 12 weeks of pregnancy was conducted for this study.

The Emergence of Perceived Susceptibility (Chapter 5)

Theory, previous research and the findings of Chapter 2 and Chapter 4 implied that perceived susceptibility plays a key role in whether people will take steps to optimise their fertility and pregnancy. However, less is known about the factors that predict when people start to feel susceptible to fertility problems, referred to in this chapter as the emergence of perceived susceptibility. The HBM postulates that a range of factors (demographic, psychological) predict how susceptible an individual feels to fertility problems (Stretcher & Rosenstock, 1997). The HBM also argues that people are more likely to feel susceptible to fertility problems if they experience a cue to action (Stretcher & Rosenstock, 1997). Cues to action are events that increase the personal relevance of a health problem (i.e., fertility problems) and trigger people to change their behaviour (Rosenstock, 1966; Stretcher & Rosenstock, 1997). Exceeding the age at which one planned to have a first child (i.e., missing a fertility target) may be a cue to action that prompts people to consider their susceptibility to fertility problems. Indeed, before missing their childbearing targets (i.e., exceeding one's intended age of first

birth), people feel there is no evidence to suggest they are not fertile (Blenner, 1990). Infertility is set apart from many other diseases in that it does not have any symptoms other than a lack of pregnancy after unprotected sexual intercourse (White, McQuillan, Greil & Johnson, 2006). People may be especially unlikely to consider their susceptibility to fertility problems in the absence of a cue to action due to an educational curriculum that educates young people about using contraception to avoid pregnancy but not about monitoring their risk factors for fertility problems (Department for Education, 2000). According to the HBM, if people do not feel susceptible to fertility problems until they miss a fertility target (i.e., exceed the age at which they intended to have a first birth), then they are unlikely to take action to optimise their fertility (i.e., reduce unhealthy lifestyle habits, seek medical advice) until this point (Rosenstock, 1990). This is problematic, especially since people are having their first birth at increasing older ages (ONS, 2013), as it leaves people with less time to reduce infertility risk factors and investigate relevant fertility treatment options (if needed). The aim of Chapter 5 was to investigate the factors that make people feel susceptible to fertility problems, focusing on factors known to modify perceived susceptibility as specified by the HBM and also the influence of missing a fertility target.

Closing the Gap in Fertility Health Awareness: Evaluation of the Fertility Status Awareness Tool (FertiSTAT) (Chapter 6)

The fact that many people fail to optimise their fertility may be contributed to by the considerable gaps in people's knowledge about fertility and their lack of awareness of their risk status for fertility problems (Bretherick et al., 2010; Lampic et al., 2006; Bunting & Boivin, 2008). Without knowing what their risk factors for fertility problems are, people are unlikely to know whether and what action to take to reduce their risk and optimise their fertility. There is a clear and urgent need for fertility health awareness interventions to help people make informed decisions in relation to their fertility (e.g., lifestyle, help-seeking). Research shows that people are much more likely to reduce risky health behaviour when they are given personalised risk information as opposed to generic health information (Noar, Benac & Harris, 2007; Sohl & Moyer, 2007). This may be because personalised risk information helps people to apply health risks to their situation. The Fertility Status Awareness Tool (FertiSTAT; Bunting & Boivin, 2010) was developed as the first validated evidence-based, personalised self-assessment tool

for female fertility. The FertiSTAT allows women to assess risk factors that can affect their fertility potential and receive personalised guidance about reducing these risks and optimising their fertility. The efficacy of a health intervention rests on whether it is feasible to implement in practice and acceptable to target users and service providers. Therefore, the aim of Chapter 6 was to evaluate the feasibility and acceptability of the FertiSTAT amongst women of reproductive age (service users) and medical and health professionals (service providers). The evaluation was done via a think-aloud protocol and semi-structured interview. The interviews also investigated women's beliefs about their susceptibility to fertility problems and adverse pregnancy outcomes and how these beliefs related to their evaluation of the FertiSTAT. It was hoped that this qualitative investigation would evaluate the FertiSTAT and shed light on the beliefs underpinning perceived susceptibility.

General Discussion (Chapter 7)

The final chapter presented an overview of the main findings of the studies in this thesis, the implications of the work, methodological strengths and limitations, and recommendations for future research. The main points raised were that the present work made progress on explaining fertility and pregnancy related behaviour by demonstrating the important role of health-related cognitions, using a mixed-methods approach. Suggested targets for public health campaigns included providing more timely fertility and pregnancy related education aimed at improving knowledge but also at helping people to become aware of their susceptibility to fertility problems and adverse pregnancy outcomes. The main methodological considerations included sampling issues (e.g., recruitment of participants via online sources) and design issues (e.g., cross-sectional versus prospective research). Recommendations for future research included the use of prospective designs to examine causal associations between health-related cognitions and behaviour and to evaluate the impact of personalised educational interventions on fertility and pregnancy related behaviour.

Chapter 2: The Role of Knowledge and Perceived Susceptibility in Intentions to Optimise Fertility: Findings From the International Fertility Decision-Making Study (IFDMS)

Introduction

One would expect women at risk for reduced fertility to take measures to optimise their chance of pregnancy when they start trying to conceive. However, evidence suggests that people continue to smoke, avoid losing weight and delay seeking timely medical advice about their fertility. Research is needed to establish what motivates people to take steps to protect and optimise their chances of pregnancy (e.g., quit smoking, engage with medical services when attempts to get pregnant are unsuccessful). Public knowledge about fertility is generally poor (e.g., Lampic et al., 2006; Bretherick et al., 2010; Bunting & Boivin, 2008), which may contribute to a lack of fertility-optimising behaviours. However, according to the HBM (Rosenstock, 1990; Stretcher & Rosenstock, 1997), having knowledge about fertility is not enough to initiate behaviour change; people also need to feel susceptible to fertility problems in order to take steps to reduce their risk. The aim of the present study was to investigate the role of fertility knowledge and perceived susceptibility in intentions to optimise fertility among women who were currently trying to conceive and had not yet sought medical advice.

Suboptimal Fertility-Related Behaviour

Measures to optimise fertility include adopting healthier lifestyles and seeking timely medical and non-medical help (NICE, 2013). However, despite the fact that the vast majority of people want to eventually be parents (Berrington, 2004; Testa & Toulemon, 2006; Lampic et al., 2006) many people fail to optimise their chance of having children. For example, rates of obesity in the United Kingdom (UK) have increased to 66.6% in men and 57.2% in women (Health and Social Care Information Centre, 2014) and 20% of men and 19% of women smoke (Health and Social Care Information Centre, 2013). In addition, people are delaying childbearing to older ages. The number of women giving birth aged 40 and over has more than quadrupled from 6,860 in 1981 to 29,350 in 2011 (ONS, 2012a), at which age pregnancy-related health complications are more likely (Utting & Bewley, 2011). Further, fertility help-seeking is generally poor, with

only 56% of couples consulting a doctor when they have problems conceiving (Boivin et al., 2007) and 20% delaying seeking that help for more than two years (Bunting & Boivin, 2007). The present study therefore aimed to find out when people become willing to take measures to optimise their fertility.

The Joint Role of Knowledge and Perceived Susceptibility

The negative effects on fertility associated with failure to change unhealthy lifestyle habits and/ or engage in timely fertility help-seeking are well-documented. For example, the likelihood of assisted reproductive technologies (ART) resulting in a pregnancy is lower amongst women who are older than 35 (Templeton, Morris & Parslow, 1996) and who are overweight and/ or smoke (Lintsen et al., 2005; Maheshwari et al., 2007). According to the HBM to understand why people fail to take measures to improve their chance of pregnancy it is necessary to consider how much they know about fertility (Rosenstock, 1990; Stretcher & Rosenstock, 1997). People have relatively poor knowledge about fertility (e.g., Bretherick et al., 2010; Bunting & Boivin, 2008; Lampic et al., 2006) and this may delay those with one or more infertility risk factors from identifying that they are at risk, which is a necessary step in help-seeking (Rosenstock, 1990; White et al., 2006). For example, people answer correctly on average only 52.9% of questions about fertility facts, risks and myths (Bunting & Boivin, 2008).

The HBM argues that people also need to feel susceptible to a health risk in order to make efforts to reduce that risk (Rosenstock, 1990). How susceptible an individual feels to a health risk (in this case, reduced chance of pregnancy) refers to how likely they believe it is that they could have the health risk (Rosenstock, 1990). An individual is unlikely to take measures to optimise their fertility if they do not feel susceptible to reduced chance of pregnancy (Rosenstock, 1990). This is indeed the case in other health contexts; for example, people who do not feel susceptible to poor health outcomes are less likely to undergo cancer screening (Kim et al., 2008), quit smoking (Norman et al., 1999), and use condoms during sexual encounters (Bryan et al., 1997). As well as predicting actual health behaviour, the HBM constructs are related to health behaviour intentions; for example, the HBM explains 57% of the variance in dieting intention and 41% of the variance in fasting intention (Nejad, Wertheim & Greenwood, 2005). The HBM would predict that fertility knowledge and perceived susceptibility are

independently and jointly associated with intention to optimise fertility, such as seeking medical advice or making lifestyle adjustments.

The Present Study

The aim of the present study was to investigate whether knowledge, perceived susceptibility and infertility risk status relate to intentions to optimise fertility.

Participants were women who were trying to get pregnant and had not sought any medical help regarding their fertility. The present study used archival data, drawing participants from the International Fertility Decision-Making Study (IFDMS; Bunting, Tsibulsky & Boivin., 2013)¹. The IFDMS is an international study aimed at understanding the decision to have a child and the decision of what to do if natural attempts were unsuccessful. It was hypothesised that having fertility knowledge and feeling susceptible to infertility would be associated with heightened intentions to optimise fertility and furthermore that this association would be stronger amongst women with at least one infertility risk factor.

Methods

Participants

Recruitment for the IFDMS was via three sources. The first source was online advertising (search engines [Google]; social media websites [Facebook] and websites targeted at people trying to conceive [e.g., Babycentre, patient advocacy sites, fertility clinics]). The second source was market research companies (four countries where online recruitment was limited: Japan, Russia and India [Ipsos-Health] and China [IMS-Health]). The third source was fertility clinics (two countries where online recruitment was limited: China and India). Patients using specialist fertility medical services (e.g., treatment for human immunodeficiency virus [HIV] sero-positive or HIV discordant or hepatitis C, PGD) were excluded from recruitment in fertility clinics. All other people attending fertility clinics were eligible whether it was for fertility-related or other reasons (e.g., smear tests, gynaecological reasons). Inclusion criteria were that respondents were aged between 18 and 50, currently married or living with their

¹ Recruitment for the IFDMS was performed by other researchers: Bunting et al. (2013). Analyses for the present study were performed by the author of the thesis (Bethan Fulford).

partner, currently trying to conceive for at least six months and not pregnant. The IFDMS survey generated a total of 10,045 respondents (8355 women and 1690 men) from 79 countries. Full details of the study and its cohort profile are published elsewhere (Bunting et al., 2013).

In the present study, the following inclusion criteria were additionally applied: (1) female respondent (2) aged below 45 years, i.e., within the childbearing age range (3) never given birth and (4) never sought medical consultation regarding trying to conceive. The final sample consisted of 1345 women from 38 countries. The majority of participants ($n=1199$, 89.1%) were recruited via online advertising, with 130 (9.7%) recruited from social research panels and 16 (1.2%) recruited from fertility clinics. On average participants were 28.5 years old ($SD = 5.6$), had been living with their partner for 3.8 years ($SD = 3$) and had been trying to conceive for 1.5 years ($SD = 1.9$). Within the sample, 534 (39.7%) women had tried lifestyle change and 709 (52.7%) had sought non-medical help (e.g., advice from friends or books, acupuncture) as a means of improving their fertility.

Materials

Questionnaire design.

Psychological theories (e.g., TPB, Azjen, 1991; HBM, Rosenstock, 1990) and a systematic review of published literature regarding reproductive decision-making informed the selection of survey items. Survey wording was adapted to be appropriate to men and women and to people who had/ had not sought fertility treatment. The final survey consisted of 64 items covering five broad domains of decision-making. Only items relevant to analyses for the present study are described (see Appendix A for survey items relevant to the present analyses; for the full survey see www.startingfamilies.org).

Background characteristics.

Background characteristics were length of time living with current partner (years and months), whether the participant had paid work, and whether their partner had paid work (yes/ no).

Infertility risk factors.

The four infertility risk factors included were: body mass index (BMI; weight in kilograms divided by height in metres squared [kg/m^2]); number of cigarettes smoked per day (amongst participants who indicated that they smoked); age; and length of time trying to conceive (number of years and months spent trying to get pregnant). Participants were considered to be at risk for infertility if their score on one or more of the risk factors was above the critical thresholds used in the FertiSTAT (Bunting & Boivin, 2010); specifically, if their BMI was 25 or over, if they smoked 10 or more cigarettes per day, were aged over 34 or had been trying to conceive for 12 months or more.

Fertility knowledge.

The Cardiff Fertility Knowledge Scale (CFKS; see Bunting et al., 2013) assessed fertility knowledge. The CFKS consists of 13 items derived from previous research (Adashi et al., 2000; Boivin et al., 2007; Bunting & Boivin, 2010; Lampic et al., 2006; NICE, 2004; Tough, Tofflemire, Benzies, Fraser-Lee & Newburn-Cook, 2007; Zegers-Hochschild et al., 2009) that measure knowledge about fertility facts, risks and myths. Three items referred to facts (e.g., a woman is less fertile after the age of 36 years), five items referred to risks (e.g., smoking decreases female fertility), and five items referred to myths (e.g., if a man produces sperm he is fertile). All items were rated on a three-point scale of 'true', 'false' or 'do not know'. Reliability of the items amongst the present sample was good; Cronbach's alpha = .74 (for the total IFDMS sample of $n = 10045$, Cronbach's alpha = .79). The items were combined into a composite correct variable, where one point was awarded for each correctly identified fact, risk or myth, with total score ranging from 0 to 100% correct. The 'do not know' response was coded as incorrect.

Perceived susceptibility.

Perceived susceptibility to infertility was measured using two items that asked participants whether they suspected that they/ their partner had a fertility problem

(yes/no) to indicate whether a fertility problem was suspected in either member of the couple.

Intention to optimise fertility.

Intention to optimise fertility was conceptualized as the likelihood of seeking medical and non-medical help and making lifestyle changes to improve chances of getting pregnant. Intention was measured using variables derived from previous research on help-seeking (e.g., Bunting & Boivin, 2007). Specifically, the likelihood of medical help-seeking was assessed using ten items referring to seeking medical advice (e.g., from a medical doctor) and/or medical intervention (e.g., diagnostic tests or fertility medication) to increase the chance of conceiving. Likelihood of non-medical help-seeking was assessed via five items relating to non-medical advice (e.g., from friends or books) and non-medical interventions (e.g., acupuncture, treatment from a traditional healer). Items were combined to form two composite variables measuring likelihood of trying medical options and likelihood of trying non-medical options. Reliability was satisfactory (Cronbach's alpha = .91 for medical help-seeking items and .72 for non-medical help-seeking items). Intention to make lifestyle change was measured using one item that asked participants to rate the likelihood that they would use 'lifestyle change (e.g., quit smoking, lose weight)'. Examples of target behaviours were provided within the wording of the item. Participants rated the likelihood that they would try each fertility-optimising behaviour (i.e., medical help-seeking, non-medical help-seeking, and lifestyle change) on a five-point scale ('not at all likely' to 'extremely likely').

Control variables.

Education was categorised as whether or not the participant had a university education (yes/no). Economic hardship was assessed via two items in which participants indicated whether during the last twelve months they had had trouble paying bills and trouble buying essentials (e.g., food, clothes) on a five-point scale ('never' to 'very often'; or 'do not know') adapted from McQuillan's economic hardship index (McQuillan, Greil & Shreffler, 2011). The items were combined to form a variable with scores of one to nine representing never to always experiencing economic hardship.

Procedure

The IFDMS study received ethical review and approval from the Ethics Committee of the School of Psychology, Cardiff University and from each clinic as per country requirements. The data collection period was from July 2009 to April 2010. Multiple data collection methods were used (social research panel, fertility clinic or online) according to what was feasible in each target country. Social research companies, fertility clinics and webmasters distributed the IFDMS survey. For all online methods, a banner about the IFDMS (e.g., “Trying to conceive? Contribute to a fertility survey from Cardiff University”) and a study hyperlink were placed at an appropriate position on the website. The survey was produced in English and translated into 12 languages (see Bunting et al., 2013, for full procedural details).

Data Analyses

Data screening showed that the variables were normally distributed and appropriate for intended analyses. Descriptive statistics were used to examine the socio-demographic and fertility profile of the sample. A repeated measures ANOVA to examine whether likelihood of engagement varied between the fertility-optimising behaviours (medical and non-medical help-seeking, lifestyle change) was computed amongst participants with no prior engagement in any of these behaviours ($n = 333$). Hierarchical multiple regression analyses were computed for the three fertility-optimising behavioural intentions as dependent variables amongst participants who had not already engaged in the behaviour. Owing to missing data, 1178 participants were included for the composite medical help-seeking intentions variable, 451 participants were included for the composite non-medical help-seeking intentions variable and 634 participants were included for the lifestyle change intentions variable. Education and economic hardship were controlled for because people with higher education level and socioeconomic status are less likely to have infertility risk factors (e.g., smoking) and more likely to have a healthy lifestyle and seek advice from medical services for health check-ups (Ross & Wu, 1995). The regression analysis was the same for each dependent variable and designed to achieve the two aims of the study. On the first step of the analysis, the control variables were entered (education level and economic hardship). On the second step the main effects of the infertility risk factors, knowledge and perceived

susceptibility were entered to examine whether these factors were independently related to fertility-optimising behavioural intentions. The infertility risk factors were entered into the regression as four separate variables, coded 0 or 1 for absence or presence of risk (respectively): BMI risk factor, number of cigarettes smoked per day risk factor, age risk factor and length of time trying to conceive risk factor. On the third step the two-way interactions were entered to examine whether the association between each of the infertility risk factors and intentions to engage in fertility-optimising behaviours was moderated by knowledge and/ or perceived susceptibility. On the fourth and final step of the analysis, the three-way interactions were entered to examine whether the association between the infertility risk factors and intentions to optimise fertility depended jointly on knowledge and perceived susceptibility. Interactions were created by taking the cross-product of the variables considered in the interaction, and interactions significant at the .05 probability level were investigated using simple slope analyses according to the method of Aiken & West (1991). All analyses were computed using the software Statistical Package for the Social Sciences.

Results

Demographic Characteristics

Table 2.1 shows the demographic characteristics of the total sample that was used in the regression analysis for medical help-seeking intentions and separately for the subsamples used in the analyses for non-medical help-seeking intentions and lifestyle change intentions. The majority of participants were between 18 and 29 years old, had university-level education, paid work for both themselves and their partner and did not experience economic hardship.

Fertility Context Variables

The proportion of the total sample and subsamples scoring above and below the infertility risk factor thresholds, level of perceived susceptibility and knowledge are shown in Table 2.2. The most prevalent infertility risk factors were time spent trying to get pregnant, with roughly half of the sample meeting the WHO criteria for infertility (i.e., having tried to conceive for 12 months or more; Zegers-Hochschild et al., 2009).

Data on BMI showed that almost 40% of participants were overweight. Overall 15.4% of the sample was older than 34 years and 14.6% smoked 10 or more cigarettes per day (26.6% of the sample smoked any number of cigarettes per day). In the total sample 60.3% of participants suspected that either they or their partner had a fertility problem (of those who suspected a problem: 52.1% self, 10.7% partner, 37.2% both). Mean score on the CFKS showed that on average 51.9% of fertility knowledge questions were answered correctly (SD =22.9).

Table 2.1.

Means (standard deviations) or frequencies (n, %) of demographic variables amongst participants included in the medical help-seeking intentions analysis, the non-medical help-seeking intentions analysis and the lifestyle change intentions analysis.

Variable	Medical help-seeking intentions (total sample) <i>n</i> = 1345	Non-medical help-seeking intentions <i>n</i> = 490	Lifestyle change intentions <i>n</i> = 721
Age (M, SD)	28.5 (5.6)	27.9 (5.8)	28.2 (5.7)
Years living with partner (M, SD)	3.8 (3)	3.5 (2.9)	3.6 (2.9)
University Education (n, %)	686 (51.2)	241 (49.3)	355 (49.4)
Paid work (n, %)	988 (74.4)	341 (70.2)	511 (71.7)
Partner paid work (n, %)	1197 (90.2)	429 (88.6)	639 (89.9)
Economic hardship (M, SD)	2 (1.7)	2.1 (1.7)	2 (1.8)

Note. Due to missing data *N* varies per variable: 1327 to 1341 (medical help-seeking intentions), 484 to 489 (non-medical help-seeking intentions), 711 to 720 (lifestyle change intentions).

Table 2.2.

Means (standard deviations) and frequencies (n, %) of fertility context variables amongst participants included in the medical help-seeking intentions analysis, the non-medical help-seeking intentions analysis and the lifestyle change intentions analysis.

Variable	Medical help-seeking intentions				Non-medical help-seeking intentions				Lifestyle change intentions			
	n = 1345				n = 490				n = 721			
Risk factor thresholds	n	%	M	SD	n	%	M	SD	n	%	M	SD
BMI												
<25	803	61.6	21.2	2.2	304	62	20.8	2.4	455	63.1	21	2.3
≥25 (Risk)	500	38.4	30.8	6.2	174	35.5	30.8	5.4	244	34.8	30.9	6.6
Cigarettes smoked per day												
<10 ^a	1112	85.4	4.5	2.4	383	78.2	4.1	2.3	572	79.3	4.4	2.4
≥10 (Risk)	190	14.6	15.8	6	100	20.4	15.6	5.9	130	18	15.2	5.4
Age in years												
≤34	1135	84.6	26.8	4.2	419	85.5	26.2	4.2	610	84.6	26.5	4.2
>34 (Risk)	206	15.4	37.8	2.5	70	14.3	38.1	2.6	110	15.3	37.8	2.4
Months trying to conceive												
<12	645	48.2	6.6	2.2	235	48	6.1	2.3	357	49.5	6.4	2.2
≥12 (Risk)	692	51.8	29.1	28.3	254	51.8	27.7	26.9	359	49.8	29.5	29.2

Table 2.2. Continued

Variable	Medical help-seeking intentions				Non-medical help-seeking intentions				Lifestyle change intentions			
	n = 1345				n = 490				n = 721			
	<i>n</i>	%	M	SD	<i>n</i>	%	M	SD	<i>n</i>	%	M	SD
Perceived susceptibility	798	60.3	-	-	273	56.9	-	-	413	57.8	-	-
Cardiff Fertility Knowledge Scale (CFKS)	-	51.9	-	22.9	-	45.6	-	23.2	-	50.1	-	23.2

Note. Due to missing data *N* varies per variable, 1302 to 1341 (medical help-seeking intentions), 478 to 489 (non-medical help-seeking intentions), 699 to 720 (lifestyle change intentions). Perceived susceptibility refers to whether participants suspected that they or their partner had a fertility problem (yes/no). CFKS fertility knowledge 0 to 100%. BMI = body mass index.

^aSmoke <10 cigarettes per day includes non-smokers: n=971 (73.4%) medical help-seeking intentions, n=336 (69.1%) non-medical help-seeking intentions, n=497 (70.2%) lifestyle change intentions.

Intention to Optimise Fertility

A repeated measure ANOVA was computed to examine whether likelihood of trying differed among the fertility-optimising behaviours in participants with no prior engagement in any of these behaviours ($n = 333$). The analysis was significant, $F(2, 664) = 61.927, p < .001$. Post hoc tests using the Bonferroni correction revealed that participants who had not tried any fertility-optimising behaviours were more likely to intend to try lifestyle change than medical help-seeking ($p = .004$) or non-medical help-seeking ($p < .001$) with intention to seek medical help significantly higher than non-medical help ($p < .001$). Participants who had already tried to make lifestyle changes ($n = 143$) were most likely to want to use medical help-seeking as their next means of improving their chance of pregnancy ($F[1, 142] = 68.909, p < .001$). In contrast, those who had only previously tried non-medical options ($n = 303$) indicated no preference in which fertility-optimising behaviour they would try next ($F[1, 302] = 1.66, p = .199$).

Direct Associations Between Infertility Risk Status, Fertility Knowledge, Perceived Susceptibility and Intention to Optimise Fertility

After education level and economic hardship were controlled, infertility risk, knowledge and perceived susceptibility predicted medical help-seeking intentions ($F [8, 1170] = 12.999, p < .001$, mean square error [MSE] = 0.891), accounting for 8.2% of the variance. The main effects showed that women who smoked 10 or more cigarettes per day and women who had been trying to conceive for 12 months or more had lower intentions to seek medical help ($\beta = -0.058, p = .042$ and $\beta = -0.076, p = .009$ respectively). Intentions to seek medical help were also stronger when fertility knowledge was high ($\beta = 0.190, p < .001$) and when a fertility problem was suspected ($\beta = 0.15, p < .001$). The semi-partial correlation coefficients indicated that knowledge and perceived susceptibility were the strongest predictors of medical help-seeking intentions, explaining 3.3% and 2.1% of the variance respectively.

With the same control and predictor variables, the regression on lifestyle change intentions was also significant ($F [8, 626] = 5.31, p < .001$, MSE = 1.876), accounting for 6.4% of the variance. Women with a BMI of 25 or over and those with greater fertility knowledge had higher intentions to change their lifestyle ($\beta = 0.142, p < .001$; β

= 0.1, $p = .013$, respectively). The semi-partial correlations showed that BMI was the strongest predictor of lifestyle change intentions, explaining 1.9% of the variance.

The regression model for non-medical help-seeking intentions was non-significant showing that none of the variables selected could explain these intentions (See Table 2.3 for the regression summary analyses).

Table 2.3.

Summary statistics for hierarchical regression testing direct associations and moderation in medical help-seeking intentions, non-medical help-seeking intentions and lifestyle change intentions.

	Medical help-seeking intentions <i>n</i> =1178	Non-medical help-seeking intentions <i>n</i> =451	Lifestyle change intentions <i>n</i> =634
Step 1:			
Main effect control variables	$R^2\Delta = .01^{***}$	$R^2\Delta = .00$	$R^2\Delta = .02^{***}$
Education	0.11***	0.00	0.13***
Economic hardship	0.04	0.05	0.09*
Step 2:			
Main effect infertility risk status	$R^2\Delta = .07^{***}$	$R^2\Delta = .01$	$R^2\Delta = .04^{***}$
BMI	0.01	0.01	0.14***
Number of cigarettes per day	-0.06*	-0.02	0.06
Age	-0.00	-0.02	0.04
Time trying to conceive	-0.08**	-0.03	0.00
Main effect fertility knowledge & perceived susceptibility			
Fertility knowledge	0.19***	0.04	0.1*
Perceived susceptibility	0.15***	0.10	0.02
Step 3^a: 2-way interactions infertility risk status & fertility knowledge/perceived susceptibility	$R^2\Delta = .02^{***}$	$R^2\Delta = .02$	$R^2\Delta = .02$
Fertility knowledge X number of cigarettes per day	0.07*	0.07	0.07
Fertility knowledge X age	-0.09**	-0.02	0.01
Perceived susceptibility X age	-0.15**	-0.12	-0.03
Perceived susceptibility X time trying to conceive	0.15**	0.17	0.15
Step 4^a: 3-way interactions infertility risk status, fertility knowledge & perceived susceptibility	$R^2\Delta = .00$	$R^2\Delta = .01$	$R^2\Delta = .02^{**}$
Fertility knowledge X perceived susceptibility X number of cigarettes per day	0.08	0.15	0.23***

Note. Standardised coefficients reported. $R^2\Delta = R^2$ change.

^aInteractions significant for at least one dependent variable are reported.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Moderation Among Infertility Risk Status, Fertility Knowledge, Perceived Susceptibility and Intention to Optimise Fertility

Predictive power for medical help-seeking intentions was significantly improved by adding two-way interaction terms to the regression model ($F [17, 1161] = 7.058, p < .001$, $MSE = 0.874$; $\Delta R^2 = .024, p < .001$). Table 2.4 displays the simple slope coefficients for the significant two-way interactions which were between (a) knowledge and smoking status; (b) knowledge and age; (c) perceived susceptibility and age; and (d) perceived susceptibility and time trying to conceive. As shown in Table 2.4, knowledge was positively associated with medical help-seeking intentions amongst women who smoked less than 10 cigarettes per day and the positive association was even stronger amongst women who smoked 10 or more cigarettes per day. In addition, knowledge was associated with heightened intentions to seek medical help amongst women aged 34 or younger but not amongst women older than 34.

The relationship between perceived susceptibility and medical help-seeking intentions differed according to age. Slope analyses indicated that this interaction occurred because the slopes differed significantly from each other, with the association being positive (but not significantly different from 0) amongst women aged 34 or younger and negative (but not significantly different from 0) amongst women older than 34. Further, perceived susceptibility was related to stronger intentions to seek medical help amongst women who had been trying to conceive for 12 months or more but was unrelated to intentions amongst women who had been trying to conceive for less than 12 months.

The predictive power of the lifestyle change intentions model was significantly improved by adding three-way interaction terms (i.e., interaction between infertility risk status, knowledge and perceived susceptibility) to the regression ($F [21, 613] = 3.495, p < .001$, $MSE = 1.827$; $\Delta R^2 = .021, p = .006$). As shown in Figure 2.1, amongst women who smoked 10 or more cigarettes per day, having fertility knowledge was associated with stronger intentions to engage in lifestyle change when perceived susceptibility was high ($\beta = 0.311, p = .007$) but was unrelated to lifestyle change intentions when perceived susceptibility was low ($\beta = -0.147, p = .30$). By contrast, amongst women who smoked less than 10 cigarettes per day, knowledge was unrelated to lifestyle change intentions when perceived susceptibility was high ($\beta = 0.104, p = .152$) and when perceived susceptibility was low ($\beta = 0.094, p = .263$).

Two- and three-way interaction terms were not significant for non-medical help-seeking intentions.

Table 2.4.

Simple slope regression coefficient matrix for two-way interactions that predicted medical help-seeking intentions.

	Fertility knowledge	Perceived susceptibility
Risk factor thresholds		
Smoke cigarettes per day		
<10	0.19**	-
≥10 (Risk)	0.35***	-
Age in years		
≤34	0.19**	0.1
>34 (Risk)	-0.03	-0.13
Months trying to conceive		
<12	-	0.10
≥12 (Risk)	-	0.25***

Note. Standardized coefficients reported. Coefficients indicate strength of association (and significance) between medical help-seeking intention and fertility knowledge (or perceived susceptibility) when risk present/ absent. Only coefficients from significant two-way interactions are shown (see Table 2.3).

** $p < .01$, *** $p < .001$.

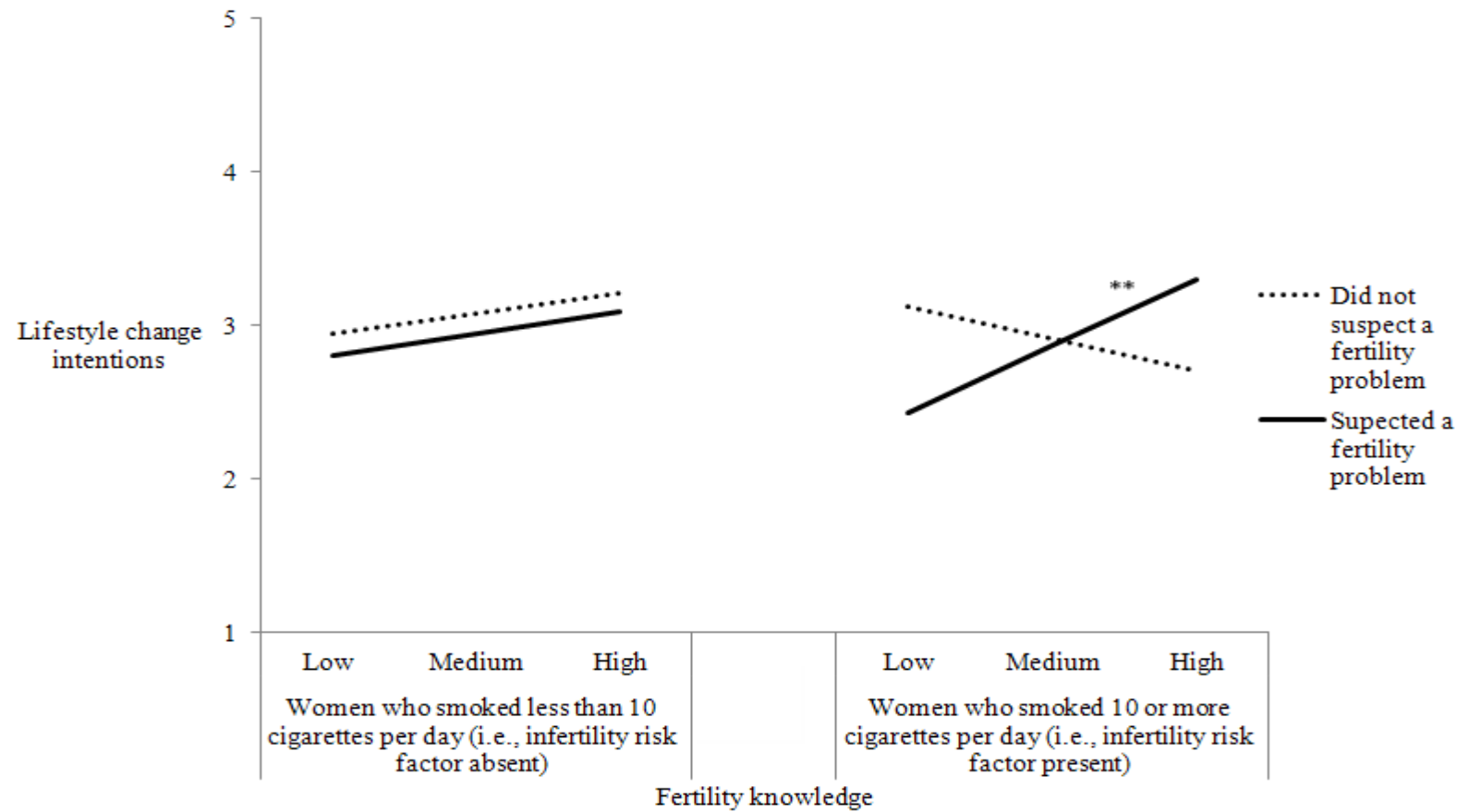


Figure 2.1. Moderation of the association between fertility knowledge and lifestyle change intentions by whether a fertility problem was suspected (perceived susceptibility) among women who smoked <10 cigarettes per day (i.e., infertility risk factor absent) and women who smoked 10 or more cigarettes per day (i.e., infertility risk factor present). ** $p < .01$.

Discussion

Women's intentions to take action to improve their chance of getting pregnant depends on how much they know about fertility, how vulnerable they feel to infertility and their level of risk for infertility. Being able to correctly identify fertility risks, myths and facts because of greater fertility knowledge and feeling susceptible to infertility are the most salient correlates of readiness to seek medical help. Being overweight is the most relevant factor amongst those intending to change their lifestyle. Concerningly, being at risk for infertility can actually reduce the likelihood of intending to optimise pregnancy chances. Specifically, women who smoked and those who were medically infertile (defined as had been trying to conceive for over a year) were less likely to intend to seek medical help in relation to their attempts to conceive.

The present results support the HBM in that knowledge and perceived susceptibility are critical in understanding when people become willing to optimise their fertility. Importantly, the role played by knowledge and perceived susceptibility in intentions to optimise fertility varies according to the characteristics of the target population (presence and type of infertility risk factor) and the type of fertility-optimising behaviour (medical help-seeking or lifestyle change). Improving fertility knowledge and awareness of personal susceptibility to infertility could help women choose the most appropriate strategy to achieve their parenthood goals (e.g., make healthy lifestyle adjustments, consult a doctor). However, barriers to help-seeking amongst older women, who are not responsive to knowledge or perceived susceptibility, need to be further investigated.

Women in the present sample were likely to have compromised fertility. The prevalence of infertility risk factors ranged from 14.6-51.8%. The risk factors were established using the empirically-identified and validated critical thresholds of the FertiSTAT which discriminate to a high degree medically confirmed fertile and infertile women (Bunting & Boivin, 2010). Importantly, over half of the women in the present sample met the medical criteria for infertility (as defined by not having conceived after one year of trying). The presence of these risk factors indicates that many of these women may have difficulties achieving their childbearing goals. Consistent with this risk profile, most women also suspected themselves (or their partners) to have a fertility problem (of those who suspected a problem; 52.1% self, 10.7% partner, 37.2% both).

Paradoxically, most women had this suspicion despite relatively poor knowledge about fertility. The sample answered roughly only half of the CFKS items correctly. This suggests that people may lack knowledge about what to do to optimise their chances of pregnancy and alleviate their concerns about their fertility.

Feeling susceptible to infertility and being more knowledgeable about fertility were (overall) associated with greater likelihood of intending to optimise the chance of pregnancy. However, the role of knowledge and perceived susceptibility varied according to type of behaviour and risk status. For example, interactions showed that heavy smokers who knew the causes of infertility (such as smoking) intended to consult a doctor presumably because they recognised that smoking was a risk factor for infertility. However, to be motivated to take the ultimate step of lifestyle change (i.e., quit smoking) they needed to additionally believe that infertility could happen to them. This suggests that educational interventions to promote healthy lifestyle and timely help-seeking when fertility problems are encountered will be most effective if they are tailored to the infertility risk factors present in the target audience.

The present findings are in line with previous health research showing that smokers who do not feel susceptible to the negative health effects of smoking have lower intentions to quit smoking (Dillard, McCaul & Klein, 2006; Norman et al., 1999). Whilst most smokers know that smoking increases risk for a multitude of diseases, they underestimate their susceptibility to the health-effects associated with smoking (Arnett, 2000; Dillard et al., 2006; Williams & Clarke, 1997), which may be a major barrier to behaviour change. Aspiring parents who are smokers may ignore medical advice to quit smoking if they do not feel vulnerable to fertility problems. Medical practitioners should consider using tools such as the FertiSTAT to provide patients with personalised risk information regarding their chance of infertility. Giving personalised feedback about risk for a disease, based on factors such as health status and the presence of symptoms, is effective at increasing behaviours which are linked to improved fertility including smoking cessation, physical activity, and healthy eating (e.g., Colkesen et al., 2011; Cupples & McKnight, 1999; Parkes, Greenhalgh, Griffin & Dent, 2008).

In the present study older women (aged 35 or above) were not responsive to knowledge and perceived susceptibility, suggesting that there is a critical age range (below age 35) in which these variables are important in decision-making about having children. Lack of efforts to safeguard fertility amongst older women may be driven by the belief that there are limited options available for age-related infertility and as such

consulting a doctor would be futile even when a fertility problem is suspected. This belief may be especially possible given the existence of international social norms that dictate acceptable age deadlines for women giving birth. In a survey of 25 European countries, 14 of which were the country of residence for participants in the present study, the majority of participants in each country (77.5-100% depending on country) perceived a maternal age deadline for childbearing with a mean of 41.7 years (Billari et al., 2011). People comply with these norms, with fewer women having children at older ages in countries in which social age deadlines exist (Billari et al., 2011). Societal expectations regarding the timing of childbirth could potentially dissuade older women from investigating relevant childbearing options, even though medical procedures such as ART could help them reach parenthood, especially if sought in a timely way (i.e., as soon as a fertility problem is suspected; Lintsen et al., 2007; Templeton et al., 1996). To help older women achieve their childbearing goals, it is imperative to investigate the factors that motivate them to consult with fertility medical services, including the role of beliefs about available medical interventions and perceived norms regarding maternal age at childbirth. Similarly, to understand non-medical help-seeking it may be necessary to take into account a broader range of variables than was measured in the present study. Use of non-medical sources may represent a preliminary form of help-seeking that occurs before couples become aware of and gain knowledge about problems with their fertility (Blenner, 1990). An important consideration for fertility educational campaigns is that the factors that influence help-seeking may differ across countries; for example belief in the negative effects of fertility treatment (physical, emotional) tends to be higher in countries with greater socioeconomic development (Bunting et al., 2013).

In the present study, perceived susceptibility to infertility was defined as whether participants suspected that they or their partner had a fertility problem. It is possible that intention to take action differed according to whether participants believed it was they or solely their partner who had a fertility problem. For example, motivation to make lifestyle changes may be lower amongst women who suspect that the fertility problem originates from their partner, perhaps especially if the infertility is attributed to a lifestyle habit (e.g., smoking). It would be important for future research to examine the impact of perceived causes of personal and/ or partner infertility on whether and what action people intend to take to improve their pregnancy chances. However, it is common practice to treat infertility as a couple rather than individual problem and couples experiencing problems conceiving are seen together by fertility services,

because both partners are a part of decision-making about investigation and treatment (NICE, 2013). Chances of conception (naturally and through fertility treatment) amongst couples having problems conceiving are improved by seeking help and reducing negative lifestyle habits regardless of which partner is suspected to be infertile (NICE, 2013). According to the HBM, if an individual suspects that they are having difficulty conceiving, even if they believe the difficulty to be due to a fertility problem with their partner, they will be more likely to take action (e.g., seek advice from a doctor) to reduce the threat and increase the chance of pregnancy for the couple.

This study provides insight into the context of behaviour change amongst women who are trying to get pregnant and demonstrates the complex interplay between knowledge, perceived susceptibility and objective infertility risk status. It is important to consider that the data were cross-sectional and thus causality cannot be inferred. In addition, the sample was biased towards high levels of perceived susceptibility, potentially due to the recruitment method (i.e., websites targeted at people currently trying to conceive) which likely captured individuals who were concerned about their fertility. However, as none of the women had sought medical advice regarding their attempts to get pregnant, the relationship with fertility-optimising intentions is not contaminated with treatment experience and should reflect genuine predictive associations between variables. It is important to note the relatively large number of predictors included in analyses in the present study. Each regression on fertility-optimising intentions included 21 predictor variables (total of main effects, 2-way interaction terms and 3-way interaction terms). A higher number of predictor variables leads to an increased Type I error rate, making it more likely for significant effects to be found (Budescu, 1993). In present analyses predictor variables were selected based on being theoretically and empirically hypothesised to explain variance in the outcome variables and a large sample size was used to test the expected associations. An ongoing challenge for researchers is to avoid including unnecessary variables in analyses which would increase the error rate, whilst at the same time not omitting variables that belong in the model, which would introduce bias in the parameter estimates (Budescu, 1993).

Online samples are associated with higher education (Haagen et al., 2003). However, the present sample was comparable to the population on key variables. For example, mean age in the overall sample was 28.5, which is comparable to mean maternal age at first birth in the UK (28.1 years; ONS, 2013). In terms of the prevalence of unhealthy lifestyle factors, 26.6% of the present sample smoked in comparison with

19% of women in the UK (Health and Social Care Information Centre, 2013). Intentions do not always translate into behaviour (Scholz, Schuz, Ziegelmann, Lippke & Schwarzer, 2008) and as such it is not certain that individuals who intend to optimise their fertility will do so. However, research in other domains shows that intentions correlate highly with behaviour; in the range of 0.75 to 0.82 (Ajzen, 1991). The present study shows that what people know about fertility and how vulnerable they feel to infertility, as well as their objective level of infertility risk, plays a role in how ready they are to make lifestyle changes and/ or consult with a doctor in relation to their fertility. Future prospective research should investigate the factors influencing the likelihood of individuals realising their plans to optimise their fertility.

In conclusion, the present results suggest that when deciding what to do about their fertility, people try to match their current needs to the most appropriate solution. For example, heavy smokers will seek advice from a doctor when they are aware that smoking can reduce fertility but will not make plans to quit smoking until they have reached the stage of worrying about their chance of getting pregnant. Tools providing tailored information about one's risk for infertility (e.g., the FertiSTAT) may increase risk awareness amongst this group. On the other hand, older women avoided medical help-seeking even when they knew that age affects fertility and felt susceptible to infertility, possibly because of reduced confidence in the availability or effectiveness of fertility treatment at advanced ages. Barriers to help-seeking amongst older women must be further explored in order to promote timely decision-making about fertility.

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Chapter 3: What Are the Factors Related to Participation and Drop-Out in an Outdoor Physical Activity Intervention? An Application of the Theory of Planned Behaviour

Introduction

Chapter 2 examined what makes people who have an infertility risk factor but have not yet sought advice from a doctor more likely to take action to optimise their fertility. The results indicated that knowledge and perceived susceptibility increased people's intentions to change their behaviour. However, even when people intend to take action to improve their health, their intentions do not always translate into actual behaviour (McEachan et al., 2011). The present study aimed to build on the findings of Chapter 2 by examining the association between intentions to optimise health and actual health-optimising behaviour. It was hoped that the study would highlight the barriers people face when actually trying to implement health-optimising changes. People may express an interest in making positive health changes, but there are often various stages involved in actually implementing these changes (e.g., from agreeing to make health changes to completing recommended health programmes; Gidlow et al., 2005) that give people multiple opportunities to drop out. In the present chapter, drop-out is defined as deciding not to participate in a health programme at some point after expressing an initial interest in participating in the programme. Participation and drop-out were investigated in the context of an outdoor physical activity programme. Regular physical activity helps maintain a healthy body weight and is recommended to optimise chances of conception (naturally and via fertility treatment) as well as pregnancy outcomes (NICE, 2010; NICE, 2013). As such, the factors that make people more likely to continue with physical activity programmes are of relevance in the wider context of health initiatives to improve fertility and pregnancy outcomes. The theoretical framework employed was the TPB (Ajzen, 1991). The predictive utility of intentions to participate in physical activity was examined for participation in the physical activity programme at various stages from registering an interest in the programme to completing the programme. The aim was to provide insight into the factors that predict participation and drop-out at various stages of a physical activity programme and hence shed light on what needs to be done to improve uptake of physical activity programmes.

Physical Activity: High Benefits, Low Participation

Regular physical activity optimises fertility. Obese women who undertake 30 minutes of exercise three times a week experience improvements in menstrual cyclicity and ovulation rates (Palomba et al, 2008). Further, physical activity is associated with weight loss (Jeffery, Wing, Sherwood & Tate, 2003) and as little as a 5% reduction in body weight leads to significant improvements in menstrual cyclicity and restoration of ovulation in overweight women (Clark et al., 1998; Huber-Buchholz et al., 1999; Moran et al., 2003). Women with a healthy weight ($\text{BMI} < 25 \text{ kg/m}^2$) are more likely to achieve a pregnancy naturally and after assisted reproductive technology (e.g., Maheshwari et al., 2007). As such, most fertility clinics advise overweight women to lose weight before being offered fertility treatment, with regular physical activity being one of the main strategies recommended to achieve the weight loss (NICE, 2013). Among people with infertility or disorders linked to fertility problems (e.g., polycystic ovary syndrome; PCOS), weight loss through regular physical activity is recommended to reduce symptoms and improve prognosis before any medical fertility intervention is considered (NICE, 2013; Thessaloniki ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group, 2008). Maintaining a healthy weight through regular physical activity also optimises pregnancy. For example, women with a BMI below 25 kg/m^2 are less likely to experience pregnancy complications such as hypertension and gestational diabetes (Linné, 2004). For this reason, the UK government recommends that women engage in regular physical activity before, during and after pregnancy to help them maintain a healthy body weight and optimise their pregnancy (NICE, 2010).

Recommendations about physical activity cannot be effectively implemented given the low participation and high drop-out from physical activity. The WHO recommends that to achieve health benefits, adults aged 18-64 years should engage in at least 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity per week, or an equivalent combination of moderate- and vigorous-intensity physical activities (WHO, 2011). However, in the UK 63.3% of adults aged 15 years or older are insufficiently physically active (WHO, 2011), which puts them at increased risk for fertility problems and, among those who become pregnant, adverse pregnancy outcomes. Low participation in exercise also applies in infertile populations. For example, a systematic review of exercise interventions for women with PCOS revealed drop-out rates as high as 40-45% (Harrison, Lombard,

Moran & Teede, 2011). Further, self-reported baseline levels of physical activity are lower in women with PCOS than in control women without PCOS (Wright, Zborowski, Talbott, McHugh-Pemu & Youk, 2004).

The full chronology of participation and drop-out in physical activity programmes can be thought of as starting with expressing an interest in participating in a physical activity programme, to formally enrolling in the programme, and finally to completing the programme (i.e., staying in the programme until the final assessment; e.g., Gidlow et al., 2005; Yohannes, Yalfani, Doherty & Bundy, 2007). Completing the programme can be thought of as different to complying with the recommended exercise regime, which means to adhere to the prescribed amount of exercise during the programme. Data from randomised controlled trials (RCT) and evaluations of UK exercise referral schemes, in which people not meeting physical activity level recommendations are referred to exercise programmes by their general practitioner (GP), show that approximately 80% of participants drop out before the end of the programme, with only about 12-18% of participants attending the final assessment of the trial (Gidlow et al., 2005). Reviews show that men and younger people are less likely to enrol in physical activity programmes (Pavey et al., 2012). Once enrolled, individuals more likely to drop out from physical activity programmes include those with ill health (Thorsen et al., 2005), lower baseline physical activity levels, and higher BMI (Nascimento, Pudwell, Surita, Adamo & Smith, 2014), although associations among participant characteristics and physical activity participation/ drop-out are inconsistent across studies (Gidlow et al., 2005). Reasons participants provide for dropping out of physical activity programmes include physical constraints such as injury and practical barriers such as having insufficient time for exercise or moving out of the area (Wallace & Cumming, 2000). It is essential to provide a clearer picture of the factors related to drop-out at each stage of participation in a physical activity programme, from expressing an initial interest in taking part to actually completing the programme, to determine how best to modify programmes to reduce drop-out at each stage of engagement (Gidlow et al., 2005).

Along with optimising fertility and pregnancy, regular physical activity reduces risk for a multitude of other adverse health outcomes, including cardiovascular disease (Shaw et al., 2006), kidney disease (Hawkins et al., 2011), stroke (Lee, Folsom & Blair, 2003), diabetes (Laaksonen et al., 2005) and mortality amongst cancer patients (Kenfield, Stampfer, Giovannucci, & Chan, 2011). There are also psychological

benefits of engaging in physical activity, including reduced levels of stress, depression and anxiety, and improvements in mood (Hassmén, Koivula & Uutela, 2000; Penedo & Dahn, 2005). This emphasises that participation in physical activity is a worthy and timely area of investigation. Effective physical activity interventions must be acceptable to the public in order to promote participation and prevent drop-out. According to the Medical Research Council (MRC) framework (Campbell et al, 2000; Craig et al, 2008), to evaluate interventions it is necessary to adopt an empirically- and theoretically-driven approach to identifying the determinants of physical activity.

Theoretical Framework for Participation in Physical Activity

The Theory of Planned Behaviour.

According to the Theory of Planned Behaviour (TPB; Ajzen, 1991), to understand when a person is likely to participate and/ or drop out from a physical activity programme it is necessary to measure their attitudes towards participating in physical activity, whether they believe significant others such as friends and family would want them to participate in physical activity (subjective norms), the amount of control they feel they have in relation to participating in physical activity (perceived behavioural control), and their intention to participate in physical activity. Attitudes, subjective norms and perceived behavioural control are argued to predict a person's intention to participate in physical activity and intention directly affects the likelihood that the individual will participate in and/ or drop out from physical activity (Ajzen, 1991). Perceived behavioural control is argued to also reflect actual behavioural control (e.g., opportunity, resources) and is thus postulated to have a direct effect on behaviour (Ajzen, 1991; Ajzen, 2002). To illustrate with an example; a person with more positive attitudes towards participating in physical activity would be expected to be more likely to participate in a physical activity programme and less likely to drop out from the programme, whereas an individual with less positive (or more negative) attitudes towards participating in physical activity would be expected to be less likely to participate and more likely to drop out from the programme.

The TPB has been applied to a range of health behaviours, including physical activity, addictive behaviours (e.g., drug use), screening for illness, eating behaviours, behaviours related to human immunodeficiency virus (HIV), and oral hygiene (Godin &

Kok, 1996). The overall variance explained across behaviours by the TPB is reported as 34% (range 15.6% to 42.3%; Godin & Kok, 1996). The TPB is one of the most widely tested and applied models in the domain of physical activity (Buchan et al., 2012). Out of eight different health behaviours, physical activity was the third best predicted behaviour and the accuracy of prediction was above the overall average prediction across behaviours (36.3% of the variance in physical activity explained compared to an average across behaviours of 34%; Godin & Kok, 1996). A more recent meta-analysis found that out of six different health behaviours, the TPB was most accurate at predicting physical activity (23.9% of the variance explained) and least effective at predicting safer sex behaviours (13.8% of the variance explained; McEachan et al., 2011). A review that focused exclusively on the application of the TPB to physical activity ($n=72$ studies) reported that, overall, attitudes, subjective norms and perceived behavioural control explained 44.5% of the variance in intentions to participate in physical activity and that the whole TPB model explained 27.4% of the variance in participation in physical activity (Hagger, Chatzisarantis & Biddle, 2002). According to the TPB, demographic and participant characteristics (e.g., gender, health status) are associated with participation in health behaviours such as physical activity indirectly through their influence on the TPB constructs (Ajzen, 1991). For example, a person with poor health may have lower perceived behavioural control over their ability to participate in a physical activity programme, and their reduced perceived behavioural control would be predicted to make them less likely to participate in the programme.

The TPB has enabled researchers to explain variations in physical activity in a range of contexts, including physical activity amongst diabetic patients (Plotnikoff, Lippke, Courneya, Birkett & Sigal, 2010) and older adults (> 60 years; Courneya, 1995), walking in the general population (Darker, French, Eves & Sniehotta, 2010), and maintenance of physical activity once people decide to become more physically active (Armitage, 2005). Overall the evidence base suggests that the TPB may be an effective model for understanding participation and drop-out from physical activity programmes.

Moderators to the TPB construct relationships.

Despite findings supporting the overall efficacy of the TPB in predicting health behaviour, relationships among the TPB constructs are moderated by behavioural and methodological factors. For example, intentions to perform a behaviour do not always

translate into behaviour. The correlation (mean true score correlation corrected for sampling and measurement error, denoted ‘mean rho [p]’) between intentions and individual health behaviours varies, being strongest for physical activity behaviour (mean $\rho = .48$) and weakest for safe sex and abstinence behaviours (both mean $\rho = .37$; McEachan et al., 2011). Conceptual variations may also impact on the predictive utility of the TPB. For example, implementation intentions, whereby an individual specifies where, when and how they will perform certain actions that will lead to the attainment of a goal, increase the likelihood of intentions being translated into behaviour (medium-large effect size; Gollwitzer & Sheeran, 2006; Gollwitzer, 1999).

The inclusion of past physical activity behaviour has been shown to add 10.3% to the prediction of future physical activity behaviour (McEachan et al., 2011). This may be because behaviours that are repeated frequently become automatic or habitual and are learned patterns of responses to environmental cues (Ouellette & Wood, 1998; Rhodes, de Bruijn & Matheson, 2010). Habitual behaviours are automatically activated when people are in an environment that is similar to the context in which they learned the behaviour (Ouellette & Wood, 1998; Rhodes et al., 2010).

Overall, research suggests that the TPB is an appropriate model to apply to predicting participation in a physical activity intervention. However, behavioural and methodological factors are a key consideration in the predictive utility of the TPB.

Understanding Participation and Drop-Out in Physical Activity Interventions

As well as the TPB constructs, contextual and environmental factors affect the likelihood that people will engage in physical activity. The majority of physical activity interventions take place in the context of indoor settings such as gyms (Pavey et al., 2012; Gidlow et al., 2005). However, research suggests that people prefer to exercise in outdoor environments and that outdoor settings may be associated with greater engagement and better health outcomes. For example, reviews of the causes and correlates of physical activity in the general population show that individuals are more willing to engage in physical activity in an aesthetically pleasing environment, including enjoyable scenery, attractive natural features, and hills (Brownson, Baker, Housemann, Brennan & Bacak, 2001; Humpel, Owen & Leslie, 2002; Owen, Humpel, Leslie, Bauman & Sallis, 2004; Saelens & Handy, 2008). In addition, individuals who engage in physical activity report exercising most often in outdoor settings such as

neighbourhood streets (66.1%) and least often in indoor settings such as a gym (21.3%; Brownson et al., 2001). In one RCT evaluating the efficacy of a gym-based physical activity programme, dislike of the gym environment was a concern raised among participants during the evaluation process, especially among non-adherers (Taylor, Doust & Webborn, 1998).

There is an apparent preference for exercising in outdoor contexts. However, less is known about the factors that predict participation and drop-out in outdoor physical activity programmes. Preference for exercising in outdoor contexts over indoor contexts may be linked to the superior benefits of outdoor exercise on well-being. Systematic reviews of controlled trials show that, compared with indoor exercise programmes, participation in outdoor exercise programmes is associated with greater feelings of revitalisation, positive engagement during exercise, self-esteem, and energy, and less frustration, tension, anxiety, fatigue, and depression (Bowler, Buyung-Ali, Knight & Pullin, 2010; Thompson Coon et al., 2011). Experimental studies show that participants report greater enjoyment and satisfaction with exercise and a greater intention to exercise in the future in outdoor contexts compared with indoor contexts (Thompson Coon et al., 2011). These findings imply that outdoor physical activity improves physical health, incurs greater psychological benefits, and promotes greater engagement than indoor physical activity and these benefits may reduce drop-out (Bowler et al., 2010; Thompson Coon et al., 2011).

Exercising in a group context is an additional factor that improves engagement and outcomes in physical activity programmes. A meta-analysis of controlled trials showed that exercising in a group context is associated with better adherence and health outcomes (e.g., strength, balance, flexibility) compared to exercising individually (Burke, Carron, Eys, Ntoumanis & Estabrooks, 2006). Other studies show that individuals are more likely to engage in physical activity when there are other people exercising with them, when they have at least one friend with whom to exercise, and when they have friends who encourage exercise (Brownson et al., 2001; King et al., 2000). According to the TPB, engaging in a health behaviour such as physical activity with other people may increase the likelihood of the behaviour in the future because it strengthens subjective norms of the behaviour (Ajzen, 1991). A further advantage of group-based physical activity is that it increases sociability, mood and wellbeing (Williams & Lord, 1997). Social support may buffer against drop-out from physical activity interventions, whilst feeling alone and unsupported may be a risk factor for

drop-out; for example, individuals who drop out from physical activity interventions score higher on measures of loneliness and lower on measures of self-efficacy in relation to physical activity (Jancey et al., 2007). Promoting a cohesive and supportive group environment may increase participation in physical activity programmes due to forming interpersonal relationships, feelings of mutual social support, and improving self-efficacy and mastery in relation to physical activity (Christensen, Schmidt, Budtz-Jørgensen & Avlund, 2006).

Taken together, the research discussed implies that physical activity interventions may be most effective in terms of participation and outcomes (physical, psychological) when they occur in an outdoor context and adopt a group-exercise format.

The Present Study

The aim of the present study was to evaluate and understand participation and drop-out in an outdoor physical activity intervention using the TPB and to examine the predictive utility of the TPB at different stages of physical activity participation: registering an interest, enrolling in the programme, and completing the programme. The study followed the MRC framework for developing and evaluating interventions (Campbell et al, 2000; Craig et al, 2008), which comprises four main stages: development, feasibility and piloting, evaluation, and implementation.

The present study was designed to encompass the first two stages of the MRC framework: a) development, and b) feasibility and piloting. The first stage (development) involves identifying the evidence base and relevant theories to understand the likely process of change, inform hypothesis formation, and to establish the confounding variables that need to be controlled for. This stage also comprises modelling the intervention, which involves designing the intervention and identifying the components of the intervention and the underlying mechanisms by which they will influence outcomes such that evidence-based predictions can be made about how the components will influence outcomes. To implement the first stage, an online survey (the Cardiff Fitness Survey; CFS) was conducted to identify factors associated with the intention to participate in physical activity and to model the behavioural determinants and outcomes. The theoretical framework used was the TPB and the outcomes of

interest were anthropometric characteristics (e.g., BMI), physical fitness and psychological wellbeing (e.g., mood).

The second stage (feasibility and piloting) involves an exploratory trial to evaluate the acceptability and delivery of the intervention, and to estimate recruitment and retention rates. This stage enables researchers to obtain necessary evidence that the proposed determinants of behaviour change are indeed related to change and predicted outcomes as well as allowing important moderators of change to be identified. The second stage was implemented via an exploratory trial of a six-week outdoor physical activity programme using participants who completed the CFS.

Conceptual and methodological aspects that affect the predictive utility of the TPB were taken account of. Firstly, implementation intentions can be formed by asking participants to write down where, when and how they will perform a specific behaviour, provided the study design permits participants to choose where, when and how they will perform the behaviour (e.g., Chatzisarantis, Hagger & Wang, 2010). It was not deemed possible to ask participants to form an implementation plan in the present study as this was a structured physical activity intervention and where, when and how the behaviour (i.e., physical activity) was to be implemented was pre-specified. In the CFS participants were informed when, where and how the physical activity intervention would be implemented as this should make decision-making easier and initiation of physical activity more efficient because it requires fewer cognitive resources (Gollwitzer 1999). Additionally, when decision-making about how to implement the behaviour is made easier, the individual is likely to be able to allocate more resources to reducing unwanted barriers that might impede the behaviour (Gollwitzer, 1999). Secondly, past physical activity behaviour, which may affect future physical activity behaviour (McEachan et al., 2011), was measured.

To the knowledge of the author of the present thesis this study was the first study to apply the TPB to participation and drop-out in an outdoor physical activity intervention. In line with theory and previous research, it was hypothesised that individuals with more positive attitudes, stronger subjective norms, and higher perceived behavioural control would be more likely to intend to participate in the physical activity programme at baseline. It was expected that people with higher intentions and perceived behavioural control at baseline would be more likely to participate in the physical activity programme at the three stages measured (registering an interest, enrolling, and completing the programme). A further expectation was that

participation in the physical activity intervention would lead to positive changes in attitudes, subjective norms, perceived behavioural control, and intentions to engage in physical activity in the future. Finally, in terms of health outcomes, it was predicted that participation in the physical activity intervention would lead to more a favourable anthropometric profile (i.e., reduced waist-hip ratio and improved lung capacity), better physical fitness, and enhanced psychological wellbeing (i.e., more positive mood and lower levels of negative mood and stress).

Method

Participants

The final sample comprised 170 participants; 120 women (70.59%) and 50 men (29.41%), who were recruited for the CFS via an advertisement sent to staff and students at Cardiff University. Given that fertility risk factors were assessed as part of the sample profile, eligible age range was defined as 18 to 50 years with the upper age limit being the theoretical upper end of natural fertility for women (ESHRE Capri Workshop Group, 2005).

The baseline demographic characteristics of the sample are presented in Table 3.1. Average age was 32.71 years in women and 35.31 years in men. The majority of participants had a university education, were living with a partner and did not have children.

Table 3.1.

Sample demographic characteristics at baseline (n = 170)

Variable	Women (n=120)	Men (n=50)
Demographic characteristics		
	Mean (SD)	
Age (years)	32.71 (8.49)	35.31 (8.38)
	n (%)	
Education level:		
< Secondary school	0	0
Secondary school	4 (3.3)	4 (8)
Post-secondary vocational training	13 (10.8)	5 (10)
University	103 (85.8)	41 (82)
Relationship status:		
Single	31 (25.8)	13 (26)
In relationship, not living with partner	23 (19.2)	7 (14)
Cohabiting (living with partner)	66 (55)	30 (60)
Children:		
Yes	34 (28.3)	17 (34)

Note. Due to missing data *N* varies per variable: 168 (age) to 170. Means after outliers trimmed to within $\pm 3SD$ of the mean. SD = standard deviation.

Design

The research comprised a survey study in which a single-blind exploratory RCT with a cross-over design was embedded. The research was designed to examine participation in a physical activity programme at different stages of the programme from registering an interest to completing the programme. Figure 3.1 shows the study procedure and assessment schedule. In stage I (Baseline assessment) participants completed the CFS and were informed of a free outdoor fitness (OF) programme and invited to register an interest in taking part in the programme six weeks later. In stage II (Pre assessment) participants having expressed an interest were invited to enrol in the trial and exercise

programme by attending a pre assessment (anthropometric, fitness, and psychological measurements), with attending participants having been randomly assigned to start the exercise programme in the week immediately after the assessment (IM-OF group) or after a six-week waitlist period (WL-OF group). In stage III participants undertook the exercise programme or waitlist period (depending on group randomisation), with two further assessments after three weeks (Mid assessment) and six weeks (Post assessment).

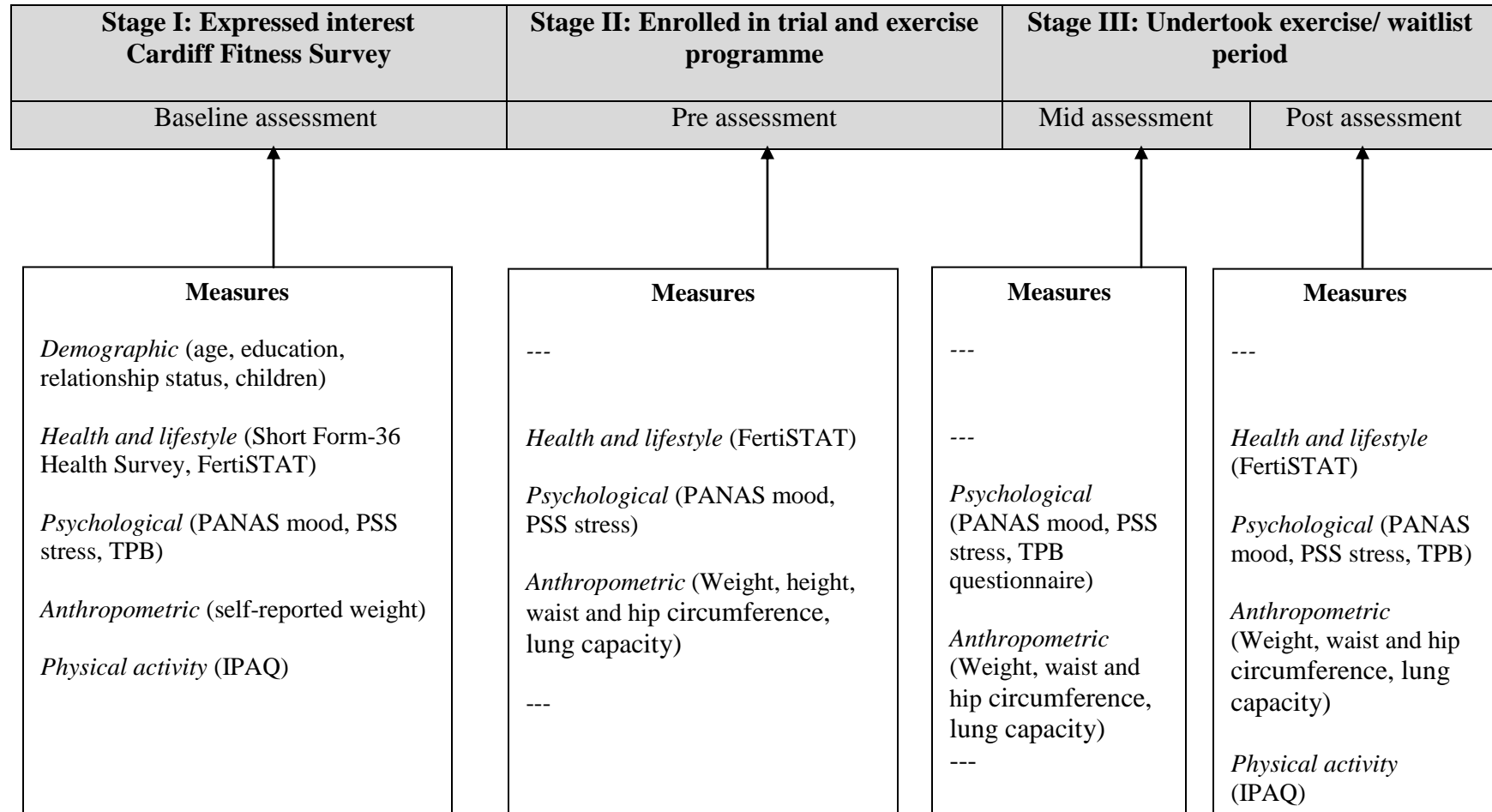


Figure 3.1. Flowchart showing study procedure and assessment schedule (only variables relevant to the present research question are described). FertiSTAT = Fertility Status Awareness Tool; PANAS = Positive and Negative Affect Scale; PSS = Perceived Stress Scale; TPB = Theory of Planned Behaviour; IPAQ = International Physical Activity Questionnaire.

Materials

Overview of measures.

The variables measured in the CFS were of six broad categories; demographic, health and lifestyle, reproductive characteristics (women only), physical activity factors (e.g., current physical activity level), psychological wellbeing (mood, stress levels), and the TPB constructs. Only variables relevant to the present research question are described (see Appendix B for relevant survey items). Additional variables measured during the physical activity trial were anthropometric characteristics and physical fitness.

Demographic variables.

Demographic variables were age, education level (highest level of education achieved), relationship status (in a relationship and living/not living with partner; single), and whether the participant had any children (yes/no).

Health, lifestyle and reproductive characteristics.

One item taken from the Short Form-36 Health Survey (SF-36; Ware & Sherbourne, 1992) required participants to rate their general health on a five-point rating scale (1 = poor to 5 = excellent). The SF-36 scales have high reliability (Cronbach's $\alpha > .85$) and are able to distinguish between groups with expected health differences (e.g., patients with or without chronic diseases; Brazier, et al., 1992). Lifestyle and reproductive risk factors for reduced fertility were measured via the 22-item FertiSTAT (Bunting & Boivin, 2010), which can classify fertile (pregnant) and infertile (trying to get pregnant for more than 12 months) women with an accuracy comparable to medical tests of ovarian reserve (85.8% classification rate; Bunting & Boivin, 2010). The lifestyle factors were whether participants currently smoked (yes/no) and amongst those who smoked how many cigarettes per day, number of units of alcohol consumed per week, and weight in kilograms (kg). The reproductive risk factors were presence/absence of period, menstrual cycle irregularity (i.e.,

menstrual lasts less than 21 days or more than 35 days), menstrual cycle predictability, severity of period pains, and history of pelvic surgery, endometriosis and Pelvic Inflammatory Disease.

Physical activity level.

Current physical activity was assessed using a short version of the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003) that comprised eight items for recalling how many days and how much time per day during the last seven days had been spent doing vigorous and moderate physical activities, walking and sitting. IPAQ data from 12 countries demonstrates good test-retest reliability, with a pooled Spearman's correlation coefficient of .81 for the long version and .76 for the short version of the questionnaire. Tests of concurrent validity between the short and the long version of the IPAQ show satisfactory validity (pooled Spearman's coefficient of .67; Craig et al., 2003). Whilst validity of the IPAQ against motion detector assessments of physical activity is lower (Spearman's coefficient of .33 and .30 for the long and short forms respectively), it is comparable to that of other self-report physical activity measures. In the present study, level of physical activity as measured by the IPAQ was categorised into high, moderate or low according to scoring guidelines on the website of the developers of the IPAQ (<http://www.ipaq.ki.se/scoring.pdf>). Respondents were categorised into high or moderate levels of physical activity based on their physical activity over the last seven days which is scored on type of activity (vigorous or moderate), number of days and minutes per day spent doing the activity, and metabolic equivalent minutes (MET-minutes) accumulated over the week. The MET-minute score expresses the energy cost of a physical activity (with higher scores representing physical activities with higher energy costs) and is the multiple of the time spent doing a physical activity (days per week X minutes per day) by a MET score that is weighted according to the type of activity (MET score = 8.0 for vigorous physical activity; 4.0 for moderate physical activity; 3.3 for walking). Participants with physical activity levels below the criteria for moderate physical activity category were categorised as having low physical activity.

A single item measured whether participants felt they were currently meeting their fitness goals (yes/no).

Psychological wellbeing: Mood and stress levels.

Mood was assessed via the 20-item Positive and Negative Affect Scale (PANAS; Watson, Clark & Tellegen, 1988). The PANAS requires participants to rate how often over the last week they have felt 10 positive emotions (e.g., inspired, enthusiastic) and 10 negative emotions (e.g., upset, guilty) on a five-point likert-scale with 1 representing 'very slightly or not at all' and 5 representing 'extremely often'. Previous empirical work shows that the PANAS scales are reliable (Cronbach's $\alpha = .86$ to $.90$ for the positive affect scale and $.84$ to $.87$ for the negative affect scale; Watson et al, 1988) and correlate with other measures of mood (e.g., the Depression Anxiety and Stress Scales and the Hospital Anxiety and Depression Scale, Crawford & Henry, 2004). In the present study, the positive and negative affect scales at baseline showed acceptable reliability (for positive affect items Cronbach's $\alpha = .90$; [$> .70$ indicates acceptable reliability, Field, 2009] and for negative affect items all corrected items-to-total values $> .30$ [indicating acceptable reliability, Field, 2009] with a range of $.35$ to $.60$).

Levels of experienced stress were measured via the self-report 10-item Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983), in which participants rate how often they have felt or thought in a certain way during the last month (e.g., in the last month, how often have you been upset because of something that happened unexpectedly?) on a 5-point likert-scale with 0 representing 'never' and 4 representing 'very often'. Previous research demonstrates that the PSS scale is reliable (Cronbach's $\alpha .84$ to $.86$) and correlates with other indices of stress (e.g., experience of negative life events; Cohen et al., 1983). In the present study reliability of the PSS at baseline was acceptable (Cronbach's $\alpha = .87$).

Theory of Planned Behaviour constructs.

The TPB variables were measured using a 15-item questionnaire according to recommendations on the website of the developer of the TPB, Icek Ajzen (<http://people.umass.edu/aizen/pdf/tpb.measurement.pdf>).

The questionnaire used seven-point rating scales to measure the TPB constructs in relation to the target behaviour of exercising for at least one hour three times per week for six weeks. Attitude was measured via five items asking participants to rate the statement 'My exercising for at least one hour, three times per week for six weeks would be...' on five separate scales, with one extreme of the scale representing a negative evaluation (e.g., bad, not enjoyable) and the opposite extreme representing a positive evaluation (e.g., good, enjoyable). Perceived behavioural control was measured via four items requiring participants to rate the extent to which they had control over engaging in exercise, for example 'For me, exercising for at least one hour, three times per week for six weeks is...', on a scale of 'very easy' to 'very difficult'. Subjective norms were measured via four items assessing respondents' perceptions of how important others evaluate exercise, for example 'The people who are important to me would encourage and support me exercising for one hour, three times per week for six weeks', rated on a scale of 'agree' to 'disagree'. Intention was assessed via two items, for example 'I intend to exercise for at least one hour, three times per week for six weeks', rated on a scale of 'likely' to 'unlikely'.

Reliability of the TPB constructs at baseline was satisfactory. For the attitude and subjective norms items, all corrected item-to-total values were greater than .30 (indicating acceptable reliability; Field, 2009), with a range of .52 to .75 and .44 to .63 respectively. For the perceived behavioural control items, Cronbach's alpha was .89. The two intentions items at baseline were not reliable (Spearman-Brown's coefficient of .21; > .70 is acceptable; Field, 2013).

Physical activity participation and drop-out behaviour.

Participation and drop-out from the physical activity programme were measured at three stages. The first stage was expressing an interest in the programme measured by

recording whether or not participants provided an email address to receive information about enrolling in the physical activity programme (Stage 1). Drop out from the programme was measured at two further stages: whether or not participants actually enrolled in the physical activity programme (Stage 2), and whether or not participants completed the physical activity programme (Stage 3). In line with previous research, to complete the programme participants had to remain in the study until the final assessment of the study (e.g., Gidlow et al., 2005) and attend at least one exercise class during the six-week programme. For each stage, continued participation was coded one and discontinuation (drop-out) was coded zero.

Compliance with exercise regime.

Compliance with the recommended exercise regime was checked by emailing participants at the end of each week of the exercise programme with an electronic timetable on which they recorded the number of exercise classes they had attended that week. Participants also recorded the date, time and location of each class on the timetable. Self-reported compliance was checked against fitness instructor reports of compliance. Fitness instructor reports of compliance were obtained by giving participants class attendance cards which they took with them to exercise classes for the fitness instructors to sign off their attendance.

Anthropometric assessments.

Weight and height were self-reported in the CFS. During the fitness trial weight was measured using an electronic weighing scales (UK Patent No. 9024SV3R) and height, waist and hip circumference were measured using a standard tape measure. A paired samples t-test showed there was no difference between self-reported height and height measured using a tape measure ($t [25] = -1.896, p = .070$). Lung capacity was tested via a spirometer (UK Patent No. ISO23747).

Physical fitness.

Physical fitness was assessed by recording the number of press-ups, sit-ups and squats participants could do in two minutes (each timed separately), as commonly used to assess fitness and which correlates highly with measures of occupational physical fitness including muscular strength and endurance ($r = .89, p < .01$; Bilzon, Scarpello, Bilzon & Allsopp, 2002).

Intervention and Waitlist Programmes

Participants were randomised to the immediate exercise (IM-OF) condition or the waitlist delayed exercise (WL-OF) condition using a random number table in Microsoft Excel by an independent researcher that had no further contact with participants.

The six-week exercise programme comprised group exercise classes run by qualified fitness instructors at a local outdoor fitness company, Outdoor Fitness². The exercise classes alternated intervals of cardiovascular training (e.g., jogging and running) with strength and balance exercises (e.g., press-ups, sit-ups and squats). To ensure that all participants worked at their maximum physical capacity during each class, the fitness instructors matched the intensity of the exercise activities prescribed to individual current fitness. Each participants' fitness level was assessed and they were assigned a fitness colour-level, with participants working at their assessed colour-level for exercise activities during the class (e.g., blue = 10 squats, red = 15 squats, yellow = 20 squats, black = 25 squats). This was to allow participants to work at an equivalent personal level of intensity during each class. Each class was an hour long and classes were run at four outdoor sites (recreation fields and parks) in and around the Cardiff area, five times a week, in the morning and evening. Classes were open to the public so class size was variable, ranging from three to 30 people. During the six-week exercise programme participants were recommended to take part in three of the classes run by the Outdoor Fitness company per week and could choose the day, time and location of the classes they attended.

² See the company website: www.outdoorfitnessltd.com

During the six-week waitlist period participants were instructed to continue with their usual level of physical activity³. To equalise the groups on nutritional knowledge, at the point of study enrolment participants were given a healthy eating information leaflet from the British Nutrition Foundation describing methods of achieving a nutritionally balanced diet.

Procedure

The study received approval from the Ethics Committee of the School of Psychology, Cardiff University. Individuals who responded to the online Cardiff University advertisement were directed to the CFS. Recruitment for the fitness trial was done in the final section of the CFS. The survey described the six-week OF exercise programme as being for men and women who wanted to improve their fitness, health and well-being regardless of current fitness level, and gave participants the option to leave an email address in order to receive information about participating in the programme⁴. The study procedure is outlined in Figure 3.1. Total study duration for each participant was 18 weeks (six weeks data collection for the CFS, six weeks exercise intervention period, six weeks waitlist control period, order depending on assignment).

The IM-OF group started with the exercise programme and then crossed over to the waitlist, whilst the WL-OF group started with the waitlist and crossed over to the exercise programme. For ethical and practical reasons, if participants requested to change group (i.e., from IM-OF to WL-OF or vice versa) they were permitted to do so. At the end of the six-week exercise programme, participants were asked to hand in their class attendance

³ Participants were instructed to continue with usual activity during the waitlist period to allow a within-subjects comparison of a period of usual physical activity to a period of exercise. For ethical reasons, after the six-week exercise programme participants were allowed to carry on attending OF exercise classes if they wished. It is important to note that this may affect the within-subjects comparison for the group who complete the exercise condition first in cross-over design exercise studies (in this study, the IM-OF group), as these participants may continue to attend exercise classes during their subsequent waitlist period.

⁴ A second outdoor physical activity programme designed specifically for women planning a pregnancy (Fertility Fitness; FF) was also advertised in the CFS. The FF programme was not part of the RCT. All FF participants commenced their exercise programme immediately after the pre assessment. The difference between the content of the standard OF programme and the FF programme was that the FF programme additionally offered consultations with a registered Dietician and folic acid and vitamin D supplements as recommended for women planning a pregnancy. Eight women (4.71%) in the CFS left their email address to receive information about FF and two (1.18%) enrolled in the FF programme. In the present chapter data is reported only for the RCT.

cards so self-reported class attendance could be corroborated against instructor-reported class attendance.

Baseline assessments were administered during the CFS. Six weeks after baseline, participants were enrolled in the trial and exercise programme and completed pre assessments. Pre assessments were conducted immediately prior to the start of the exercise intervention/ waitlist period, mid assessments occurred half way through the exercise intervention/ waitlist period, and post assessments were administered at the end of the exercise intervention/ waitlist period. The measures completed by participants at each assessment are shown in Figure 3.1. During assessment sessions, participants rotated among three assessment stations: fitness, anthropometric and psychological measurements. The anthropometric and fitness assessments were conducted by qualified fitness instructors with extensive experience in conducting these assessments on clients. Additional researchers were trained by the fitness instructors in administering the anthropometric and fitness assessments.

The single-blind design was implemented by withholding the condition identity of each participant from the researchers conducting the assessments. Double-blinding was not deemed possible as by definition participants knew whether they were assigned to the IM-OF or WL-OF condition.

Data Analyses

In total 173 people completed the CFS but three participants (all women) were excluded from analyses; two because they indicated that they were within the eligible age range on the consent form but reported being over 50 years of age in the survey and one because they had over 90% missing data. Power calculations using the software G*Power (version 3.1, Faul, Erdfelder, Buchner, & Lang, 2009) indicated that the minimum sample size needed for intended logistic regression analyses predicting drop-out was 122 (power = .80). One participant in the IM-OF group who remained in the study until the final assessment was not coded as a programme completer because she did not attend any exercise classes during the six-week exercise programme.

Preliminary data screening revealed an issue with some frequency questions (i.e., smoking, alcohol consumption, physical activity level), where participants provided a range instead of a specific value. In such cases the mid-point was used. Outliers were trimmed to within three standard deviations of the mean. Transformations were applied to skewed variables (i.e., physical activity intentions).

Pearson's χ^2 was used to examine the association between current perceived achievement of fitness goals and current level of physical activity as measured by the IPAQ. When the sample size in χ^2 analyses was underpowered, Fisher's Exact Test was reported. Cronbach's alpha was used to assess the reliability of items that met parametric assumptions (i.e., normally distributed). Non-normality can increase error and bias in estimating reliability using the alpha coefficient (Sheng & Sheng, 2012) and therefore reliability for variables with non-normal distributions not improved by transformation was assessed using Spearman's non-parametric rank correlation coefficient. For scales with only two items, reliability was estimated using the Spearman-Brown reliability coefficient as recommended (Eisinga et al., 2013). When reliability was not acceptable, the deletion of items was considered. This was the case for the two intention items (one continuous, one dichotomous) measured at baseline (Spearman-Brown's coefficient of .21), possibly due to the extreme skewness of the dichotomous intentions item (91.2:8.8% yes/no split). The continuous intention item met parametric assumptions and so was used in analyses. Reliability of measures was estimated at baseline only because the sample size during the fitness trial was too small ($n = 26$ to $n = 9$ from enrolment to final assessment) to provide accurate estimates of reliability (Charter, 2003). At each assessment point, composite scales for the TPB constructs (attitude, subjective norms, perceived behavioural control, and intention), PANAS constructs (positive affect, negative affect), and PSS constructs were created by averaging scores across the respective construct items, as per standard scoring instructions.

Hierarchical multiple regression was used to investigate the predictive utility of attitudes, subjective norms and perceived behavioural control on intentions at baseline. On the first step of the analysis, the main effects of attitudes, subjective norms and perceived behavioural control were entered; on the second step, past physical activity behaviour (as

measured by the IPAQ) was entered to examine whether past behaviour improved the predictive utility of the TPB constructs.

Logistic regression was used to examine the predictive utility of perceived behavioural control and intentions at baseline on three measures of participation and drop-out behaviour as dependent variables: provision of email address, enrolment in the fitness trial and completion of the programme. On the first step of the analysis the main effects of perceived behavioural control and intentions at baseline were entered; on the second step of the analysis past physical activity behaviour (IPAQ) was entered.

Separate mixed factorial ANOVAs 2 (group: IM-OF, WL-OF) X 3 (time: pre assessment, mid assessment, post assessment) were computed to investigate the impact of the exercise intervention on three types of outcome: (1) anthropometric characteristics (waist-hip ratio, lung function); (2) physical fitness (number of squats, press-ups and sit-ups); and (3) TPB variables (attitude, subjective norms, perceived behavioural control, and intentions). The between-subjects factor was condition, to compare outcomes in the group undertaking the six-week exercise intervention (IM-OF group) to outcomes in the group undertaking the six-week waitlist period (WL-OF group). The within-subjects factor was time, with three assessment points: pre-intervention/ waitlist, mid-intervention/ waitlist, and post-intervention/ waitlist. It was not deemed possible to repeat the analyses for the groups after they 'crossed-over' (i.e., when the WL-OF group crossed over to the exercise intervention period and the IM-OF group crossed over to the waitlist period), as the sample size for the WL-OF group dropped to three by the post assessment point after the cross-over period.

The small final sample size ($n = 9$) of the fitness trial meant that the exploratory RCT was underpowered to detect significant effects in the trial data, according to power calculations using the software G*Power (version 3.1, Faul et al., 2009). Therefore, in analyses of trial data, the effect size was assessed and significance tests were not interpreted. The proportion of the variance in the outcome variables explained by a given factor was estimated using partial eta-squared (η_p^2 ; Stevens, 1992) in ANOVA and semi-partial correlation in t-test and chi-square analyses (Field, 2013). Small, moderate and large effect sizes were indicated respectively by η_p^2 values of .01, .06 and .14 (Cohen, 1988) and

semi-partial correlation values of .10, .30 and .50 (Cohen, 1992). Main effects and interactions were interpreted if they had at least a moderate effect size.

Results Part I: Sample Characteristics and Predictors of Participation and Drop-Out

Sample Health, Psychological Characteristics and Physical Activity Level

Table 3.2 shows baseline health, psychological characteristics and physical activity level. Average score on the SF-36 was just above 3, corresponding to a health rating of ‘good’. Women had on average 1.26 reproductive risks for reduced fertility as measured by the FertiSTAT. The most common reproductive risk factors were having an unpredictable menstrual cycle (40.20%, $n = 47$) and suffering from severe period pains (29.20%, $n = 35$) and the least common risk factors were having a history of reproductive organ diseases including pelvic inflammatory disease (1.70%, $n = 2$) and endometriosis (3.40%, $n = 4$). The majority of the sample did not smoke (94.9% of women, 88% of men). On average men drank more units of alcohol per week than women (7.49 versus 4.51 units respectively). A total of 21.5% of women and 31% of men had a low level of physical activity at baseline according to their score on the IPAQ. The majority of participants (84.2% of women, 88% of men) felt that they were not currently meeting their fitness goals.

Table 3.2.

Sample health, psychological factors and physical activity at baseline (n = 170)

Variable	Women (<i>n</i> =120)	Men (<i>n</i> =50)
Health		
	Mean (SD)	
SF-36 health rating	3.17 (0.97)	3.02 (0.77)
Number of FertiSTAT reproductive risks (women only)	1.26 (1.02)	NA
Lifestyle characteristics		
Currently smoke:		
Yes	6 (5.1)	6 (12)
If yes, how many cigarettes per day? (Mean, SD)	6.92 (3.44)	6.42 (2.54)
Units of alcohol per week	4.51 (4.90)	7.49 (7.74)
BMI (kg/m ²)	25.49 (5.27)	27.26 (4.08)
Psychological factors		
PANAS positive mood score	3.04 (.78)	3.07 (.74)
PANAS negative mood score	1.86 (.70)	1.91 (.66)
PSS perceived stress level	2.69 (.65)	2.64 (.71)
	<i>n</i> (%)	
Physical activity level		
IPAQ physical activity category:		
Low	20 (21.5)	13 (31)
Moderate	38 (40.9)	13 (31)
High	35 (37.6)	16 (38.1)
Do you feel you are meeting your fitness goals?		
Yes	19 (15.8)	6 (12)

Note. Due to missing data *N* varies per variable: 135 (IPAQ physical activity level) to 170. SF-36 health rated on a scale of 1 (poor) to 5 (excellent). PANAS positive and negative mood items measured on a scale of 1 (very slightly or not at all) to 5 (extremely), such that higher values represent more positive mood or more negative mood, respectively. PSS items measured on a scale of 1 (never) to 5 (very often), such that higher values represent experiencing stress more often. Means after outliers trimmed to within ± 3 SD of the mean. SD = standard deviation; NA = not applicable; BMI = body mass index.

Participation and Compliance With Exercise Regime

Participation at each stage of the exercise programme was: expressed an interest 135/170 (79.41%); enrolled in exercise programme 26/170 (15.29%); completed programme 9/170 (5.29%).

Details of participant flow are shown in Figure 3.2. Reasons for dropping out of the trial are detailed in Figure 3.2 and included physical health, personal reasons, other commitments, and problems getting to the exercise classes (e.g., lack of transport).

Seven out of the nine participants who completed the study returned their class attendance cards filled out by the fitness instructors. The two participants who did not return their class attendance cards had a self-reported low class attendance (1-2 classes throughout the six-week programme). There was 93.33% agreement between participant self-report attendance of exercise classes and fitness instructor reports of attendance. There were three instances of disagreement (6.66%) between participant and fitness instructor weekly reports of class attendance; in each case, the participant reported attending one more exercise class that week than the fitness instructor recorded. Of the nine participants who completed the study (i.e., remained in the study until the final assessment), none complied with the recommended exercise regime of at least three hourly exercise classes per week for the duration of the six-week exercise programme. For this reason it was not possible to include compliance with the recommended exercise regime as an additional dependent variable.

Table 3.3 shows the number of exercise classes attended per week among the nine study completers. Average class attendance was calculated using instructor-reports of class attendance, meaning the two participants who did not return their class attendance cards are excluded. Of the study completers, only three participants (all in the IM-OF group) attended at least one exercise class per week for the duration of the six-week programme. The average number of exercise classes completed per week among the three participants who attended at least one class per week was 2.67 (SD = 0.29, range = 1 – 4 classes per week). The average number of exercise classes attended per week among the completers for whom instructor reports of attendance were available ($n = 7$) was 1.83 (SD = 0.96; range of

means = 0.67 – 3 classes). The most common average number of classes attended per week among study completers was 2-3 classes (57.14% [$n=4$] of study completers).

Table 3.3.

Number of exercise classes attended per week by study completers for whom instructor reports of class attendance were available

	All study completers ($N = 7$)	Study completers who attended at least one class per week for six weeks ($n = 3$)
	<i>n (%)</i>	
Mean number of classes per week:		
>0 and <1	2 (28.57)	0
1	1 (14.29)	0
2-3	4 (57.14)	3 (100)
≥ 3	0	0
	Mean (SD)	
Overall mean (SD) per week	1.83 (0.96)	2.67 (0.29)

Note. Owing to missing instructor reports of class attendance two participants are excluded from analyses in this table. All study completers attended at least one exercise class during the six-week programme.

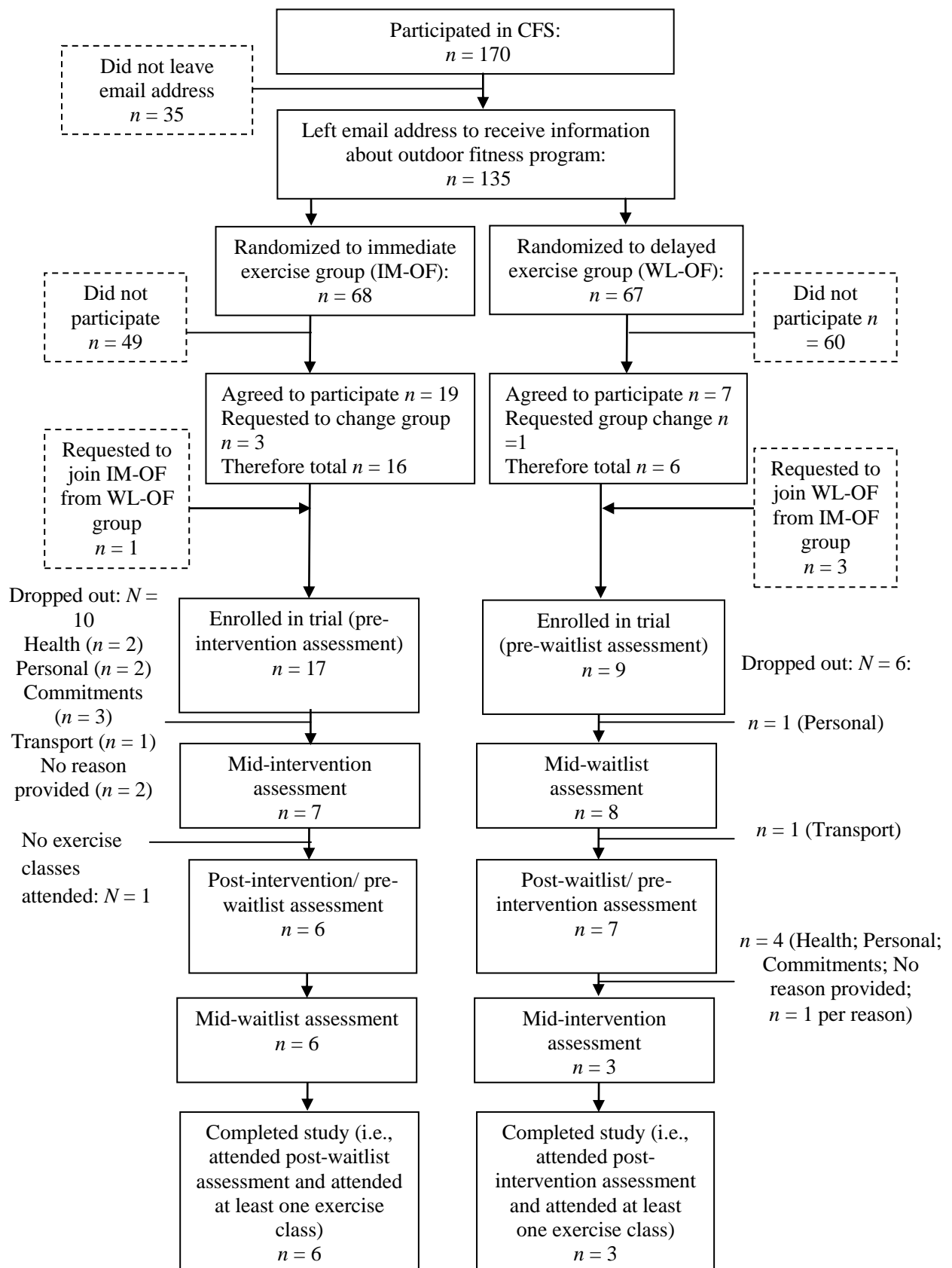


Figure 3.2. Participant progress in the study.

Theory of Planned Behaviour Prediction of Intentions, Participation and Drop-out

The overall hierarchical multiple regression of attitudes, subjective norms and perceived behavioural control at baseline on intentions to exercise for at least one hour, three times per week for six weeks was significant ($F[3, 122] = 45.910, p < .001$), accounting for 53% of the variance. As presented in Table 3.4, the main effects indicated that only perceived behavioural control was significantly associated with intentions to exercise at baseline, with the association being positive ($\beta = .639, p < .001$).

Of the 170 participants who completed the CFS, 135 left their email address to receive further information about the outdoor fitness program. The logistic regression with provision of email address (yes/ no) as the outcome variable was not significant ($\chi^2 [3] = 2.152, p = .542$). As shown in Table 3.5, intentions, perceived behavioural control and past physical activity behaviour were unrelated to provision of email address.

A total of 26 participants enrolled in the fitness trial. The logistic regression with enrolment in the trial (yes/ no) as the outcome was not significant ($\chi^2 [3] = 2.327, p = .507$). Intentions, perceived behavioural control and past physical activity behaviour were unrelated to enrolment in the trial (Table 3.5).

The number of participants who completed the exercise programme (i.e., attended their post-exercise programme assessment and attended at least one exercise class during the six-week exercise programme) was nine. The logistic regression with completion of intervention (yes/ no) as the outcome was not significant ($\chi^2 [3] = 3.650, p = .302$). Intentions, perceived behavioural control and past physical activity behaviour were unrelated to completion of the intervention (Table 3.5).

Table 3.4.

Summary statistics for hierarchical regression analyses on intentions at baseline

Intentions at baseline ($n = 126$)				
Step 1: Main effect TPB constructs	$R^2\Delta = .530, p < .001$			
	β	SE β	p	$part$
Attitudes	.103	.065	.126	.096
Subjective norms	.097	.068	.154	.089
Perceived behavioural control	.639	.071	< .001	.559
Step 2: Main effect past physical activity behaviour	$R^2\Delta = .000, p = .842$			
	β	SE β	p	$part$
Attitudes	.104	.066	.125	.096
Subjective norms	.099	.068	.151	.090
Perceived behavioural control	.642	.072	< .001	.550
IPAQ past physical activity level	-0.013	.064	.842	-.012

Note. Standardised coefficients reported. Due to missing data n is lower than total sample size. $R^2\Delta = R^2$ change. SE = standard error. Part = semi-partial correlation.

Table 3.5.

Summary statistics for logistic regression on three measures of physical activity behaviour: provision of email address, enrolment in the fitness trial and completion of the exercise programme

	Provision of email address (n = 126)			Enrolment in fitness trial (n = 126)			Completion of the exercise programme (n = 126)		
Step 1: Main effect	$R^2 = .003$ (Cox & Snell), .005			$R^2 = .016$ (Cox & Snell), .027			$R^2 = .022$ (Cox & Snell), .058		
TPB constructs	(Nagelkerke), $p = .833$			(Nagelkerke), $p = .356$			(Nagelkerke), $p = .249$		
	<i>b</i>	<i>Odds (95% CI)</i>	<i>p</i>	<i>b</i>	<i>Odds (95% CI)</i>	<i>p</i>	<i>b</i>	<i>Odds (95% CI)</i>	<i>p</i>
Intentions	-0.056	0.946 (0.460, 1.943)	.879	0.062	1.064 (0.531, 2.131)	.862	-0.266	0.766 (0.256, 2.291)	.634
Perceived behavioural control	0.189	1.208 (0.592, 2.465)	.604	0.318	1.375 (0.674, 2.805)	.382	0.863	2.370 (0.699, 8.030)	.499
Step 2: Main effect	$R^2 = .017$ (Cox & Snell), .030			$R^2 = .018$ (Cox & Snell), .031			$R^2 = .029$ (Cox & Snell), .076		
past physical activity behaviour	(Nagelkerke), $p = .542$			(Nagelkerke), $p = .507$			(Nagelkerke), $p = .302$		
	<i>b</i>	<i>Odds (95% CI)</i>	<i>p</i>	<i>b</i>	<i>Odds (95% CI)</i>	<i>p</i>	<i>b</i>	<i>Odds (95% CI)</i>	<i>p</i>
Intentions	-0.040	0.961 (0.463, 1.992)	.914	0.061	1.063 (0.530, 2.132)	.864	-0.279	0.757 (0.251, 2.278)	.620
Perceived behavioural control	0.280	1.323 (0.641, 2.730)	.449	0.278	1.321 (0.639, 2.731)	.452	0.743	2.102 (0.616, 7.174)	.236
IPAQ past physical activity level	-0.367	0.693 (0.399, 1.204)	.193	0.131	1.140 (0.688, 1.890)	.611	0.399	1.491 (0.622, 3.575)	.371

Note. Due to missing data N per regression is lower than total sample size. SE = standard error. CI = confidence interval. NA = not applicable.

Results Part II: Impact of the Exercise Intervention

Group Equivalence Prior to and After Drop-Out

The characteristics of the IM-OF group and WL-OF group at enrolment and at post-exercise intervention/ post-waitlist period (respectively) are presented in Table 3.6. An independent t-test showed that at enrolment the IM-OF and WL-OF group were equal on age ($t [24] = -1.383, p = .180, r = .272$), general health ($t [24] = -0.153, p = .880, r = .031$) and on number of FertiSTAT reproductive risks ($t [24] = -0.442, p = .662, r = .090$). Fisher's Exact Test indicated that at enrolment the groups were equal on gender ($p = .661, r = -.105$) but that more of the WL-OF group had children than the IM-OF group ($p = .034, r = -.465$).

At the post assessment (i.e., post-intervention/ post-waitlist assessment for the IM-OF/ WL-OF group respectively), the groups were equal on age ($t [11] = -0.706, p = .495, r = .208$), general health ($t [11] = -0.051, p = .960, r = .015$), number of FertiSTAT reproductive risks ($t [11] = -1.090, p = .299, r = .312$), and gender (Fisher's Exact Test $p = .592, r = .220$). Four participants in the WL-OF group had children whereas at post assessment none of the remaining participants in the IM-OF group had children. Fisher's Exact Test for this difference was non-significant ($p = .070$) but Pearson's r coefficient indicated that this difference had a large effect size ($r = -.617$).

The impact of the exercise intervention on anthropometric characteristics, physical fitness, mood, stress and the TPB variables is presented in Table 3.7.

Table 3.6.

Characteristics of the IM-OF group and WL-OF group at enrolment (n = 26) and at post exercise- intervention/post-waitlist period (n = 13)

Variable	IM-OF group		WL-OF group		P value & r for difference between groups	
	Enrolment (n = 17)	Post assessment (end of exercise intervention) (n = 6)	Enrolment (n = 9)	Post assessment (end of waitlist period) (n = 7)	Enrolment	Post assessment
Age (years) (M, SD)	30.00 (8.28)	32.17 (7.25)	35.56 (12.16)	36.00 (11.43)	$p = .180, r = .272$	$p = .495, r = .208$
Gender:						
Female (n, %)	13 (76.5)	3 (50)	6 (66.7)	5 (71.4)	$p = .661, r = -.105$	$p = .592, r = .220$
Children:						
Yes (n, %)	1 (5.9)	0 (0)	4 (44.4)	4 (57.1)	$p = .034, r = -.465$	$p = .070, r = -.617$
SF-36 health rating (M, SD)	2.94 (.90)	2.83 (0.41)	(3.00 (1.00)	2.86 (1.07)	$p = .880, r = .031$	$p = .960, r = .015$
Number of FertiSTAT reproductive risks (women) (M, SD)	.82 (.88)	.50 (0.84)	1 (1.12)	1.14 (1.21)	$p = .662, r = .090$	$p = .312, r = .299$

Note. SF-36 health rating measured on a scale of 1 (poor) to 5 (excellent). M = mean, SD = standard deviation.

Table 3.7.

Summary statistics for mixed factorial ANOVAs examining the effect of the intervention on anthropometric characteristics, physical fitness, psychological factors, and the TPB constructs

Outcome	Main effect group			Main effect time ^a			Interaction group X time		
	F	η_p^2	p^b	F	η_p^2	p^b	F	η_p^2	p^b
Anthropometric									
Waist-hip ratio	0.616	.053	.449	0.766	<u>.065</u>	.477	2.534	<u>.187</u>	.102
Lung capacity	0.575	.050	.464	0.206	.018	.816	1.726	<u>.136</u>	.201
Physical fitness									
Sit-up performance	0.608	<u>.057</u>	.454	1.759	<u>.150</u>	.198	1.645	<u>.141</u>	.218
Squat performance	0.039	.004	.847	1.566	<u>.135</u>	.233	1.096	<u>.099</u>	.354
Press-up performance	0.010	.001	.921	7.463	<u>.404</u>	.003	0.979	<u>.082</u>	.391
Psychological									
PANAS positive mood	4.309	<u>.281</u>	.062	1.341	<u>.109</u>	.282	1.270	<u>.104</u>	.301
PANAS negative mood	4.494	<u>.290</u>	.058	1.080	<u>.089</u>	.357	.298	.026	.746
PSS perceived stress	9.263	<u>.457</u>	.011	4.182	<u>.275</u>	.029	.692	<u>.059</u>	.511
TPB									
Attitudes	0.586	.051	.460	1.884	<u>.146</u>	.176	0.995	<u>.083</u>	.386
Subjective norms	0.090	.008	.770	4.722	<u>.300</u>	.020	1.320	<u>.107</u>	.287
Perceived behavioural control	1.083	<u>.098</u>	.323	0.759	<u>.071</u>	.481	0.273	.027	.764
Intentions	0.901	<u>.083</u>	.365	0.761	<u>.071</u>	.480	0.176	.017	.840

Note. Effect sizes reaching at least the moderate effect threshold ($\geq .06$) are underlined. Due to missing data N varies per analysis (13 to 14). η_p^2 = partial eta squared.

^aTime points for anthropometric measures, physical fitness and psychological measures are pre assessment, mid assessment and post assessment; time points for TPB measures are: baseline (i.e., measured in CFS), mid assessment and post assessment.

^b p value not interpreted because small sample size means the analysis is underpowered to detect statistically significant effects.

Impact on anthropometric outcomes and physical fitness.

Table 3.7 shows the results of the mixed factorial ANOVAs examining change in anthropometric characteristics and physical fitness over time by group. Owing to the small sample size ($n = 13$), effect sizes were interpreted. For waist-hip ratio, there was an overall decrease between pre assessment and mid assessment ($\eta_p^2 = .095$) and no change between mid assessment and post assessment ($\eta_p^2 = .000$). Simple main effects to explore the large effect size for the interaction between group and time indicated that time had a large effect size on waist-hip ratio for the IM-OF group ($\eta_p^2 = .245$), with there being no change in waist-hip ratio between pre assessment and mid assessment ($\eta_p^2 = .016$) but a decrease in waist-hip ratio between mid assessment and post assessment ($\eta_p^2 = .426$) and an overall decrease in waist-hip ratio between pre assessment and post assessment ($\eta_p^2 = .193$). Simple main effects showed that the effect size of time on waist-hip ratio was also large for the WL-OF group ($\eta_p^2 = .227$), with waist-hip ratio decreasing between pre assessment and mid assessment ($\eta_p^2 = .257$) and increasing between mid assessment and post assessment ($\eta_p^2 = .238$), with overall no change in waist-hip ratio between pre assessment and post assessment ($\eta_p^2 = .007$).

For lung capacity, simple main effects to explore the large effect size for the interaction showed that time had a small effect size on lung capacity for the IM-OF group ($\eta_p^2 = .048$) and a large effect size on lung capacity for the WL-OF group ($\eta_p^2 = .288$). Specifically, in the WL-OF group, lung capacity increased between pre assessment and mid assessment ($\eta_p^2 = .429$) and decreased between mid assessment and post assessment ($\eta_p^2 = .092$).

For sit-up performance, overall the IM-OF group performed more sit-ups in two minutes than the WL-OF group, and overall the number of sit-ups participants could do increased between pre assessment and mid assessment ($\eta_p^2 = .189$) and remained unchanged between mid assessment and post assessment ($\eta_p^2 = .016$). Simple main effects to explore the large effect size for the interaction showed that time had a large effect size for the IM-OF group ($\eta_p^2 = .429$), with sit-up performance increasing between pre assessment and mid assessment ($\eta_p^2 = .397$) and increasing between mid assessment and post assessment ($\eta_p^2 = .212$). Simple main effects indicated that amongst the WL-OF group, the effect size of time for sit-up performance was small ($\eta_p^2 = .002$).

For squat performance, overall the number of squats participants could do increased between pre assessment and mid assessment ($\eta_p^2 = .204$) but remained

unchanged between mid assessment and post assessment ($\eta_p^2 = .017$). Simple main effects to explore the moderate effect size for the interaction that among the IM-OF group the effect size of time was large ($\eta_p^2 = .364$), with squat performance increasing between pre assessment and mid assessment ($\eta_p^2 = .439$) and increasing between mid assessment and post assessment ($\eta_p^2 = .135$). Simple main effects showed that among the WL-OF group, the effect size of time was moderate ($\eta_p^2 = .098$). Specifically, the number of squats the WL-OF group did increased between pre assessment and mid assessment increased ($\eta_p^2 = .101$) but decreased between mid assessment and post assessment ($\eta_p^2 = .116$). This suggests the interaction between group and time for squat performance was driven by the fact that squats increased between all time points for the IM-OF group but decreased between mid assessment and post assessment for the WL-OF group.

For press-up performance, overall, the number of press-ups participants could do in two minutes increased between pre assessment and mid assessment ($\eta_p^2 = .147$) and increased between mid assessment and post assessment ($\eta_p^2 = .513$). Simple main effects to investigate the moderate effect size for the interaction indicated that time had a large effect size for the IM-OF group ($\eta_p^2 = .411$), with press-up performance increasing between pre assessment and mid assessment ($\eta_p^2 = .222$) and increasing between mid assessment and post assessment ($\eta_p^2 = .556$). According to the simple main effects the effect size of time was also large among the WL-OF group ($\eta_p^2 = .470$), with the number of press-ups remaining unchanged between pre assessment and mid assessment ($\eta_p^2 = .040$) but increasing between mid assessment and post assessment ($\eta_p^2 = .485$). This indicates that the interaction between group and time for press-up performance was driven by the fact that press-ups increased between all time points for the IM-OF group but only between mid assessment and post assessment for the WL-OF group.

Impact on mood and stress.

The results of the mixed factorial ANOVAs to examine PANAS positive and negative mood and PSS stress levels over time by group are shown in Table 3.7. For PANAS positive mood, the IM-OF group had more positive mood overall than the WL-OF group, and overall participants showed no change in positive mood from pre assessment to mid assessment ($\eta_p^2 = .001$) but a decrease in positive mood between mid assessment

and post assessment ($\eta_p^2 = .161$). Simple main effects to follow up the moderate effect size for the interaction between group and time indicated that time had a small effect size on positive mood for the IM-OF group ($\eta_p^2 = .005$) and a large effect size on positive mood for the WL-OF group ($\eta_p^2 = .278$). Specifically, the WL-OF group reported no change in positive mood between pre assessment and mid assessment ($\eta_p^2 = .005$) but showed a drop in positive mood between mid assessment and post assessment ($\eta_p^2 = .277$).

For PANAS negative mood, the IM-OF group reported less negative mood overall than the WL-OF group, and overall participants showed a reduction in negative mood between pre assessment and mid assessment ($\eta_p^2 = .185$) but no change in negative mood between mid assessment and post assessment ($\eta_p^2 = .017$).

For PSS stress levels, the IM-OF group reported less stress overall than the WL-OF group, and overall participants reported a reduction in stress between pre assessment and mid assessment ($\eta_p^2 = .407$) but an increase in stress between mid assessment and post assessment ($\eta_p^2 = .149$). Simple main effects to explore the moderate effect size for the interaction indicated that time had a large effect size for the IM-OF group ($\eta_p^2 = .404$), with reported stress decreasing between pre assessment and mid assessment ($\eta_p^2 = .565$) and increasing between mid assessment and post assessment ($\eta_p^2 = .314$), with an overall decrease in stress over the exercise programme (i.e., between pre assessment and post assessment; $\eta_p^2 = .248$). Simple main effects indicated that time also had a large effect size among the WL-OF group ($\eta_p^2 = .136$), with stress decreasing between pre assessment and mid assessment ($\eta_p^2 = .200$) and remaining unchanged between mid assessment and post assessment ($\eta_p^2 = .019$), with an overall decrease in stress over the waitlist period (i.e., between pre assessment and post assessment; $\eta_p^2 = .113$). This suggests the interaction was driven by the fact that stress increased between mid assessment and post assessment only for the IM-OF group, but that the IM-OF group experienced a greater decline in stress between pre assessment and post assessment than the WL-OF group.

Impact on the TPB variables.

Table 3.7 displays the summary statistics for the mixed factorial ANOVAs examining change in the TPB variables over time by group. For attitudes, overall participants had less positive attitudes at mid assessment compared to baseline ($\eta_p^2 = .120$) and more

positive attitudes at post assessment compared to mid assessment ($\eta_p^2 = .522$), with no overall difference in attitudes between baseline and post assessment ($\eta_p^2 = .004$). Simple main effects to explore the moderate effect size for the interaction between group and time indicated that time had a large effect size for the IM-OF group ($\eta_p^2 = .235$). For the IM-OF group, attitudes became more positive between baseline and post assessment ($\eta_p^2 = .254$), with no change in attitudes between baseline and mid assessment ($\eta_p^2 = .030$) and the increase in attitudes occurring between mid assessment and post assessment ($\eta_p^2 = .661$). Simple main effects showed that for the WL-OF group, time also had a large effect size on attitudes ($\eta_p^2 = .189$). For the WL-OF group, attitudes became less positive between baseline and post assessment ($\eta_p^2 = .080$), with the means showing that attitudes became less positive between baseline and mid assessment ($\eta_p^2 = .245$) and more positive between mid assessment and post assessment ($\eta_p^2 = .326$).

For subjective norms, overall participants reported a decrease in subjective norms between baseline and mid assessment ($\eta_p^2 = .279$) and no change in subjective norms between mid assessment and post assessment ($\eta_p^2 = .031$), with an overall decrease in subjective norms between baseline and post assessment ($\eta_p^2 = .375$). Simple main effects to follow up the moderate effect size for the interaction indicated that time had a large effect size for the IM-OF group ($\eta_p^2 = .458$), with subjective norms decreasing between baseline and mid assessment ($\eta_p^2 = .509$) and not changing between mid assessment and post assessment ($\eta_p^2 = .038$). Simple main effects showed that in the WL-OF group, the effect size for time was moderate ($\eta_p^2 = .106$), with subjective norms decreasing between baseline and mid assessment ($\eta_p^2 = .062$) and not changing between mid assessment and post assessment ($\eta_p^2 = .028$). Group means indicated that the interaction was driven by a steeper drop in subjective norms from baseline to mid assessment in the IM-OF group compared to the WL-OF group.

For perceived behavioural control, overall the IM-OF group had higher perceived behavioural control over exercise than the WL-OF group. Overall participants reported a decrease in perceived behavioural control between baseline and mid assessment ($\eta_p^2 = .063$) and no change in perceived behavioural control between mid assessment and post assessment ($\eta_p^2 = .013$), with an overall decrease in perceived behavioural control between baseline and post assessment ($\eta_p^2 = .161$).

For intentions, the IM-OF group reported overall stronger intentions to exercise than the WL-OF group. Overall participants reported an increase in intentions between baseline and mid assessment ($\eta_p^2 = .093$) but a decrease in intentions between mid

assessment and post assessment ($\eta_p^2 = .161$), and overall no difference in intentions between baseline and post assessment ($\eta_p^2 = .024$).

Discussion

The present study demonstrates that high drop-out from physical activity applies to outdoor physical activity programmes. This was against expectations given the superior enjoyment and engagement reported for outdoor physical activity observed in previous research (Bowler et al., 2010; Thompson Coon et al., 2011). Overall 80% of participants expressed an interest in participating in the physical activity programme but only 5% completed the programme. The biggest drop in participation occurred between expressing an interest and enrolling and not with maintenance once activity had started. These results contribute to isolating the vulnerable points in the exercise trajectory. The present study did not support the use of the TPB in explaining significant variance in participation in an outdoor physical activity programme, with intentions and perceived behavioural control unrelated to participation in the programme at any stage. However, for those who did continue in the programme, it paid to stay with improvements observed in anthropometric outcomes and physical fitness.

The present results are in line with systematic reviews showing that drop-out from physical activity RCTs is high (approximately 80%; Gidlow et al., 2005). The physical activity programmes of these previous RCTs are comparable to the present RCT for example in the frequency of exercise, with participants typically encouraged to attend two or three exercise classes per week, and in the incentive for attending the exercise classes (i.e., exercise classes given free or at a reduced rate; Gidlow et al., 2005). The difference was that the present study employed an outdoor physical activity programme, with expectations for higher participation and lower drop-out than observed in literature of indoor programmes. People report several barriers to physical activity including work and study commitments (Zunft et al., 1999), lack of access to areas or facilities for exercise (de Groot & Fagerström, 2011; Sallis et al., 1990), lacking company for exercise and not being able to afford to exercise (Booth, Bauman, Owen & Gore, 1997). Similar reasons (e.g., work commitments, transport) were reported here. The present intervention was designed to reduce empirically-established barriers to engagement in physical activity (e.g., offering exercise classes on each day of the week and at several times throughout the day, in a group format, and free of charge).

However, this was not sufficient to retain participants in the intervention over and above retention rates observed in previous literature.

Contra to the predictions of the TPB, the only variable related to intentions to participate in the physical activity programme was participants' perception of the amount of control they had over engaging in physical activity. Previous research shows that perceived behavioural control is the strongest predictor of physical activity intentions (Armitage, 2005). Again, against theoretical predictions, intentions to engage in physical activity and perceived control over engaging in physical activity did not discriminate individuals who participated in physical activity from those who did not. The apparent gap between intentions and behaviour is a widely studied issue (e.g., Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; McEachan et al., 2011; Sheeran, 2002; Sniehotta, Scholz & Schwarzer, 2005). In the present study three stages in the physical activity trajectory were examined (provision of email address as the first step of signing up to the physical activity intervention, enrolment in the intervention, and completion of the intervention), with the TPB constructs unable to predict participation at any of these stages accounting for less than 3% of the variance in participation at each stage. It is well established that the TPB constructs are better at predicting self-reported physical activity than objectively measured physical activity (Armitage & Conner, 2001; McEachan et al., 2011). For example, a meta-analysis of 237 studies applying the TPB to health behaviours showed that intentions and perceived behavioural control had small to medium effect sizes in their prediction of objectively measured physical activity, explaining 12.1% of the variance ($n=14$ studies), compared to medium to large effect sizes for the prediction of self-reported physical activity ($n=91$ studies), explaining 25.7% of the variance (McEachan et al., 2011). The present study measured objective participation in physical activity (i.e., actual provision of email address, enrolment and completion of the exercise programme), which may be part of the reason for the low variance explained by the TPB constructs. Objective measures of physical activity are preferable over self-reported measures because objective measures of physical activity are expected to be more strongly related to health benefits (McEachan et al., 2011). The ability of the TPB to predict objectively measured behaviours linked to actual health outcomes, as opposed to self-reported behaviours not necessarily related to improvements in health, needs to be reviewed (McEachan et al., 2011).

The present findings imply that additional factors, not measured by the TPB, must explain people's engagement in outdoor physical activity programmes, including

conceptual and methodological issues. Conceptual reasons for the apparent lack of success of the TPB in explaining participation in an outdoor physical activity programme may include the absence of implementation intentions. In the present study it was not deemed possible to ask participants to form an implementation plan of where, when and how they would engage in physical activity as these details were predetermined by the RCT. However, factors outside of the control of the present investigation (e.g., clashes of the exercise classes with work commitments, problems with transport to exercise classes) were provided as reasons for drop-out from the programme among those who enrolled and these barriers likely also contributed to the highest drop-out observed between expressing an interest and enrolling in the trial. Forming an implementation plan would have given participants the opportunity to foresee possible barriers to participating in the physical activity programme (e.g., lack of transport) and to come up with an 'if-then' plan specifying how they would deal with such barriers to promote goal attainment (Gollwitzer & Sheeran, 2006). This may have strengthened the relationship between intentions and physical activity participation and improved the correspondence between the initial high number of participants intending to participate in the trial ($n = 135$) and the actual number of participants who enrolled in the trial ($n = 26$). Future research should investigate the effect of asking participants to form an implementation plans of where, when and how they will instigate responses to promote goal attainment (Gollwitzer & Sheeran, 2006) on the success of the TPB in explaining participation in outdoor physical activity.

One methodological factor for why the TPB did not explain variance in participation in physical activity may have been that there was skewness in the outcome variable at each stage (i.e., 79/21% split for the provision of email address outcome, 15/85% split for the enrolment outcome, and 5/95% split for the completion of programme outcome), although logistic regression is robust to skewness in categorical variables (Stage, 1988). The fact that the present study was an RCT in which participants were randomly assigned to condition may have affected the associations among the TPB constructs. For example, if a participant was assigned to the WL-OF group but would have preferred the IM-OF group, they may have had strong intentions to participate in physical activity but their lack of preference for their condition assignment meant they dropped out of the trial. That being said, for ethical and practical reasons participants were permitted to change condition if they requested to do so and only four of the 26 participants who enrolled (15.38%) requested to change. However, it

is a worthy consideration for future research that the factors affecting participation in physical activity may vary when the physical activity is carried out of people's own accord (e.g., leisure time physical activity) as opposed to constrained by assignment to particular groups in an RCT design.

Prescribing too high a level of exercise may have a detrimental effect on participation rates in exercise interventions. For example, randomised controlled trials show that the higher the intensity of the prescribed exercise (i.e., the extent to which the exercise increases heart rate), the less likely participants are to adhere (Perri et al., 2002). High exercise intensity may have contributed to drop-out in the present study. Exercise activities were tailored such that participants worked at their maximum capacity during each class, in order to equalise participants on exercise intensity. However, this tailoring of the exercise activities was designed to match each individual's current fitness level and increase fitness in a progressive and manageable way. In addition, there was no evidence that participants who were less used to physical activity were more likely to drop out from the exercise programme; past physical activity level as measured by the IPAQ was unrelated to participation in the physical activity programme.

Factors related to the timing of the present study may have affected drop-out rates. Recruitment was conducted in December and January, with the trial beginning at the end of January. The start of the trial was timed with the end of the holiday season, when people reduce their dietary intake and may be more motivated to improve their health (Klesges, Klem & Bene, 1989), and was indeed successful in generating a large amount of interest in participating in the exercise programme. However, objective measures of physical activity show that people tend to engage in less physical activity during cold months compared to warmer months (Matthews et al., 2001; Riddoch et al., 2007). The fact that the present physical activity programme was run outdoors during cold months may have contributed to a lack of motivation or willingness to participate in the programme (Tucker & Gilliland, 2007), despite initial interest in the programme. Indeed, systematic reviews show that people commonly cite cold weather as a barrier to physical activity and are less likely to meet physical activity recommendations during cold months than warm months (Tucker & Gilliland, 2007). Season and weather variables may play a key role in drop-out from physical activity interventions (Tucker & Gilliland, 2007) and future RCTs should evaluate the impact of these variables on outdoor exercise participation rates.

With regards to the health outcomes of the physical activity intervention, factor effect sizes suggested that it did indeed pay to stay. Specifically, participants in the IM-OF group experienced improvements in anthropometric profiles and physical fitness, as indicated by reduced waist-hip ratio and an increase in the number of fitness activities they could perform in a set amount of time. Corresponding benefits were not observed for the WL-OF group. Participants in the IM-OF group reported less negative mood and stress overall than participants in the WL-OF group. This may have been contributed to by differences in characteristics between participants in the IM-OF group and the WL-OF group. Participants in the WL-OF group were more likely to have children than participants in the IM-OF group, which may have contributed to the greater levels of overall stress observed in the WL-OF group (Lundberg & Frankenhaeuser, 1999). However, factor effect sizes indicated that positive mood decreased over time for the WL-OF group but remained stable for the IM-OF group. Enrolling in the trial may have caused a temporary elevation in positive mood for all participants, which then declined for participants not engaging in exercise (the WL-OF group) but was maintained among those taking part in exercise (the IM-OF group).

Some limitations of the present study need to be considered. The small final sample size of the fitness trial meant that the study was underpowered to detect statistically significant effects and so factor effect sizes were assessed according to Cohen's (1988; 1992) effect size thresholds. Of further consideration is that whilst empirically validated measures of the TPB constructs and outcome variables were used, the small sample size in the trial meant that reliability could not be estimated other than at baseline (Charter, 2003). The present hypotheses would need to be tested among larger samples with more statistical power. However, the results of this pilot RCT provide a preliminary indication of associations among variables and may guide future research towards areas worthy of investigation (e.g., the high drop-out rate observed between recruitment and enrolment in the trial). An additional methodological consideration is that for ethical reasons it was not possible to test the present RCT among an infertile population. Decision-making and cognitions about participating in health programmes may be different among people with fertility problems; for example people with fertility problems are more likely to adhere to health guidelines for people trying to conceive such as folic acid supplementation (Frishman, Spurrell & Heber, 2001). It might be anticipated that people with fertility problems have more favourable attitudes towards participating in physical activity provided they are aware of the

fertility benefits of physical activity; although the relationships among the TPB constructs would be predicted to be the same.

In conclusion, given current high rates of physical inactivity and obesity in the population and the detrimental effect of these factors on fertility, pregnancy outcomes and general health, research into the barriers to physical activity is timely. The present study showed that high drop-out from physical activity programmes extends to outdoor exercise. This study is a step towards understanding where barriers to physical activity kick in: whilst people seem ready to register an initial intention to become more physically active, intervening factors and circumstances prevent these wishes from being translated into behaviour. In addition, the present study calls into question the predictive power of the TPB in objectively measured physical activity behaviour. Other unmeasured factors not captured by the TPB appear to be instrumental in whether people will participate in outdoor physical activity programmes. To make progress on promoting engagement in physical activity, future research should investigate situational and personal barriers to physical activity and evaluate support mechanisms that could be put in place to help people to realise their physical activity goals.

Chapter 4: Mental Models of Pregnancy May Explain Low Adherence to Folic Acid Supplementation Guidelines: A Cross-Sectional International Survey

Introduction

The studies presented in this thesis so far have demonstrated that the association between health-related cognitions and willingness to optimise health is not straightforward. Chapter 2 supported the predictions of the HBM that people who felt susceptible to fertility problems had greater intentions to optimise their fertility by making lifestyle changes and/ or seeking medical help when needed. However, as shown by Chapter 3, intentions to optimise health do not always translate into behaviour. The relationship between perceived susceptibility and behaviour to optimise fertility and pregnancy remains unclear. The present chapter examined this issue by investigating the association between perceived susceptibility and behaviour in the context of optimising pregnancy.

During pregnancy there are measures a woman can take to optimise her health and prevent adverse health outcomes for the unborn infant, such as NTDs. NTDs are birth defects of the brain or spinal chord (e.g., spina bifida) and affect around 0.086% of births (De Wals et al., 2007). Worldwide around 300,000 babies are born with NTDs every year (Rofail, Maguire, Kissner, Colligs & Abetz-Webb, 2013). Folic acid supplementation can prevent 72% of cases of NTDs (MRC Vitamin Study Research Group, 1991). However, only 31-37% of women adhere to the recommended 400 microgram (μg) daily folic acid supplement from the point at which they begin trying to conceive until week 12 of pregnancy (Barbour et al., 2012; Timmermans et al., 2008). Finding effective ways to increase compliance with folic acid supplementation guidelines is of key priority to practitioners and policy makers (NICE, 2008b). Research shows that noncompliance with folic acid supplementation is more common amongst women who see themselves as healthy, as indexed by not having any previous obstetric or general health problems and by having ‘proven’ fertility (i.e., given birth before; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant, Younger, Sheridan-Pereira & Kearney, 2011; Timmermans et al., 2008). Noncompliance is also more prevalent amongst women with adverse health environments, indicated by factors such as lower socioeconomic status, having an unplanned pregnancy, and smoking and drinking during pregnancy (Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant et al.,

2011; Timmermans et al., 2008). However, why these associations exist and what should be done to optimise compliance is unclear. The aim of the present investigation was to test a theoretically-driven explanation for poor compliance with folic acid supplementation guidelines.

Low Adherence to Folic Acid Supplementation Guidelines

Research using diverse methodologies has identified barriers to folic acid supplement intake, including cost of supplements (Seck & Jackson, 2008), method of supplement intake (Hyder, Choudhury & Zlotkin, 2008) remembering to take supplements (Seck & Jackson, 2008), lack of knowledge of the correct timing and dosage (Hyder et al., 2008; Seck & Jackson, 2008) poor habits developed in previous pregnancies (Goldberg et al., 2006), restricted supply and access to supplements, and lower engagement and monitoring of compliance by medical services (Lacerte, Pradipasen, Temcharoen, Imamee & Vorapongsathorn, 2011). Campaigns to increase adherence to folic acid supplementation guidelines have largely focused on increasing knowledge of the benefits of folic acid supplementation and removing barriers to taking the supplements (e.g., cost of supplements; Ray et al., 2004; Robbins et al., 2005; Stockley & Lund, 2008). However, such an approach results in compliance rates of no higher than 40-50% (Ray et al., 2004; Robbins et al., 2005; Stockley & Lund, 2008).

Compliance with folic acid supplementation guidelines may be better understood using the HBM. According to the HBM, to make progress on compliance with folic acid supplementation recommendations it may be necessary to investigate perceived susceptibility (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990). Perceived susceptibility may be particularly relevant to compliance with folic acid supplementation guidelines given the low base rate of NTDs. Low prevalence and limited exposure to infants with NTDs makes it especially possible for women to pay minimal attention to the risk of their child developing NTDs. If women perceive themselves or their pregnancies to be insusceptible to poor health outcomes then they are unlikely to fully comply with periconceptional health recommendations (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990).

Invulnerable Mother Versus Invulnerable Pregnancy

Beliefs about susceptibility to a given illness come from many sources, however two from which people make inferences are their own health and the health of others in their environment (i.e., social norms; Chapman, Wong & Smith, 1993). According to the HBM, women who perceive themselves as healthy may be less likely to comply with folic acid supplementation recommendations because they believe that they are ‘invulnerable mums’ whose health protects the pregnancy from risk. Indeed, folic acid non-compliers tend to be more fertile than compliers; for example, non-compliers are more likely to have already had children and a higher number of children (Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Timmermans et al., 2008), conceived naturally rather than via infertility treatments (Nilson et al., 2006) and not experienced previous miscarriage (Timmermans et al., 2008). Non-compliers also have better general health (i.e., no previous or current medical illness; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006) than compliers. Further, mothers with no past or current fertility problems display more stress and denial following a diagnosis of infant NTDs (e.g., spina bifida, hydrocephalus) than mothers with fertility problems (Hunfeld et al., 1993), and express disbelief at the diagnosis given their own good health status: “We thought we were pretty immune because we weren’t that old and we were both really healthy and we really looked after ourselves. We’d had one healthy child already” (Chaplin, Schweitzer & Perkoulidis, 2005, p.154). Data in other health contexts also shows that a background of good health leads individuals to feel immune to illness; for example, women with good general health feel less susceptible to breast cancer (McQueen, Swank, Bastian & Vernon, 2008).

What constitutes a norm in our environment also contributes to beliefs about susceptibility to illnesses. Non-compliers with folic acid supplementation guidelines are more likely to live in adverse health environments, as indexed by unhealthy behaviours and demographic profiles. Specifically, inadequate folic acid intake is associated with suboptimal maternal health behaviours including having an unhealthy pre-pregnancy body mass index (overweight, Goldberg et al., 2006; or underweight; Tarrant et al., 2011), smoking and consuming alcohol during pregnancy (Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant et al., 2011; Timmermans et al., 2008) and having an unplanned pregnancy (Goldberg et al., 2006; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant et al., 2011; Timmermans et al., 2008). Demographic characteristics associated with improper use of folic acid include younger maternal age (Goldberg et al., 2006; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant et al., 2011;

Timmermans et al., 2008), lower social class (Nilsen et al., 2006; Tarrant et al., 2011) and education (Goldberg et al., 2006; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006), and single marital status (Nilsen et al., 2006; Timmermans et al., 2008). Cohort studies show that these behavioural and demographic profiles are correlated (Kiernan & Pickett, 2006; Stringhini et al., 2011) and are common characteristics of people living in impoverished environments. Migrant status is also correlated with low uptake of folic acid (Goldberg et al., 2006; Navarrete-Muñoz et al., 2010; Timmermans et al., 2008) and migrants represent an additional group of individuals more likely to have lower socioeconomic status, poorer health and inadequate access to antenatal care services (Jayaweera & Quigley, 2010). In adverse health environments, unhealthy behaviours can become the norm as they are transmitted within social networks. For example, parent and peer-group smoking is a highly significant predictor of adult smoking (Hu, Davies & Kandel, 2006) and parental obesity is correlated with offspring obesity (O'Loughlin, Paradis, Renaud, Meshefedjian & Gray-Donald, 1998). Women living in adverse health environments may routinely be exposed to seemingly healthy births occurring despite these suboptimal conditions and such norms may give rise to belief in the 'invulnerable pregnancy'. Women themselves have shown the impact of social norms on their beliefs about folic acid supplementation: "I wouldn't berate yourself for not taking [folic acid]... Some women do everything right... and don't get a healthy baby - and others, like one of my... cousins, smoke, drink and take drugs through their pregnancies - and both her babies were fine" (LouieL81, 2012). Research demonstrates that feeling insusceptible to disease is more common amongst individuals living in deprived conditions; for example amongst those with markers of low education (Boulware, Carson, Troll, Powe & Cooper, 2009) of single marital status (Humphries & Krummel, 1999), of migrant status (Boulware et al., 2009), and who engage in unhealthy behaviours such as such as alcohol consumption during pregnancy (Morris, Swasy & Mazis, 1994). This suggests that perceived susceptibility may mediate the link between perceived maternal health/ adversity and use of folic acid supplements.

The Present Study

The aim of the present study was to examine whether women with high perceived health or adverse health environments feel less susceptible to the health risks of folic acid deficiency. It was hypothesised that women with high perceived health and those

with adverse health environments would feel less susceptible and be less likely to take folic acid supplements. In addition, it was expected that the link between perceived health/ adversity and use of folic acid supplements would be mediated by perceived susceptibility.

Methods

Participants

Recruitment for the study was undertaken by a healthcare research company (Opinion Health) in four countries (France, Germany, Poland, and Belgium). Inclusion criteria were (1) female, (2) aged between 18 and 45 years, and (3) actively planning a pregnancy (i.e., not pregnant but planning a pregnancy) or being within the first 18 weeks of pregnancy (i.e., currently pregnant). Women actively planning a pregnancy (i.e., pregnancy planners) were eligible if they had been trying to conceive for 6 months or less to ensure that the sample did not include people with fertility problems (who are likely to have a different approach to pregnancy preparation than fertile couples; Frishman et al., 2001). Of the 3762 women screened, 925 were eligible. Of those eligible, 169 exited the survey without completing, resulting in 756 completed responses. A total of 105 responses were excluded because they did not meet the quality index threshold automatically assigned by the market research company⁵. The final sample size was therefore 651 women (326 currently pregnant; 325 pregnancy planners).

Materials

Survey.

⁵ The quality rating used by the market research company was based on factors including: [1] survey completion time, to identify respondents who completed the survey significantly faster than the mean completion time; [2] straight-lined responding, to identify respondents who ran through a battery of items and rated all options the same; [3] consistency check, where similar questions are inserted at different points in the survey to determine the consistency of responses (e.g., “what is your age” and “which year were you born in”), and; [4] duplicates, to check whether a respondent completed the survey twice.

The HBM and a literature review regarding the causes and correlates of noncompliance with folic acid supplementation recommendations informed selection of survey items. Variables related to demographic, health, obstetric and lifestyle factors were measured as per previous research linking these variables to folic acid supplement use (Goldberg et al., 2006; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant et al., 2011; Timmermans et al., 2008). The final survey consisted of 41 questions for currently pregnant women (Appendix C) and 37 questions for women planning a pregnancy (Appendix D). Only variables relevant to analyses for this study are described.

Demographic characteristics. Demographic variables were age (calculated from year of birth), relationship status, education level, household income, employment status, and migrant status (whether participants were born in their country of residence). Whether the pregnancy was planned/ unplanned amongst currently pregnant women was determined by an affirmative response to either ‘just before I became pregnant with my current pregnancy I was sexually active, not using contraception, and trying to get pregnant’ or to ‘just before I became pregnant with my current pregnancy I did not plan to get pregnant’ (adapted from Barrett, Smith & Wellings, 2004).

General health, obstetric characteristics, and lifestyle factors. General health was assessed by asking participants whether they currently or had ever had a serious medical illness or chronic disease. The obstetric characteristics were parity and ever having had a miscarriage. The lifestyle factors were whether participants currently smoked, number of units of alcohol consumed per week, and whether participants were more than 13 kilograms overweight before their pregnancy, which is an empirically established risk factor for infertility that discriminates between medically confirmed fertile and infertile women (Bunting & Boivin, 2010).

Perceived health and adversity.

Composite variables were created for perceived health and adversity based on indicators of noncompliance in previous research. First, variables were coded 0 or 1 for absence or presence (respectively) of risk for poor folic acid supplement uptake based on associations observed in previous literature (see Goldberg et al., 2006; Navarrete-Muñoz et al., 2010; Nilsen et al., 2006; Tarrant et al., 2011; Timmermans et al., 2008).

Second, indicators were summed to create the composite variable. The ‘perceived health’ composite variable was the sum of ‘no prior or current serious medical illness or chronic disease’ and ‘never had a miscarriage’. The ‘adversity’ composite variable combined demographic and behavioural indicators of adversity and was the sum of ‘maternal age below 25 years’, ‘pregnancy unplanned’, ‘not married or living with partner’, ‘lower than university-level education’ ‘not born in country of residence’, ‘currently smoked’, and ‘currently consumed alcohol’. These composite scores were confirmed via factor analysis, which showed factor loadings ≥ 0.45 on each composite and no cross-loadings > 0.30 (see Appendix E).

Awareness and use of folic acid supplements. Awareness of folic acid was assessed by asking participants whether they had heard of folic acid. Use of folic acid supplements was reported from three timeframes: pre-conception, post-conception and currently.

Perceived susceptibility. Perceived susceptibility was assessed by the question ‘how likely do you think it is that taking folic acid before getting pregnant could reduce the risk of health issues for the offspring?’ (adapted from Gerend, Aiken & West, 2004; Rosenstock, 1990). Responses were rated on a five-point rating scale (1 = not at all likely to 5 = extremely likely).

Procedure

The study received approval from the Ethics Committee of the School of Psychology, Cardiff University. Panellists from Opinion Health were invited to participate in the study via email. Respondents completed various screening questions to confirm eligibility and determine pregnancy status so they could be directed to the appropriate online version of the survey.

Data Analyses

Descriptive statistics were used to examine outliers and variable distributions. Use of folic acid supplements was measured for three timeframes; (1) as a pre-conception preparation, (2) as a post-conception preparation, and (3) currently. Logistic regression

was used to test the association between ‘perceived health’/‘adversity’ and use of folic acid supplements. On the first step of the analysis, the main effects of perceived health and adversity were entered. A median split was used to assign participants to low/ high perceived health or adversity. On the second step the interaction between perceived health and adversity was entered to examine whether perceived health and adversity moderated each other’s association with use of folic acid supplements. Interactions were created by taking the cross-product of the variables considered in the interaction. Following recommendations from Preacher and Hayes (2008), a mediation model examined whether perceived susceptibility (mediator) explained the association between ‘perceived health’/ ‘adversity’ and use of folic acid supplements. The model was tested using logistic regression with bootstrapping methodology (Preacher & Hayes, 2008). Normal theory tests of indirect effects are not conducted when the DV is dichotomous, but 95% bias-corrected bootstrap confidence intervals for the indirect effect are generated. The indirect effect was considered significant (i.e., mediation present) if zero was not included in the confidence interval (Preacher & Hayes, 2008).

Results

Sample Characteristics

Table 4.1 shows the demographic characteristics of the sample. The majority of participants were born in their country of residence, were married or cohabiting with a partner, and were employed. Of the currently pregnant women, most had planned their pregnancy. Table 4.2 displays the general health, obstetric and lifestyle characteristics of the sample. The majority of participants reported a good record of general and obstetric health.

Table 4.1.

Demographic characteristics of the sample (n = 651)

Variable	Mean (SD)
Age (years)	29.57 (5.8)
	<i>n (%)</i>
Planned pregnancy (amongst currently pregnant women, <i>n</i> = 326):	
Yes	241 (73.9)
Relationship status:	
Single	16 (2.5)
In relationship, not married and not living with partner	109 (16.7)
Co-habiting (living with partner but not married)	202 (31)
Married	324 (49.8)
Education level:	
No education	3 (0.5)
Primary school	8 (1.2)
Secondary school	169 (26.0)
Post-secondary school vocational training	157 (24.1)
University	314 (48.2)
Household income:	
<12,000 Euros	137 (21.0)
12,000-23,999 Euros	173 (26.6)
24,000-35,999 Euros	148 (22.7)
36,000-47,999 Euros	94 (14.4)
48,000-59,999 Euros	50 (7.7)
60,000-72,000 Euros	31 (4.8)
>72,000 Euros	18 (2.8)
Employment status:	
Employed	429 (65.9)
Self-employed	31 (4.8)
Studying full-time	53 (8.1)
Unemployed	60 (9.2)
Housewife/househusband	77 (11.8)
Retired	1 (0.2)
Migrant status:	
Born in country of residence	599 (92)

Note. SD = standard deviation.

Table 4.2.
General health, obstetric and lifestyle characteristics of the sample (n = 651)

	<i>n (%)</i>
General health characteristics	
Prior or current serious medical illness or chronic disease:	
Yes	95 (14.6)
Obstetric characteristics	
Parity:	
0	325 (49.9)
1-2	296 (45.5)
3-4	25 (3.8)
≥5	5 (0.8)
Total parity >0	326 (50.1)
Ever had miscarriage ^a	
Yes	113 (17.4)
Lifestyle characteristics	
Currently smoke	
Yes	103 (15.8)
Units of alcohol per week	
0	372 (57.1)
1-2	174 (26.7)
3-7	77 (11.8)
8-14	11 (1.7)
>14	2 (0.3)
More than 13 kilos overweight before pregnancy	
Yes	96 (14.7)

Note. ^aParticipants missing (*n* = 14; 2.2%) because preferred not to disclose.

Awareness and Use of Folic Acid Supplements and Perceived Susceptibility

Overall, 82.8% (*n* = 539) of the sample had heard of folic acid (80.1% [*n* = 261] of pregnant women; 85.5% [*n* = 278] of pregnancy planners). Under half (45.5% [*n* = 296]) of the sample (48.8% [*n* = 159] of pregnant women; 42.2% [*n* = 137] of pregnancy planners) was currently taking folic acid supplements. Current use of supplements did not differ significantly between pregnant women and pregnancy planners (Pearson's χ^2 [1] = 2.88, *p* = .09).

On average participants rated the likelihood of folic acid reducing health risks for the offspring as 3.33 out of 5 (SD = 1.05).

Direct Associations Between Perceived Health, Adversity and Use of Folic Acid Supplements

The logistic regression model showed that perceived health significantly predicted use of folic acid supplements. Perceiving oneself to be healthy was associated with decreased odds of using folic acid supplements as a pre-conception preparation ($\beta = -0.57, p = .004$; odds ratio = 0.57, 95% CI 0.39 and 0.83) and a decreased odds of currently taking folic acid supplements ($\beta = -0.55, p = .003$; odds ratio = 0.58, 95% CI 0.41 and 0.83). Perceived health was unrelated to use of folic acid supplements as a post-conception preparation ($\beta = -0.43, p = .18$; odds ratio = 0.65, 95% CI 0.35 and 1.22).

The logistic regression model showed that adversity significantly predicted use of folic acid supplements. Having an adverse health environment was related to a decreased odds of using folic acid supplements as a pre-conception preparation ($\beta = -0.92, p < .001$; odds ratio = 0.4, 95% CI 0.28 and 0.56), as a post-conception preparation ($\beta = -1.44, p < .001$; odds ratio = 0.24, 95% CI 0.14 and 0.41), and currently ($\beta = -0.8, p < .001$; odds ratio = 0.45, 95% CI 0.33 and 0.62).

The interaction term for perceived health and adversity was not significant.

Mediation of the Association Between Perceived Health or Adversity and Use of Folic Acid Supplements By Perceived Susceptibility

Intercorrelations met conditions for mediation (range $r = -.33$ to $.42$, see Appendix F).

Results of the mediation analyses (Table 4.3, path coefficients displayed in Figure 4.1) showed that perceived susceptibility mediated the relationship between perceived health and use of folic acid supplements as a pre-conception preparation (model explained 14.3 to 19.3% of the variance, indirect effect $\beta = -0.26$, 95% CI -0.44 and -0.11) and current use of folic acid supplements (model explained 11.7 to 15.7% of the variance, indirect effect $\beta = -0.23$, 95% CI -0.37 and -0.10). Mediation analyses also showed that perceived susceptibility mediated the association between adversity and use of folic acid supplements (Table 4.3, Figure 4.2 for path coefficients) as a pre-conception preparation (model explained 15.8 to 21.3% of the variance, indirect effect $\beta = -0.41$, 95% CI -0.58 and -0.25), as a post-conception preparation (model explained 21.4 to 30.1% of the variance, indirect effect $\beta = -0.65$, 95% CI -0.98 and -0.39), and

current use of folic acid supplements (model explained 12.7 to 17% of the variance, indirect effect $\beta = -0.32$, 95% CI -0.49 and -0.20).

As shown in Figure 4.1 and Figure 4.2, the results of the mediation analyses were in the same direction for perceived health and adversity, and across the three measures of use of folic acid supplements.

Table 4.3.

Standardized regression coefficients showing mediation of the association between perceived health or adversity and folic acid supplement uptake through perceived susceptibility

Independent variable	Dependent variable								
	Use of folic acid supplements as a pre-conception preparation			Current use of folic acid supplements			Use of folic acid supplements as a post-conception preparation		
	Total effect β (SE)	Direct effect β (SE)	Indirect effect ^a β (SE [95% CI])	Total effect β (SE)	Direct effect β (SE)	Indirect effect ^a β (SE [95% CI])	Total effect β (SE)	Direct effect β (SE)	Indirect effect ^a β (SE [95% CI])
Perceived health	-0.59 (0.19)**	-0.41 (0.21)*	-0.26 (0.08 [-0.44, -0.11])†	-0.57 (0.18)**	-0.4 (0.19)*	-0.23 (0.07 [-0.37, -0.10])†	--	--	--
Adversity	-0.96 (0.17)***	-0.68 (0.18)***	-0.41 (0.08 [-0.58, -0.25])†	-0.86 (0.16)***	-0.62 (0.17)***	-0.32 (0.07 [-0.49, -0.20])†	-1.55 (0.28)***	-1.12 (0.3)***	-0.65 (0.15 [-0.98, -0.39])†

Note. $N = 295$ (analysis on pregnant women only) - 637 depending on DV. β = Standardized regression coefficients. SE = standard error. 95% CI = lower and upper 95% bias-corrected confidence intervals for the indirect effect of the IV on the DV through the proposed mediator (perceived susceptibility).

^aBootstrap estimate of indirect effect (mean of the indirect effect estimates calculated across all bootstrap samples) reported.

†Significant indirect effect because confidence intervals do not include zero.

* $p < .05$. ** $p < .01$. *** $p < .001$.

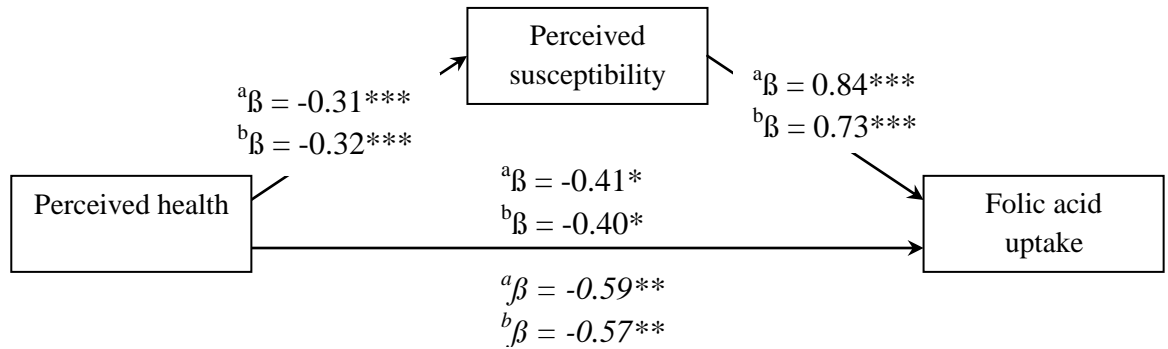


Figure 4.1. Association between perceived health and two measures of folic acid uptake with the proposed mediator (i.e., perceived susceptibility) in the model. Indirect effects demonstrated that perceived susceptibility mediated the association between perceived health and two measures of folic acid uptake (use of folic acid as a pre-conception preparation and current use of folic acid supplements). Coefficients in italic font show the association between perceived health and folic acid uptake before adding the proposed mediator (i.e., perceived susceptibility) in the model. Standardized regression coefficients are reported. ^ause of folic acid supplements as a pre-conception preparation, ^bcurrent use of folic acid supplements. * $p < .05$. ** $p < .01$. *** $p < .001$.

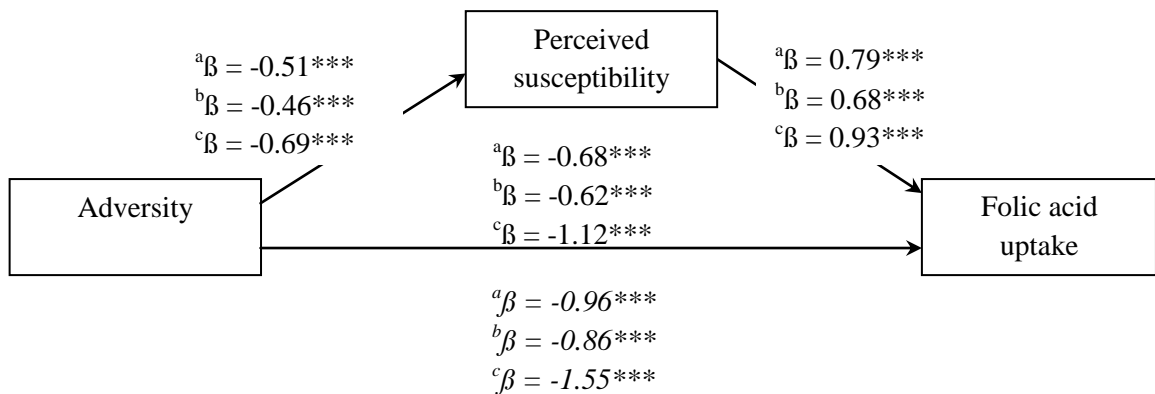


Figure 4.2. Association between adversity and three measures of folic acid uptake with the proposed mediator (i.e., perceived susceptibility) in the model. Indirect effects demonstrated that perceived susceptibility mediated the association between adversity and the three measures of folic acid uptake. Coefficients in italic font show the association between adversity and folic acid uptake before adding the proposed mediator (i.e., perceived susceptibility) in the model. Standardized regression coefficients are reported. ^ause of folic acid supplements as a pre-conception preparation, ^bcurrent use of folic acid supplements, ^cuse of folic acid supplements as a post-conception preparation (for currently pregnant women only). * $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

The present results show that mental models of the susceptibility of pregnancy are key in adherence to folic acid supplementation guidelines. Women who saw themselves as healthy felt less susceptible to the risks of folic acid deficiency potentially due to the belief that their good health protects the pregnancy from adverse outcomes ('invulnerable mum'). Mothers living in suboptimal conditions felt insusceptible possibly because the frequent occurrence of seemingly healthy pregnancies in adverse environments fosters the belief that pregnancies are immune to risk ('invulnerable pregnancy'). To promote informed health decision-making, a key aim of educational campaigns should be to elicit mental models of susceptibility and reinforce the message that no woman is exempt from the need for folic acid supplementation.

Regardless of origin, beliefs about the invulnerability of pregnancy are a misconception. Women are more likely to deliver an infant with NTDs if they do not take folic acid supplements, whereas if they adhere to supplementation they have a 72% protective rate compared to other vitamin or no vitamin supplementation (MRC Vitamin Study Research Group, 1991). This result applies regardless of prior general and obstetric health and socioeconomic background (MRC Vitamin Study Research Group, 1991). Parents report that before receiving a diagnosis they did not consider NTDs as a serious possibility for their unborn child (Chaplin et al., 2005), suggesting that the risk of NTDs is not adequately communicated in current periconceptional care.

Even though 82% of women in the present sample had heard of folic acid, only 45% were taking folic acid supplements. The present findings may be a step towards understanding this apparent mismatch between awareness and behaviour. The results support the predictions of the HBM that a woman with a mental model of being insusceptible to pregnancy-related health complications (i.e., NTDs) may erroneously believe that risks do not apply to her and therefore that protective action (i.e., folic acid supplementation) is not required. Health organisations urge clinicians to improve patients' knowledge about illnesses in order to help them make informed decisions about their health (Silverman et al., 2001). However, improving knowledge is unlikely to change behaviour if individuals do not have the appropriate mental model to accept the facts as relevant to their situation (Silverman et al., 2001). There is an apparent need to emphasise during patient consultations that even though NTDs have a low base rate,

folic acid supplements reduce the risk of infant NTDs in all women regardless of prior health and/ or normative experiences (MRC Vitamin Study Research Group, 1991).

Whilst in this study mental models of susceptibility were examined in the context of folic acid supplementation, beliefs about susceptibility are linked to other poor periconceptional health habits. For example, women who believe that consuming alcohol has no effect on the unborn child are less likely to cut down on drinking during pregnancy (Morris et al., 1994). Targeting beliefs about susceptibility may be an effective means for practitioners to combat negative periconceptional health behaviours. Indeed, research shows that when a woman becomes aware of the susceptibility of her unborn infant to harm as a result of her behaviour, she is more likely to reduce the harmful behaviour. For example, in a randomised controlled trial, pregnant women who were frequently exposed to cigarette smoke were presented with information and photographs detailing the way in which their current behaviour (i.e., passive smoking) could be affecting their infant; for example low birth weight (Kazemi, Ehsanpour & Nekoei-Zahraei, 2012). As a result of this intervention, women's ratings of their infant's susceptibility to the health effects of passive smoking increased and women consequently reduced their exposure to cigarette smoke.

This was a large study that provided insight into beliefs linked to noncompliance amongst women who were pregnant or planning a pregnancy. The findings should be interpreted in light of the fact that the data were cross-sectional and so causality cannot be inferred. The results may have been affected by recruitment procedure, which is often associated with higher education (Haagen et al., 2003). Future prospective research amongst a sample with a more varied socioeconomic background is needed. In addition, samples within countries were too small to investigate country differences, and these may exist.

In conclusion, noncompliance with folic acid supplementation is prevalent and may be largely contributed to by the fact that women do not feel susceptible to poor pregnancy outcomes. Practitioners may improve compliance by eliciting and correcting erroneous mental models and beliefs women have about pregnancy. Future research should investigate the impact of improving awareness of susceptibility to adverse pregnancy outcomes on adherence to medical recommendations.

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Chapter 5: The Emergence of Perceived Susceptibility

Introduction

The research in the present thesis has supported the predictions of the HBM that perceived susceptibility is associated with how willing people are to optimise fertility and pregnancy. People who feel insusceptible to fertility problems are less likely to optimise their fertility by reducing unhealthy lifestyle behaviours or seeking medical help when they have problems conceiving (Chapter 2; Fulford et al., 2013). Further, feeling insusceptible to pregnancy complications makes women less likely to take folic acid supplements as recommended to optimise pregnancy (Chapter 4; Fulford et al., 2014). However, not much is known about when people start to feel susceptible to fertility problems. Considering one's susceptibility to fertility problems is beneficial to people as soon as they enter the reproductive years, as it enables people to monitor and identify risks to their fertility early on (e.g., reproductive complications such as irregular periods, lifestyle factors such as being overweight) and gives them sufficient time to reduce their risk (e.g., seek advice from a doctor, make lifestyle changes) and ultimately increases their chances of conceiving if and when a child is desired. In addition, thinking about susceptibility to fertility problems early on may help people to make informed choices about whether to engage in behaviours that put their fertility at risk (e.g., smoking); behaviours that people may otherwise engage in without knowing that they are reducing their chance of conceiving in the future. However, until they reach the age at which they plan to have children, people may fail to consider their susceptibility to fertility problems and disregard information about fertility because it is not seen as personally relevant. People are relatively poor at forecasting about when they will have children (e.g., Testa & Toulemon, 2006) and are having children at increasingly older ages (ONS 2012a; 2013) which means that people may start thinking about their susceptibility to fertility problems later than would be beneficial in terms of optimising their fertility. The aim of the present chapter was to investigate the association between missed childbearing targets and perceived susceptibility to fertility problems.

Awareness of Susceptibility to Fertility Problems

According to the HBM, a range of modifying factors affect how susceptible an individual feels to health problems, including age, gender, education, socioeconomic status, and knowledge (Stretcher & Rosenstock, 1997). Specifically, empirical work shows that people who feel less susceptible to health complications are younger, have lower education and socioeconomic status, and poorer knowledge about health (e.g., Bish & Michie, 2010; Boulware et al., 2009; Janz & Becker, 1984). Findings for the influence of gender on perceived susceptibility vary by disease, with women feeling more susceptible to some diseases (e.g., malignant melanoma; Brandberg et al., 1996) and men feeling more susceptible to others (e.g., chronic kidney disease, Boulware et al., 2009). It is not known to what extent these factors impact on perceived susceptibility to fertility problems. Perceived susceptibility is also influenced by events that trigger people to change their behaviour, known as cues to action (Stretcher & Rosenstock, 1997). Cues to action can be internal (e.g., beliefs or perceptions) and external (e.g., interpersonal interactions) and are argued to increase people's awareness and the personal relevance of fertility problems (Rosenstock, 1966; Stretcher & Rosenstock, 1997). In terms of fertility, exceeding the age at which one plans to have a first child could be a cue to action that increases awareness and the personal relevance of fertility health issues. The cue could be driven by internal factors (e.g., realising one has passed one's desired parenthood age and still does not have children) and external (e.g., seeing friends of a similar age becoming parents which reinforces that one has missed one's fertility target) (Rosenstock, 1966; Stretcher & Rosenstock, 1997).

Before reaching the age at which they plan to have children, people may feel they have no reason to consider risks to their fertility and that information about fertility is personally irrelevant. According to the Elaboration Likelihood Model (ELM), when information is perceived as personally irrelevant and of no personal consequence, people are unmotivated to process this information and it has little impact on their behaviour (Petty & Cacioppo, 1986). In this way, fertility health messages (e.g., from medical professionals, public health campaigns) may be ignored and people may remain unaware of potential risks to their fertility and ways that they can optimise their fertility. Additionally, before missing a fertility target (i.e., before exceeding the intended age of first birth), people identify as fertile and feel they have no evidence to differentiate them from other people who are fertile (Blenner, 1990). This perception may be reinforced by

an educational curriculum that teaches young people to use condoms during every sexual encounter to prevent pregnancy (and sexually transmitted infections [STI]; Department for Education, 2000), which may create a norm that everyone is fertile and will conceive as soon as they stop contraception. Because young people are not educated about risks to their fertility, presumed fertility remains unchallenged. However, even when people believe that they might have a fertility problem, they often delay fertility testing because of feeling otherwise healthy; “I’m disgustingly healthy. I don’t have menstrual cramps; I’m never ill; all of the women in my family have had babies at the drop of a hat” (Blenner, 1990, p.154). If people get to beyond the point at which they intended to conceive, they experience a ‘dawning of awareness’ whereby they start to become concerned about their fertility (Blenner, 1990, p.154). This is in line with research in other health contexts showing that concern about a health problem prompts people to consider their level of susceptibility. For example, when people become worried or concerned about developing breast cancer they start to consider their personal risk for breast cancer (Katapodi, Lee, Facione & Dodd, 2004).

The research discussed thus far suggests that it might be expected that people feel more susceptible to fertility problems when they exceed the age at which they planned to have children. According to the HBM, cues to action (such as missing a fertility target) make people feel susceptible and also make people think about how disruptive a health condition (fertility problems) would be to their life (perceived severity; Stretcher & Rosenstock, 1997). Heightened consideration of susceptibility as well as the potential disruptive effects of a health problem is argued to increase the likelihood that people will take action to optimise their health, in this context fertility (Stretcher & Rosenstock, 1997).

Postponed Childbearing

People are having children at increasingly older ages, which may mean that they do not start considering their susceptibility to fertility problems until older ages when risks to their fertility are greater. The average age at which women have their first birth is rising, being 28.1 years in 2012 compared with 26.8 years in 2002 (ONS, 2013). Nearly half (49%) of babies are born to mothers aged 30 or older and the number of women giving birth aged 40 or older has more than quadrupled between 1981 and 2011 (6,860 in 1981 to 29,350 in 2011; ONS, 2012a). Delayed parenthood may be partly contributed to by

the fact that people are generally poor at forecasting (or judging) when they will have children. People tend to have children later than they intend; for example, 64% of people who say they will have a child within the next five years have still not had a child by the end of this period (Testa & Toulemon, 2006). Prospective studies show that roughly half (50 - 52.57%) of women aged 18-39 who intend to have a (further) birth have not had this birth six years later, even though they still intend to have the birth (Berrington, 2004; Heaton, Jacobson & Holland, 1999 [calculations based on data in Table 1 for Heaton et al.]). It might be expected that postponement of childbearing is found only in younger women, who still have a number of childbearing years left in which to have children. However this is not the case; even among older women (aged 35-39), 44% had not had the child they intended six years later (compared to 63.7% of women aged 18-24; Berrington, 2004). This indicates that even women who are approaching the end of their reproductive years are postponing childbearing. Altogether the trends toward later parenting mean that the triggers of perceived susceptibility (i.e., missed fertility target) occur later in the reproductive cycle.

The Effects of Postponing Childbearing

Postponing childbearing to older ages increases actual susceptibility to fertility problems. Age is the strongest risk factor for female infertility, with fertility starting to decrease at around age 30 (van Noord-Zaadstra et al., 1991) and showing a marked decline at age 35 (Dunson, Colombo & Baird, 2002). Older women are less likely to get pregnant and those who do eventually have a pregnancy will have taken longer to conceive (Broekmans et al., 2007; Gindoff & Jewelewicz, 1986; Gnoth et al., 2003). Older women who become pregnant are more likely to experience adverse health outcomes such as gestational diabetes, hypertension, venous thrombosis, premature birth, and infant developmental abnormalities (Utting & Bewley, 2011). Fertility treatment cannot fully compensate for the age-related decline in fertility (Leridon, 2004). After 12 cycles of fertility treatment, the likelihood of pregnancy is 0.54 in women aged greater than 31 years compared with 0.74 in women aged 20 to 31 years (van Noord-Zaadstra et al., 1991). Among women who become pregnant after fertility treatment, the probability of the pregnancy resulting in a healthy baby decreases by 3.5% each year after the age of 30 (van Noord-Zaadstra et al., 1991). Overall, women aged 35 are half as likely to have a healthy baby after fertility treatment compared to

women aged 25 (van Noord-Zaadstra et al., 1991). Timely identification of fertility problems is therefore vital to optimise fertility. However, when childbearing is delayed to older ages, women are faced with less time to investigate and address causes of lack of conception (e.g., lifestyle, reproductive complications) and relevant treatment options.

Concerningly, people do not seem to be fully aware that postponing childbearing to older ages increases their susceptibility to fertility problems. For example, less than 50% of people correctly identify age as the strongest risk factor for female infertility (Bretherick et al., 2010). Further, only 36% and 24% of women and men (respectively) know that a marked decline in women's fertility occurs at age 35, with 46% and 63% of women and men (respectively) believing that this decline occurs after age 40 (Lampic et al., 2006). In addition, people overestimate the success of their efforts to conceive. For example, 57% and 58% of women and men (respectively) overestimate the likelihood that a couple will conceive after a year of regular unprotected sexual intercourse and 63% and 53% of women and men (respectively) overestimate the likelihood that a couple will achieve a pregnancy after *in vitro* fertilisation (IVF; Lampic et al., 2006). Bunting et al. (2013) showed that poor fertility knowledge (< 60% correct answers) was common across low and high resource countries (sample N > 10,000) and was predicted by male gender, younger age, poorer socioeconomic conditions (lower education, employment and country resources) and non-exposure to fertility medical consultation. Poor knowledge about fertility may make people less likely to consider their susceptibility to fertility problems and the detrimental effect of postponing childbearing on their chance of conception. Until they have a cue or a prompt, such as exceeding the age at which they intended to have their first child, people may give little attention to opportunities to increase fertility health knowledge which could also stall consideration of their susceptibility to fertility problems.

The Present Study

The aim of the present study was to investigate the emergence of perceived susceptibility to fertility problems among men and women of reproductive age. Specifically, the effect of exceeding one's intended age of first birth on perceived susceptibility was examined. Data collected for the present study were part of the Cardiff University Parenthood Planning Survey (CUPPS) study, which is a prospective

survey of the background, psychological, social, and health factors that influence how people decide when to start a family. Cardiff University childless staff and students who desired to have a child sometime in the future but were not currently trying or pregnant were recruited and completed a survey about parenthood plans (Time 1) and, three years later (Time 2), completed a survey asking about their progress toward these parenthood goals.⁶ At Time 2, additional factors related to the emergence of perceived susceptibility according to the HBM were also examined, including fertility knowledge, age, gender, education, and socioeconomic status. The association between these factors and perceived severity of fertility problems was also examined. In line with the HBM, it was hypothesised that people who had exceeded the age at which they intended to have their first child would feel more susceptible to fertility problems and perceive fertility problems to be more severe. Further, in line with previous research, it was expected that perceived susceptibility and perceived severity would be higher among people with higher fertility knowledge, who were older, and had higher education and socioeconomic status. It was predicted that women would feel more susceptible to fertility problems than men, because, historically, research and medical practice focused almost exclusively on women as the cause of infertility, which gave rise to the myth that women are more likely to have fertility problems than men (Apfel & Keylor, 2002; Sandlow, 2000).

Method

Participants

Participants were $N = 176$ men and women who had been recruited into the CUPPS study and agreed to participate in wave 2 of data collection. CUPPS participants were men and women who: (1) were 18 to 49, (2) did not have any children, (3) were not pregnant or about to father a child, and (4) were not trying to conceive. Participants were recruited via two methods: (1) an advertisement available to staff and students at Cardiff University and (2) an advert on the online social networking site Facebook. The final sample for the present analyses comprised the CUPPS participants who also agreed to complete Time 2 of data collection. The final sample size at Time 1 was 886:

⁶ Time 1 data collection was performed by a previous student (Natasha Kalebic). Time 2 data collection was performed by the author of the thesis (Bethan Fulford).

166 (18.74%) men and 717 (80.93%) women.⁷ Of these, 176 participants agreed to complete the Time 2 survey, of which 22 were men (12.5%) and 154 were women (87.5%).

Attrition analyses are presented in Table 5.1, showing demographic differences between participants who remained in the study at Time 2 (Completers; $n = 176$) and participants who dropped out of the CUPPS study after Time 1 (Dropouts, $n = 710$). Dropouts were younger ($t [867] = 3.155, p = .002$), more likely to be students ($\chi^2 [2] = 10.30, p = .006$) and less likely to be in a relationship ($\chi^2 [1] = 9.74, p = .002$). Fisher's Exact Test indicated that there was no difference between Dropouts and Completers on sexual orientation ($p = 1.00$) or having a university education ($\chi^2 [1] = 1.312, p = .252$).

⁷ At Time 1, three participants did not provide their gender (did not participate at Time 2) and were omitted from analyses in which gender was a variable.

Table 5.1.

Demographic characteristic of the CUPPS Dropouts (n = 710) and Completers (n = 176), according to gender

Variable	CUPPS Dropouts at Time 1			P-value ^a for difference between women & men (Dropouts)	CUPPS Completers at Time 1			P-value ^a for difference between women & men (Completers)
	Total (n = 710)	Women (n = 563)	Men (n = 144)		Total (n = 176)	Women (n = 154)	Men (n = 22)	
Age (M, SD)	23.17 (4.66)	23.01 (4.25)	23.13 (4.61)	$p = .761$	24.47 (4.70)**	24.27 (4.69)	25.85 (4.71)	$p = .160$
Education (n, %)								
At least university education	505 (71.8)	411 (73.7)	92 (64.8)	$p = .036$	134 (76.1)	116 (75.3)	18 (81.8)	$p = .504$
Employment (n, %)				$p = .853$				$p = .376$
Employed	160 (22.6)	129 (23)	31 (21.5)	N.S.	60 (34.1)*	50 (32.5)	10 (45.5)	N.S.
Student	531 (74.9)	418 (74.4)	110 (76.4)	N.S.	111 (63.1)*	99 (64.3)	12 (54.5)	N.S.
Other	18 (2.5)	3 (2.1)	15 (2.7)	N.S.	5 (2.8)	5 (3.2)	0	N.S.
Relationship status (n, %)				$p = .018$				$p = .229$
Single	268 (38.6)	200 (36.4)	67 (47.2)	Significant at .05	45 (25.9)*	37 (24.3)	8 (36.4)	N.S.
In a relationship	427 (61.4)	350 (63.6)	75 (52.8)	Significant at .05	129 (74.1)*	115 (75.7)	14 (63.6)	N.S.
If in a relationship, partner is same sex (% of those in a relationship) (n, %)	13 (2.3)	5 (1.4)	5 (6.7)	$p = .007$	3 (2.1)	3 (2.6)	0	Not applicable

Note. Due to missing data and screening exclusions *N* varies per variable: 869 (age) to 886. M = mean, SD = standard deviation, N.S. = not significant.

^a Using an independent samples t-test for continuous variables and chi-square analysis for categorical variables.

* $p < .05$, ** $p < .01$, *** $p < .001$ for comparison on variable between Completers and Dropouts (independent samples t-test for continuous variables, chi-square for categorical variables).

Materials

Survey overview.

The CUPPS survey measured factors relevant to the decision of when to have a child including background (e.g., age, employment status), psychological characteristics (e.g., childbearing intentions), social considerations (e.g., beliefs about important others' views of having children), and health factors (e.g., health preferences for having children). Items were derived from biological (Repression Suppression Model; Wasser & Isenberg 1986), social (Theory of Reasoned Action; Langdridge, Sheeran & Connolly, 2007; TPB; Ajzen, 1991) and psychological (Preference Theory, Hakim, 2000) theories and a literature review. Only variables relevant to the present research question are described (See Appendix G for Time 1 survey). At Time 2, items were adapted for two versions of the survey. Survey version A was for respondents with no history or current experience of having children defined as meeting all of the following criteria: Had never given birth/ fathered a child; did not have any adopted children; *and* were not currently pregnant/ expecting a child (Appendix H). Survey version B was for respondents with a history and/or current experience of having children defined as meeting one or more of the following criteria: Had given birth/ fathered a child before; had adopted children; *or* were currently pregnant/ expecting a child (Appendix I).

Demographic characteristics.

The demographic variables measured were gender, age, employment status (full time employed; part time employed; unemployed; student; retired; other), education level (no education; primary school; secondary school; post-secondary school/ trade or technical college; university graduate; postgraduate university), and relationship status (single; in a relationship and not living with partner; in a relationship and living with partner). Participants who indicated they were in a relationship were asked whether their partner was of the same sex as them.

History and current experience of having children.

At Time 1, participants were asked in how many months or years they planned to actively start trying to get pregnant with/ father their first child; this was used with participants' age to calculate the age at which participants planned to have a child. At Time 2, participants were asked whether they had given birth/ fathered a child (if yes, how many times they had given birth/ fathered a child), whether they were currently pregnant/ expecting a child, whether they wished to have a(nother) child in the future (yes/ no), whether they were currently trying to conceive, and among those who were currently trying to conceive how long they had been trying (years/ months).

At Time 2 participants who were older than their planned age to have a child, still had no children and still wished to have children in the future were considered to have missed their fertility target (fertility target missed coded as 1, otherwise coded 0).

Age-related fertility knowledge.

Age-related fertility knowledge was assessed via nine true or false items about the effect of age on fertility ('a woman's age is an important consideration in being able to get pregnant', 'a man's age is an important consideration in being able to father a child', 'a pregnancy after the age of 35 would be more physically demanding for a woman than a pregnancy before the age of 35', 'a pregnancy after the age of 35 would be more emotionally demanding for a woman than a pregnancy before the age of 35', 'a pregnancy after the age of 35 is more likely to result in complications such as increased risk of Down Syndrome or premature birth', 'any decline in female fertility could be compensated by medical treatment [e.g., IVF or fertility drugs]', 'any decline in male fertility could be compensated by medical treatment [e.g., IVF or fertility drugs]', 'a woman in her 40s has as much chance of getting pregnant as a woman in her 30s', and 'a woman in her 30s has as much chance of getting pregnant as a woman in her 20s'). Items measuring fertility knowledge were adapted from Lampic et al. (2006), Maheshwari, Porter, Shetty & Bhattacharya (2008) and Bretherick et al. (2010).

Health Belief Model constructs.

Perceived susceptibility to infertility was measured at Time 2 via two items (adapted from Rosenstock, 1966, 1990; Bryan et al., 1997). Infertility was defined to participants as being biologically unable to get pregnant or father a child. The first item assessed how susceptible participants believed they were to infertility ('How likely do you think you are to be biologically infertile?') whilst the second item assessed how susceptible participants believed other people their age were to infertility ('How likely do you think other women/ men your age are to be biologically infertile?'). Responses were rated on a scale of 1 (not at all likely) to 5 (extremely likely).

Perceived severity was measured via one item (adapted from Rosenstock, 1966, 1990; Bryan et al., 1997) assessing how disruptive participants believed infertility would be ('How disruptive would biological infertility be to your life?'). Responses were rated on a scale of 1 (not at all disruptive) to 5 (extremely disruptive).

Procedure

The study received ethical approval from the School of Psychology Ethics Committee, Cardiff University. Figure 5.1 shows the study procedure and assessments. Data collection for Time 1 of CUPPS took place in March 2011. At Time 1 all participants completed the same survey. To participate in the study, participants clicked a link that directed them to the survey information page (detailing the eligibility criteria) and consent form. On the last page of the survey, participants were asked whether they could be contacted in a follow-up to assess whether their opinions and impressions of the best time to start a family had changed. An affirmative response was indicated by the provision of an email address for future contact ($n = 625$; 70.54%).

Data collection for Time 2 of CUPPS took place in February 2014. After removing email addresses which bounced ($n = 66$; e.g., email address no longer existed or was incorrect) and participants who withdrew from the study ($n = 18$), there were 541 valid email addresses to which invitations were sent to the follow-up survey at Time 2. Participants were emailed an individualised link that directed them to the survey information page and consent form. Individualised survey links were used to match responses to email addresses in order to link participants' responses at Time 1 and Time 2. Once the data were downloaded from the survey software, email addresses were

deleted from the file containing the data and participant CUPPS identification numbers were used to link responses at Time 1 and Time 2. Final download of the Time 2 data was in April 2014. After consenting to participate, participants were directed to a page that described the eligibility criteria for the two separate versions of the survey adapted for participants' history and current experience of having children (survey version A and survey version B). Participants followed the link for the version of the survey that described their situation.

The survey at each time point took approximately 15 minutes to complete.

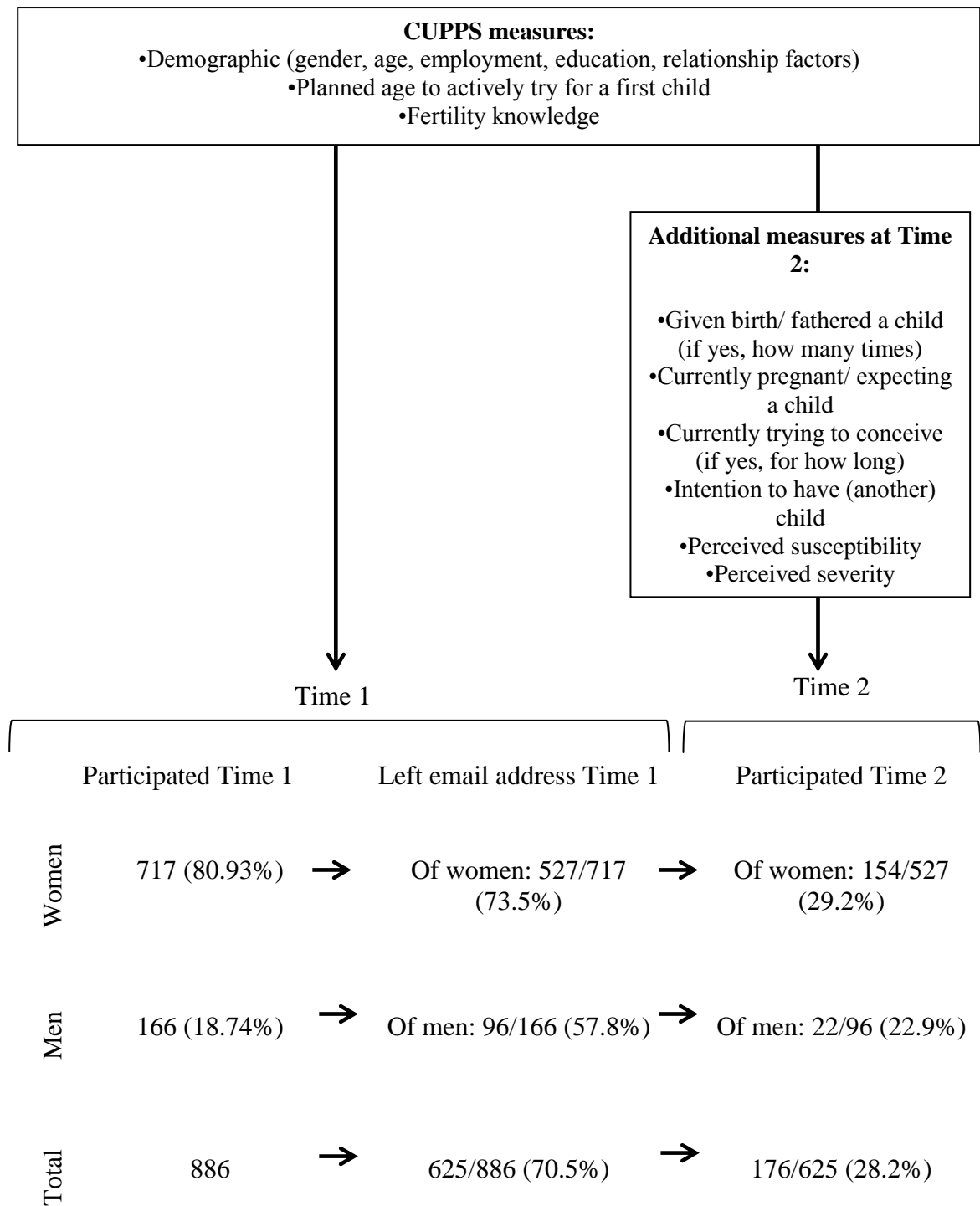


Figure 5.1. Flow chart of procedure and assessments of the CUPPS study.

Data Analyses

Transformations were applied to skewed variables (fertility knowledge, age, perceived susceptibility and perceived severity, all measured at Time 2). Outliers (score lies outside ± 3 SD of the mean) were excluded from analyses which included the variable on which the outlier was found. In total 948 people completed the CUPPS survey at Time 1 but 62 participants (6.54%) were excluded from analyses: 61 did not meet the inclusion criteria (7 had children, 1 was currently expecting a child, 4 were currently trying to conceive, and 49 did not intend to have a child in the future) and one participant had over 90% missing data. Power calculations using the software G*Power (version 3.1, Faul et al., 2009) indicated that the minimum sample size needed for intended analyses was 85 (power = .80).

Cronbach's alpha was used to assess the reliability of the nine items measuring fertility knowledge at Time 1 and Time 2. At both time points, two items were deleted from the analysis ('a man's age is an important consideration in being able to father a child' and 'a pregnancy after the age of 35 would be more emotionally demanding for a woman than a pregnancy before the age of 35') as they did not contribute to the reliability of the scale. Cronbach's alpha for the remaining seven knowledge items was .64 at Time 1 and Time 2. A percentage score was calculated for each participant from 0-100 where 0 represented low knowledge, 50 represented average knowledge and 100 represented high knowledge at each time point.

Independent t-tests and chi-square analyses were used to compare differences between participants who dropped out of the study after Time 1 (Dropouts) and participants who remained in the study until Time 2 (Completers). When the sample size in χ^2 analyses was underpowered, Fisher's Exact Test was reported. Paired-samples t-tests and McNemar's nonparametric test (using binomial distribution) were used to compare differences between Time 1 and Time 2 among Completers. At Time 1 participants were asked to provide their age as a number (as opposed to their date of birth) and so there is a possibility that participants rounded their age down or up to the nearest year depending on how close to their birthday they were when they completed the survey (e.g., someone who's 26th birthday was a week away could have rounded up to age 26). The lack of precision in measuring age at Time 1 was compensated by considering reported age to be valid if at Time 2 participants indicated that they were no less than two years and no more than four years older than the age they provided at

Time 1. Completers who indicated that their age at Time 2 was less than two years or more than four years older than their age at Time 1 ($n = 11$) were excluded from analyses that included age as a variable.

Hierarchical multiple regressions were used for two dependent variables: perceived susceptibility to fertility problems and perceived severity of fertility problems. In each regression, the independent variables were missed fertility target and the HBM modifying factors measured at Time 2: age-related fertility knowledge, age, gender (coded as 1 = female, 0 = male), and education (coded as 1 = at least university education, 0 = lower than university education). Socioeconomic status (indicated by employment status with employed [or not unemployed e.g., student] coded as 1 and unemployed coded as 0) could not be included in analyses because the number of unemployed participants was too low ($n = 3$; 1.7%). Following recommendations from Field (2013), for each regression on the first step of the analysis the HBM modifying factors were entered as these are known predictors of perceived susceptibility and perceived severity from previous research. On the second step of the analysis, missed fertility target was entered as this was the new predictor (Field, 2013).

Results

Demographic Characteristics Over Time

Table 5.2 shows the demographic characteristics of the Completers at Time 1 and Time 2. At Time 2 Completers were more likely to have a university education (McNemar's Test $p < .001$) and to be employed (less likely to be a student) or to have put 'other' as their employment status, with other including unemployed, retired, or other employment status (McNemar-Bowker Test $[3] = 66.24, p = < .001$). Completers were not more likely to have a partner at Time 2 (McNemar's Test $p = .099$).

Table 5.2.

Demographic characteristics of the CUPPS Completers at Time 1 and Time 2, according to gender (n = 176)

Variable	Time 1 <i>n</i> = 176				Time 2 <i>n</i> = 176			
	Total	Women (<i>n</i> = 154)	Men (<i>n</i> = 22)	P-value ^a for difference between women & men at Time 1	Total	Women (<i>n</i> = 154)	Men (<i>n</i> = 22)	P-value ^a for difference between women & men at Time 2
Age (M, SD)	24.47 (4.7)	24.27 (4.69)	25.85 (4.71)	<i>p</i> = .160	27.93 (4.73)***	27.73 (4.70)	29.32 (4.82)	<i>p</i> = .160
Education (<i>n</i> , %)								
At least university education	134 (76.1)	116 (75.3)	18 (81.8)	<i>p</i> = .504	162 (92)***	141 (91.6)	21 (95.5)	<i>p</i> = .528
Employment (<i>n</i> , %)				<i>p</i> = .376				<i>p</i> = .978
Employed	60 (34.1)	50 (32.5)	10 (45.5)	N.S.	130 (74.3)*	114 (74)	16 (76.2)	N.S.
Student	111 (63.1)	99 (64.3)	12 (54.5)	N.S.	36 (20.6)*	32 (20.8)	4 (19)	N.S.
Other	5 (2.8)	5 (3.2)	0	N.S.	9 (5.1)*	8 (5.2)	1 (4.8)	N.S.
Relationship status (<i>n</i> , %)				<i>p</i> = .229				<i>p</i> = .721
Single	45 (25.9)	37 (24.3)	8 (36.4)	N.S.	35 (19.9)	30 (19.5)	5 (22.7)	N.S.
In a relationship	129 (74.1)	115 (75.7)	14 (63.6)	N.S.	141 (80.1)	124 (80.5)	17 (77.3)	N.S.

Note. Due to missing data and screening exclusions *N* varies per variable: 159 (age) to 176. M = mean, SD = standard deviation, N.S. = not significant.

^a Using an independent samples t-test for continuous variables and chi-square analysis for categorical variables.

p* < .05, *p* < .01, ****p* < .001 for comparison on variable between Time 1 and Time 2 (paired samples t-test for continuous variables, McNemar's test for categorical variables).

Childbearing Preferences and Experience Over Time

Table 5.3 shows the childbearing preferences and experiences of the Completers at Time 1 and Time 2. At Time 2 only 15.4% of the sample had achieved a pregnancy (11.4% had had a child, 4% were currently pregnant or expecting a child) and 7.8% were currently trying to conceive.

At Time 2, 36 (23.7%) participants had exceeded the age at which they planned to have their first child, had not yet had a child and still wanted a child (i.e., had missed their fertility target). One participant had exceeded the age at which they planned to have their first child but no longer wanted children at Time 2 and so was not considered to have missed their fertility target. There were no differences between men and women in whether they had children, number of children, and whether they were currently pregnant or expecting a child. At Time 1, men planned to start trying for their first child at a significantly older age than women (31.20 years of age versus 28.69 years of age, $p = .004$). Among the 152 participants who were childless at Time 2, significantly more women still wished to have a child than men (130 [96.3%] versus 13 [81.3%], $p = .040$).

Fertility Knowledge, Perceived Susceptibility and Perceived Severity

Mean correct score on the age-related fertility knowledge items among Completers was 72.66% (SD = 22.14) at Time 1 and 76.62% (SD = 21.51) at Time 2. A paired samples t-test indicated that fertility knowledge score was significantly higher at Time 2 than Time 1 ($t [175] = -2.363$, $p = .019$).

On average participants rated their own susceptibility to fertility problems as significantly lower ($M=1.76$, $SD = 0.80$) than other people's susceptibility to fertility problems ($M=1.84$, $SD = 0.59$), $t (163) = -2.344$, $p = .020$.

Participants' mean rating of how disruptive fertility problems would be to their life (perceived severity) was 3.55 (SD = 1.15).

Table 5.3.

Childbearing preferences and experiences of the CUPPS Completers at Time 1 and Time 2, according to gender (n = 176)

Variable	Time 1 n = 176				P-value ^a for difference between women & men at Time 1	Time 2 n = 176				P-value ^a for difference between women & men at Time 2
	Total	Women (n = 154)	Men (n = 22)			Total	Women (n = 154)	Men (n = 22)		
Planned age to start trying for first child (M, SD)	29.02 (3.85)	28.69 (3.65)	31.20 (4.45)	p = .004		NA	NA	NA		NA
Exceeded planned age to start trying for first child, not given birth/ fathered a child, and still wants a child (i.e. missed fertility target) (n, %)	0	0	0	NA		36 (23.7)	35 (26.5)	1 (5.0)		NA ^b
If missed fertility target, by how many years? (M, SD)	NA	NA	NA	NA		1.35 (0.80)	1.33 (0.80)	2.17		NA ^b
Have children	0	0	0	NA		20 (11.4)	16 (10.4)	4 (18.2)		p = .284
If have children, how many? (M, SD)	NA	NA	NA	NA		1.05 (0.22)	1.06 (0.25)	1 ^c		p = .630
Currently pregnant/ expecting a child (n, %)	0	0	0	NA		7 (4)	5 (3.2)	2 (9.1)		p = .213
Among childless and not pregnant, wishes to have a child (n, %)	176 (100)	154 (100)	22 (100)	NA		143 (94.7)	130 (96.3)	13 (81.3)		p = .040

Table 5.3. Continued

Variable	Time 1 <i>n</i> = 176				Time 2 <i>n</i> = 176			
	Total	Women (<i>n</i> = 154)	Men (<i>n</i> = 22)	P-value ^a for difference between women & men at Time 1	Total	Women (<i>n</i> = 154)	Men (<i>n</i> = 22)	P-value ^a for difference between women & men at Time 2
Currently trying to conceive (<i>n</i> , %)	0	0	0	NA	13 (7.8)	13 (8.8)	0	NA ^b
If trying to conceive, length of time trying (years; M, SD)	NA	NA	NA	NA	1.36 (2.07)	1.36 (2.07)	NA	NA ^b

Note. Means after outliers (score on variable outside of the mean \pm 3SD) excluded (*n* = 22 outliers on planned age to start trying for first child; planned age = 46 – 75 years for outliers). Due to missing data and excluded outliers *N* varies per variable: 151 (wish to have children) to 176. M = mean, SD = standard deviation, NA = not applicable.

^aUsing an independent samples t-test for continuous variables and chi-square analysis for categorical variables.

^bt-test/ chi-square test not applicable because one cell contained one or less participants.

^cAll 4 men had 1 child.

Interrelationships Among the HBM Modifying Factors, Missed Fertility Target, Perceived Susceptibility and Perceived Severity

Table 5.4 shows the correlations between the HBM modifying factors, missed fertility target, perceived susceptibility and perceived severity. The correlation between perceived susceptibility and age approached significance ($p = .052$). Perceived susceptibility was significantly positively correlated with missing a fertility target. Perceived severity was significantly negatively associated with age.

Education and missing a fertility target were significantly positively associated with age. Fertility knowledge was significantly positively associated with gender (women had higher knowledge).

Table 5.4.

Correlations between the HBM modifying factors, missed fertility target, perceived susceptibility, and perceived severity

Variable	1	2	3	4	5	6	7
1.Age	-						
2. Gender	-.124	-					
3. Education	.242**	-.044	-				
4. Fertility knowledge	.063	.254**	.088	-			
5.Missed fertility target	.389***	.171	.060	-.005	-		
6.Perceived susceptibility	.160 ^a	.133	-.007	-.062	.188*	-	
7. Perceived severity	-.294***	.143	.002	.122	.058	-.036	-
Mean (SD) or n (%)	27.93 years (SD = 4.73)	F = 154 (87.5%)	University = 162 (92%)	76.62% (SD = 21.51)	Missed = 36 (23.7)	1.76 (SD = 0.80)	3.55 (SD = 1.15)

Note. Gender is coded 0 = male, 1 = female; education is coded 0 = does not have university education, 1 = has university education; missed fertility target is coded 0 = has not missed fertility target, 1 = missed fertility target (i.e., exceeded planned age of first birth and not had child). SD = standard deviation, F = female.

^aTrend ($p = .052$).

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

HBM Modifying Factors and Missed Fertility Target as Predictors of Perceived Susceptibility and Perceived Severity

Regression analyses were used to identify predictors of perceived susceptibility and perceived severity at Time 2. For each regression age, gender, education and fertility knowledge (modifying factors) were entered on the first step and missed fertility target (cue to action) was entered on the second step.

The regression model for perceived susceptibility to fertility problems was significant ($F [4, 136] = 2.556, P = .042, \text{MSE} = 0.980$), accounting for 7% of the variance. The coefficients showed that people who were older and female felt more susceptible to fertility problems ($\beta = 0.201, p = .023$ and $\beta = 0.207, p = .018$, respectively). The addition of missed fertility target to the regression model did not produce a significant change in the value of R^2 ($R^2 \text{ change} = .013, p = .171$). Whilst the overall model was significant ($F [5, 135] = 2.437, p = .038, \text{MSE} = 0.973$), none of the step 1 predictors remained significant after the addition of missed fertility target at step 2 (See Table 5.5 for the regression summary analyses) due to correlation among predictors. Specifically, examination of the semi-partial correlation coefficients showed shared variance of 1.1% at step 1 and 2.9% at step 2 as per significant correlation between missed fertility target and age ($r = .389, P < .001$; as shown in Table 5.4).

The regression model significantly predicted perceived severity of fertility problems ($F [4, 139] = 3.864, p = .005, \text{MSE} = 0.894$), accounting for 10% of the variance. The coefficients showed that people who were older felt that fertility problems would be less disruptive to their life ($\beta = -0.269, p = .002$). The addition of missed fertility target to the regression model (step 2) produced a significant change in the value of R^2 ($R^2 \text{ change} = .034, p = .021$; overall model $F [5, 138] = 4.279, p = .001, \text{MSE} = 0.867$), explaining 13.4% of the variance. At step 2, age remained a significant predictor of perceived severity with older people feeling that fertility problems would be less disruptive to their life ($\beta = -0.364, p = < .001$). Missed fertility target significantly predicted perceived severity, with people who had missed their fertility target (i.e., exceeded the age at which they planned to have a child and still not had a child) rating fertility problems are more disruptive to their life ($\beta = 0.210, p = .021$). See Table 5.5 for the regression summary analyses.

Table 5.5.

Summary statistics for hierarchical regression testing associations in perceived susceptibility and perceived severity.

	Perceived susceptibility <i>n</i> = 141	Perceived severity <i>n</i> = 144
Step 1:		
Main effect HBM modifying variables	$R^2\Delta = .070^*$	$R^2\Delta = .100^{**}$
Age	0.201*	-0.269**
Gender	0.207*	0.118
Education	-0.048	0.066
Fertility knowledge	-0.121	0.090
Step 2:		
Main effect missed fertility target	$R^2\Delta = .013$	$R^2\Delta = .034^*$
Age	0.144	-0.364***
Gender	0.175	0.065
Education	-0.046	0.069
Fertility knowledge	-0.110	0.110
Missed fertility target	0.128	0.210*

Note. Standardised coefficients reported. Owing to missing data *N* varies per dependent variable. $R^2\Delta = R^2$ change.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The aim of the present study was to investigate the emergence of perceived susceptibility to fertility problems. Known modifiers of perceived susceptibility as specified by the HBM (Stretcher & Rosenstock, 1997) were examined, as well as the role of missing a fertility target proposed to be a cue to action. Findings showed that younger people and men felt less susceptible to fertility problems and thus should be the target of educational campaigns to increase awareness of susceptibility to fertility problems. Missing a fertility target was unrelated to perceived susceptibility but it did attenuate the associations of age and gender potentially suggesting an indirect role. In contrast missed fertility target was associated with greater perceived severity of fertility problems, suggesting that people start to consider how disruptive fertility problems would be to their life once they exceed the age at which they planned to have their first child.

In using the HBM to understand the emergence of perceived susceptibility, it should be considered that what modifies perceived susceptibility varies across health contexts. For example, despite previous empirical support for the HBM modifiers in explaining perceived susceptibility to a range of health conditions, only two modifiers emerged as important in the context of fertility problem susceptibility. In the context of fertility problems, it seemed to be factors related to the personal relevance of fertility that explained who felt susceptible, with older people and women feeling more susceptible. Most people are aware that fertility declines with age (e.g., Bretherick et al., 2010), which may mean fertility is perceived as more relevant among older people. Younger people, on the other hand, may feel that fertility problems are not relevant to them and hence not consider their susceptibility to fertility problems. Research suggests that younger people generally have a sense of ‘invulnerability’ that means they do not consider their risk for a health problem until they have experienced the health problem (Denscombe, 2001). However, waiting to experience a problem with fertility before doing something about it is likely to reduce chances of optimising fertility and conceiving. Considering one’s susceptibility to fertility problems in a more timely way allows people more time to reduce risk factors (e.g., change unhealthy lifestyle habits) and optimise fertility by seeking advice from a doctor if needed (e.g., if one has menstrual problems such as absence of period). It may be important to educate people

that risks to fertility apply to people of all ages and that there are things they can do to optimise fertility potential and increase the success of later efforts to conceive.

In relation to gender, fertility problems may be seen as less personally relevant among men because fertility declines more rapidly in women than in men (Dunson, Baird & Colombo, 2004). Beliefs about being less susceptible among men may also be contributed to by the myth that fertility problems are more likely to be due to a problem with the woman than with the man (Apfel & Keylor, 2002; Sandlow, 2000). The HBM would predict that, because men feel less susceptible to fertility problems, men are less likely to follow medical recommendations for optimising fertility (Rosenstock, 1966; Stretcher & Rosenstock, 1997). This is problematic, given NICE's drive to include both members of the couple in matters related to fertility health, as focusing on just one member of the couple undermines the chance of the couple achieving their childbearing goals (NICE, 2013). Again, it seems important to tailor fertility educational campaigns to take into account the characteristics of the target audience and emphasise that fertility health is relevant to men and women.

Worthy of consideration is the apparent dissociation of perceived susceptibility and perceived severity in their association with age. Whilst older people felt more susceptible to fertility problems, they felt that fertility problems would be less disruptive to their life in comparison with younger people. This is in contrast to research in other health contexts, which has found that older people rate illnesses (e.g., colds) as more severe to them than do younger people (Prohaska, Leventhal, Leventhal, & Keller, 1985). However, participants in the present sample were on average younger than the national mean age of first birth (27.9 versus 28 years) and than their average planned age of first birth (29 years). Therefore, other life concerns and prospects (e.g., career, relationship) may have made infertility seem a less severe outcome, with these alternative prospects being more salient to older people than younger people. For example, older people would be more likely to have finished their education goals and to be embarking on a career, or approaching interpersonal milestones such as marriage (mean age of marriage in the UK = 30 and 32 years for women and men respectively, ONS, 2014). Among younger people, for whom many of these life events are more distant, the prospect of a future without children may have seemed more disruptive.

The hypothesis that missing a fertility target would make fertility more personally relevant was partially supported. Firstly, missing a fertility target did not operate as a HBM cue to action to make people feel more susceptible to fertility

problems. The results suggested that this may have been due to the shared variance among variables. Correlations showed that older people were more likely to have missed their fertility target. By definition age was used to compute the missed fertility target variable. Therefore, by controlling for age in the first step of the regression, variability due to age was removed, with missed fertility target not adding anything to the explanation of perceived susceptibility over and above age. However, missed fertility target did reduce the strength of the regression coefficient for age (and gender) suggesting that at least some aspect of why age was significant was connected to the missing of the fertility target.

People who had missed their fertility target reported higher perceived severity, as defined by feeling that fertility problems would be more disruptive to their life. This result is perhaps surprising given the finding that older people in the sample felt that fertility problems would be less disruptive to their life. This suggests that being older than one's intended age of first birth, as opposed to being older per se, is what makes people consider how disruptive fertility problems would be to their life. The HBM would predict that if people perceive fertility problems as severe but do not feel susceptible to fertility problems then they are less likely to take action to optimise their fertility (Rosenstock, 1966; Stetcher & Rosenstock, 1997). Future research should investigate whether and how missing a fertility target actually impacts on fertility-relevant behaviour, such as help-seeking for fertility. However, the present findings should be interpreted in light of the potential that the significant association of missed fertility target in the regression on perceived severity represents a suppressor effect. A suppressor effect is when a predictor variable added to a regression model increases the value of R^2 due its correlation with another predictor variable, as opposed to its own associated with the outcome variable (Conger, 1974; Maassen & Bakker, 2001). Indeed, in correlation analyses missed fertility target was unrelated to perceived severity ($r = .058$) but was significantly correlated with age ($r = .389^{***}$).

Some limitations need to be considered. High drop-out in the present study (80.14% drop out from Time 1 to Time 2) may have affected the results. It is possible that participants who felt more susceptible to fertility problems were more like to take part in the follow-up study at Time 2 than participants who felt less susceptible. This could have biased the Time 2 sample towards high levels of perceived susceptibility, which may have attenuated associations among the predictor variables and perceived susceptibility. It was not possible to test whether average perceived susceptibility was

different at Time 1 and Time 2 as perceived susceptibility was measured only at Time 2. Indeed, people who took part in the Time 2 follow-up were older than people who dropped out after Time 1 (mean = 24 years old compared to 23 years old), and the present findings showed that older people felt more susceptible to fertility problems. Additionally, the present sample was biased towards high levels of university education (72.1% at Time 1, 92% at Time 2). Finally, as is common in childbearing research (and in survey research in general), more women participated at both time points than men (e.g., Tough et al., 2007), which further highlights how fertility is perceived as less personally relevant among men. To address the limitations mentioned, the study would need to be replicated in a more representative sample and find effective ways to recruit men in childbearing research.

In conclusion, the present study demonstrated that missing a fertility target acts as a partial cue to action that triggers perceptions and cognitions about fertility. Whilst missing a fertility target did not make people feel more susceptible to fertility problems, it made them start to consider how severe fertility problems would be to their life. How people respond behaviourally to these cognitions needs to be investigated to get a better picture of when people become likely to take steps to optimise their fertility. In addition, given the increasing prevalence of risk factors for fertility problems and the postponement of childbearing to older ages, it seems more important than ever to tailor educational messages to raise awareness of fertility among those who may be most likely to ignore fertility-relevant information (i.e., younger people and men). Future research should examine the impact of tailored fertility health awareness campaigns on perceived susceptibility to fertility problems and on actual fertility-optimising behaviour.

Chapter 6: Closing the Gap in Fertility Health Awareness: Evaluation of the Fertility Status Awareness Tool (FertiSTAT) Among Service Users and Providers

Introduction

The studies in the present thesis have demonstrated that people's knowledge about fertility and awareness of their susceptibility to fertility problems is generally poor. Chapter 2 showed that people answer correctly 51.9% of questions about fertility knowledge (Fulford et al., 2013), whilst in Chapter 4 the results indicated that people have mental models that make them feel insusceptible to the consequences of poor pregnancy preparation (i.e., not following health recommendations for women who are pregnant or planning a pregnancy; Fulford et al., 2014). Gaps in knowledge and erroneous beliefs about fertility and pregnancy have a detrimental effect on behaviour, including unhealthy lifestyle choices, avoiding seeking medical help when fertility problems are encountered, and nonadherence to fertility-related health recommendations.

The findings of the research in the present thesis point towards the need for personalised fertility education to increase awareness of fertility and give people tailored advice about what action they need to take to reduce their risk for fertility problems. The efficacy of fertility educational interventions depends on the feasibility and acceptability of such interventions amongst target users and service providers. Therefore the aim of the present and final study was to evaluate the feasibility and acceptability of a personalised fertility awareness tool, the FertiSTAT, amongst women of reproductive age (service users) and medical and health professionals (service providers).

Barriers to Fertility Health Awareness

Low levels of fertility knowledge and fertility awareness in the population are likely contributed to by the general paucity of public education on fertility health issues. For example, the educational curriculum teaches young people about contracepting to avoid pregnancy but not about preserving fertility health and reducing risk factors that can prevent pregnancy later on, such as lifestyle (e.g., smoking, obesity) and reproductive factors (e.g., menstrual irregularity) (Department for Education, 2000). Consequently,

young people (aged 13 – 25 years) have poor knowledge about reproductive issues, answering correctly 44.4% of questions related to reproduction, with 57.5% of young people saying they have not received sufficient education about reproductive matters (Sydsjö, Selling, Nyström, Oscarsson & Kjellberg, 2006). Government health guidelines regarding fertility and pregnancy are generally about what to do if a couple is having problems conceiving (NICE, 2013) or about ensuring a healthy pregnancy and birth for pregnant women (NICE, 2008a). Guidelines do state that information about risk factors for reduced chance of conception should be offered to individuals who are trying to conceive, but again this preconception health information is embedded in guidelines for people who are having problems conceiving or are already pregnant (NICE, 2013; WHO, 2013). Routes for monitoring fertility health or obtaining information about optimising fertility before trying to conceive are less clear.

Women can obtain information about fertility and preconception health from their healthcare provider. However, in a panel study of 940 women only 22% of women reported receiving preconception health information from their healthcare provider, with 43% of women saying they had not seen, heard of read anything about preconception health recommendations (Mitchell, Levis & Prue, 2012). Focus groups to explore in depth women's beliefs about fertility and preconception health recommendations suggest that most women are unaware that seeking medical advice about planning a pregnancy (e.g., lifestyle modification, folic acid supplementation) could optimise their chance of pregnancy (Mazza & Chapman, 2010; Tuomainen, Cross-Bardell, Bhoday, Qureshi & Kai, 2013). Women view going to a general practitioner (GP) for fertility and/ or pregnancy advice as relevant only when a woman is pregnant, with many women concerned that seeking medical advice about planning a pregnancy is wasting a GP's time (Mazza & Chapman, 2013). As such, waiting for women to ask their doctor for fertility and/ or pregnancy advice may result in very few women being informed about fertility health issues prior to pregnancy. Other possibilities for raising fertility health awareness need to be explored.

An estimated 50 to 80% of women aged 18 to 44 years come into contact with primary healthcare for general health issues each year in the UK (Shannon, Alberg, Nacul & Pashayan, 2013). This presents an opportunity for practitioners to offer information about planning a pregnancy to women of reproductive age during routine general practice visits (Shannon et al., 2013). Part of counselling about planning a pregnancy could be educating people about fertility health, including factors that can

affect their chance of pregnancy. However, there may be barriers to disseminating information about fertility and pregnancy planning during general practice visits. For example, whilst most physicians agree that education about pregnancy planning is important, only 20.7% see it as a high priority in their workload and 51.4% believe that there is not enough time to provide pregnancy planning information to all women of childbearing age (Morgan, Hawks, Zinberg & Schulkin, 2006). In addition, 49.1% of physicians say that few or no patients seek advice about pregnancy planning before getting pregnant (Morgan et al., 2006), which limits opportunities for physicians to educate people about factors that can reduce chance of conception. In summary, it seems that neither patients nor physicians are engaging in preventive action to increase awareness of fertility health and reduce the likelihood of fertility problems. It is important to evaluate whether and how fertility health awareness could be promoted within a primary care setting.

As demonstrated by previous empirical work and the findings of the present thesis, people lack knowledge of fertility health, including risk factors for fertility problems. Without knowing the thresholds for when risk factors are likely to reduce their fertility, people are unlikely to know when and what action to take to safeguard their fertility (Bunting & Boivin, 2008). To be more informed about how to safeguard their fertility, people need to have access to the evidence base for fertility (NICE, 2013). However, it does not currently seem to be a norm that people are educated about fertility health and how to identify risks for reduced chance of conception when desired (Mazza & Chapman, 2010; Morgan et al., 2006; Tuomainen et al., 2013). There is a need for patient fertility education through medical practice but also wider educational initiatives to increase the public's awareness of fertility health issues. It is necessary to determine whether and how fertility health information could be disseminated via organisations involved in promoting public fertility health and education.

Even when practitioners and/ or public health campaigns have opportunities to disseminate information about fertility health, there may be barriers to communicating information in a way that actually changes people's behaviour. As indicated by the research in the current thesis and the HBM, merely telling people about risks is not enough to change behaviour. People have mental models of being insusceptible to risk that mean they will not apply risks to themselves (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990). Consequently, people are less likely to follow recommendations from a doctor to reduce their risk of adverse health outcomes such as

fertility problems (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990). For example, as demonstrated in Chapter 4 of the present thesis, women who believe that their pregnancy is immune to health complications are less likely to take folic acid supplements during the recommended periconceptional time frame (Fulford et al., 2014). To initiate behaviour change, fertility health awareness interventions need to focus not only on conveying risk information but also delivering this information in a personalised way that helps people to apply risks to their own situation.

Fertility Health Awareness Interventions: What Works?

Personalised health information is based on an assessment of an individual and so is unique to that individual, as opposed to generic health information that is not individualised or based on any kind of individual assessment (Noar et al., 2007). People may better understand their susceptibility to fertility problems with personalised fertility awareness interventions. For example, meta-analyses of health interventions show that people are more likely to take action to improve their health when they are given personalised information as opposed to generic health information (odds ratio 1.21, $N=40$ studies, Noar et al., 2007; odds ratio 1.42, $N=28$ studies, Sohl & Moyer, 2007). This may be because people are more likely to attend to and process personalised risk messages. According to the ELM, people engage in two types of processing; central route processing, in which they carefully examine the information and arguments contained within a message, and peripheral route processing, which involves forming a judgement based on cues in the message rather than on the core arguments of the message (Petty & Cacioppo, 1986). The extent of processing, or elaboration, depends on people's motivation and ability to evaluate the message (Petty & Cacioppo, 1986). People are most motivated to process the content of a message when the message is perceived as personally relevant and of significant consequence to their own lives (Petty & Cacioppo, 1986). Personalised risk messages are more likely than generic risk messages to be perceived as personally relevant and so are likely to have a greater impact on thoughts and behaviour regarding health (Noar et al., 2007).

Giving people information about their risk for fertility problems based on a personal assessment of their lifestyle and reproductive risk factors may be effective at decreasing risk behaviour. For example, in the domain of smoking cessation, one randomised controlled trial evaluated the effect of giving smokers a personal estimate of

their “lung age”, based on their chronological age and their lung function, which was used to estimate their susceptibility to lung damage (Parkes et al., 2008). The personalised intervention was compared to a control group in which participants received only a raw figure for lung function and no information about their lung age or susceptibility to lung damage. Participants given the personal estimate of “lung age” were more likely to have quit smoking 12 months later (Parkes et al., 2008). This implies that when given personalised risk information, people are more likely to reduce their risk behaviour (Parkes et al., 2008).

In addition to providing personalised risk information, fertility health awareness interventions are most effective when they provide guidance about what action to take to reduce risk (Witte & Allen, 2000). This is because without appropriate guidance people may attempt to reduce the fear produced by the risk message by denying or discrediting the information (Witte & Allen, 2000).

The research described thus far implies that the most effective fertility health awareness interventions are those that assess individual risk for fertility problems, provide personalised risk information and give guidance about what action to take to reduce risk.

The FertiSTAT: Background, development and evaluation.

The FertiSTAT (Bunting & Boivin, 2010) is the first validated evidence-based, personalised self-assessment tool for female fertility. The FertiSTAT allows women to assess risk indicators that can negatively impact on their fertility potential and receive personalised guidance about reducing these risks and seeking medical help. The 22 risk indicators refer to age, lifestyle (e.g., smoking) and reproductive (e.g., menstrual irregularity) characteristics empirically demonstrated to be associated with reduced fertility potential. The risk indicators were selected from a comprehensive literature review and a mini-Delphi consultation with reproductive experts and guidance provided by NICE (2004) fertility guidelines (see Bunting, 2008, for development studies). The FertiSTAT guidance refers to the actions needed to reduce fertility problems as recommended by NICE (2004) clinical guidance and according to current clinical practice.

The personalised nature of the risk information provided by the FertiSTAT increases the likelihood that it will change behaviour (Noar et al., 2007; Parkes et al.,

2008; Sohl & Moyer, 2007). In addition, given the alignment of the FertiSTAT with the fertility risk evidence base and current fertility health guidelines, the FertiSTAT offers a standardised approach to fertility health assessment. Further, the self-assessment nature of the tool means it can be targeted to women both within and outside a primary care setting. Quantitative and qualitative methods are needed to evaluate a health intervention (Campbell et al., 2000; Craig et al., 2008). Preliminary validation of the FertiSTAT using discriminant analysis showed that the FertiSTAT can correctly classify women according to their fertility status (currently pregnant versus trying to get pregnant for more than 12 months) with high accuracy, and comparable to medical tests of ovarian reserve that use antral follicle counts (85.8% classification rate; Bunting & Boivin, 2010). The ability of the FertiSTAT to discriminate women with fertility problems from fertile women implies that it is an effective and reliable tool for practitioners to assess risk factors for reduced fertility potential in primary care.

The feasibility of delivering the FertiSTAT and the acceptability of the tool to service users and service providers must also be tested (Campbell et al., 2000; Craig et al., 2008). For example, despite having scientific validity, a health awareness tool is unlikely to achieve beneficial outcomes if its content is perceived as unacceptable or inaccessible by users. A first step of evaluating the FertiSTAT among service users is to examine the views of childless women of reproductive age. Compared to childless women, women who have already had children may have different views and experiences about fertility and parenthood and a different approach to using the FertiSTAT. For example, women who have already had children have more positive attitudes towards children than childless women (Abbey, Andrews & Halman, 1994) and a different approach to pregnancy preparation (e.g., less likely to adhere to folic acid supplementation; Timmermans et al., 2008).

The views of healthcare professionals (service providers) on the FertiSTAT are also important. Healthcare providers are unlikely to recommend health awareness tools to patients if the tools are seen as not adding anything to practice or as increasing workload (Elwyn, Rix, Holt & Jones, 2012). It is important to evaluate the FertiSTAT among professionals working in primary care as well as professionals working in the wider domain of public health where the focus is to provide education and advice to the public about fertility health issues.

A think-aloud protocol and semi-structured interview may be an effective means of evaluating the FertiSTAT among service users and service providers. These methods

are frequently used in conjunction to evaluate health awareness tools, such as decision tools for prenatal screening, and clinical decision-making among medical professionals (Durand, Wegwarth, Boivin & Elwyn, 2012; Lundgrén-Laine & Salanterä, 2010; Fonteyn & Fisher, 1995; Ericsson & Simon, 1993). During a think-aloud protocol participants are asked to say out loud their thoughts as they use a tool (van Someren, Barnard & Sandberg, 1994), whilst the semi-structured interview is administered after having used the tool. During a semi-structured interview, the interviewer has a set of predetermined open-ended questions and other questions emerge from the dialogue between the interviewer and the interviewee (DiCicco-Bloom & Crabtree, 2006). The think-aloud protocol is believed to supplement the semi-structured interview because it captures more immediate cognitive and emotional reactions that may be less readily verbalised retrospectively (Durand et al., 2010; Ericsson & Simon, 1993; Lundgrén-Laine & Salanterä, 2010). Semi-structured interviews are well-suited to examining in depth beliefs and opinions about a particular issue, particularly sensitive issues (Barriball & While, 1994; Guassora & Tulinius, 2008), such as decision-making about fertility. In addition, the semi-structured nature of the interview means that researchers can follow-up interesting and relevant issues raised by respondents and ask for clarification of answers (Barriball & While, 1994).

To evaluate the FertiSTAT it may also be important to investigate beliefs about susceptibility to fertility problems. It is known that people who feel insusceptible to poor health outcomes are less likely to take action to improve their health (e.g., Bryan et al., 1997; Conner, Kirk, Cade & Barrett, 2001; Fulford et al., 2013 [Chapter 2]; Fulford et al., 2014 [Chapter 4]; Kim et al., 2008). However, less is known about the beliefs that underpin mental models of susceptibility. According to the HBM, beliefs about susceptibility would play a key role in women's evaluations of the FertiSTAT. For example, women who feel insusceptible to fertility problems are predicted by the HBM to be less likely to undergo risk assessment and preventive health action (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990), which may influence their interpretations of a fertility risk factor assessment tool such as the FertiSTAT. Semi-structured interviewing is an opportune method for examining beliefs about health issues (Barriball & While, 1994; Guassora & Tulinius, 2008), such as beliefs about susceptibility to fertility problems.

The Present Study

The aim of the present study was to evaluate the acceptability and feasibility of the FertiSTAT among target users and service providers. Target users were women who had not yet started trying to conceive and women who had started trying but were not yet pregnant, all of whom were childless. This was to examine views and attitudes towards the FertiSTAT among women at different stages of reproductive life.

To obtain the opinions of primary care professionals on the FertiSTAT and determine whether there is a perceived need for the FertiSTAT in primary care practice, a sample of GPs was asked to evaluate the FertiSTAT. To examine the wider applications of the FertiSTAT and whether there is a perceived need for the FertiSTAT in public health education initiatives, a sample of professionals from public health organisations evaluated the FertiSTAT.

Among all participants, the FertiSTAT was evaluated via a think-aloud protocol and semi-structured interview. The semi-structured interviews also examined beliefs about susceptibility to fertility problems.

Methods

Participants

The final sample comprised 14 women of reproductive age, seven GPs and three public health professionals. Women were recruited via an advertisement to members of Cardiff University or the Cardiff Community Panel, which is a research panel set up by the School of Psychology, Cardiff University of individuals willing to receive invitations to research studies at the university. At the time of recruitment the Cardiff Community Panel included 788 people aged 18 years and older. To be eligible women had to be childless (i.e., no biological, adopted or step-children). Two groups of women were recruited. The first group comprised childless women who were not currently trying to get pregnant, had never tried to get pregnant and had never been pregnant (non-triers, $n = 10$). The second group comprised childless women who were currently trying to get pregnant with their first child (triers; $n = 4$). The eligible age range for the non-triers was 26 to 44 years. The lower age limit was applied to ensure the sample comprised

women for whom fertility and pregnancy planning were likely to be relevant now or in the future because they were close to or older than the mean age of first birth in the UK (28.1 years, ONS, 2013). The upper age limit was applied to include women who were approaching, but not yet reached, the end of their natural reproductive life (ESHRE Capri Workshop Group, 2005). The eligible age range for the triers was 18 years or older (minimum age used to avoid requirement for parental consent). Members of the Cardiff Community Panel are paid a rate of £6 per hour for participating in research. The present study lasted 30-40 minutes so all participants in the women of reproductive age group were paid £5 and travel costs were reimbursed.

Seven GPs working in posts split between medical practice and academic positions and were recruited via colleagues working in the same academic department. Three public health professionals were recruited via academic colleagues who knew the participants via professional links. During the consenting procedure participants were informed that the views expressed by them during the think-aloud task and semi-structured interview would be reported anonymously in the write-up of the study. Public health professionals additionally consented that (a) the views expressed by them during the study would represent their views and not the views of the organisation they worked for, (b) no information that could identify them personally (e.g., position within organisation) would be used in any publications that cite the views expressed by them during the study, and (c) the organisation for whom they worked would not be named in publications of the study. Public health professionals provided a description with which to reference their organisation in the write-up of the study (as shown in Table 6.3). The 10 GPs and public health professionals were entered into a raffle prize draw for a gift voucher worth £50 and travel costs were reimbursed.

Materials

FertiSTAT.

A laminated A4 version of the FertiSTAT (Figure 6.1) was used in the present study. The FertiSTAT comprises 22 risk indicators; two items referring to age, eight items referring to reproductive history, 10 items referring to lifestyle, and two items that are risk factors uniquely for male fertility problems (undescended testicles and mumps after puberty). The layout of the FertiSTAT is in two sections. Section 1 comprises the risk

indicators for reduced fertility colour-coded according to type of risk. Instructions on the FertiSTAT ask women to tick all the risk indicators that apply to them. Section 2 of the FertiSTAT comprises four categories of guidance, colour-coded to match the associated risk indicators. The guidance informs women of what to do to safeguard their fertility. The guidance colour-coded blue applies to women who have been trying to conceive for less than 12 months (or less than 6 months if they are older than 34 years of age) and who have not ticked any other risk indicator. This guidance specifies that women have not ticked any of the FertiSTAT risk indicators but should continue to monitor their fertility because their situation can change. The guidance colour-coded yellow applies to women who ticked a lifestyle risk factor and specifies that the person should consider changing their lifestyle habits because these factors affect fertility. The guidance colour-coded orange applies to women who tick a risk factor that one might want to go and speak to a medical doctor about. This guidance specifies that the person should consider seeking medical advice, especially if they are trying to get pregnant, because these factors impact fertility. Finally, the guidance colour-coded red applies to women who tick a risk factor that one would most definitely need to go and speak to a doctor about. This guidance specifies that the person needs to go and seek medical advice if they are trying to get pregnant. For women with a male partner, the FertiSTAT also includes instructions in a separate section to assess his fertility. If women tick that their partner has either had mumps after puberty or undescended testicles then they are advised that he needs to go and speak to a doctor about his situation when they start trying to get pregnant. Women who tick that their partner engages in any of the lifestyle factors (except weight) are advised to follow the same guidance as for women (description of FertiSTAT adapted from Bunting & Boivin, 2010).

Think-aloud task.

During a think-aloud protocol a practice or ‘warm-up’ task is advised before the actual think-aloud task to get participants used to communicating their thoughts about an object with which they are familiar (Ericsson & Simon, 1993; Lundgrén-Laine & Salanterä, 2010). In the present study, a wrapped chocolate bar was used as the familiar object during the warm-up task. A chocolate bar was chosen because it is an object with which the majority of people are familiar and about which they should be able to readily verbalise their thoughts. During the warm-up task participants were encouraged to speak

out loud whatever thoughts came to mind about the chocolate bar (van Someren et al., 1994). The researcher prompted participants (“Is there anything else you would like to say?”) only if participants stopped talking (van Someren et al., 1994). The task continued until participants had no new thoughts to speak about the chocolate bar (individual data saturation).

The FertiSTAT (Figure 6.1) was used as the focal object during the actual think-aloud task. As with the warm-up task, participants were encouraged to speak out loud whatever thoughts came to mind about the FertiSTAT (van Someren et al., 1994). Participants were asked to wait until the think-aloud procedure was complete before filling out their answers on the FertiSTAT. This was to avoid asking participants to speak out loud about their responses to the sensitive items on the FertiSTAT (e.g., related to history of STIs, sexual behaviour, illicit drug use). Again, participants were prompted during the think-aloud protocol only if they stopped talking, and the task continued until participants had no new thoughts to speak about the FertiSTAT.

Do you know about your fertility?

If you're planning to have children now or in the future you need to start taking care of your body right now. Calculate your FertiSTAT score and find out what you can do for your fertility. You can calculate your FertiSTAT score whether you are currently trying to get pregnant or not. If you are not trying to get pregnant, choose your age group and consider yourself trying for under 6 months in the 'About trying' section.

1. Tick all the coloured boxes that apply to you

<p>About trying to get pregnant:</p> <p><input type="checkbox"/> 34 years of age or younger and trying for 0 – 12 months</p> <p><input type="checkbox"/> Over 34 years of age and trying for 0 – 6 months</p> <p><input type="checkbox"/> Over 34 years of age and trying for 6 or more months</p> <p><input type="checkbox"/> Any age and trying for more than 12 months</p>	<p><input type="checkbox"/> My menstrual cycle lasts less than 21 days (when I am not using contraceptives)</p> <p><input type="checkbox"/> My menstrual cycle lasts more than 35 days (when I am not using contraceptives)</p> <p><input type="checkbox"/> I suffer from endometriosis</p> <p><input type="checkbox"/> I have had pelvic inflammatory disease (PID)</p> <p><input type="checkbox"/> I do not have a period (when I am not using contraceptives)</p>	<p><input type="checkbox"/> I drink more than 14 units of alcohol per week (1 unit = a small glass of wine, ½ pint of beer, a single measure of a spirit)</p> <p><input type="checkbox"/> I drink more than 7 units of caffeine per day (1 unit = a cup of coffee. ½ unit = a cup of tea or a can of soft drink such as cola)</p> <p><input type="checkbox"/> I smoke marijuana frequently (more than four times a week)</p> <p><input type="checkbox"/> I have had a sexually transmitted infection</p> <p><input type="checkbox"/> I am more than 13 kilos (28 pounds/2 stone) overweight</p> <p><input type="checkbox"/> I have used class A drugs in the past (e.g., heroin, cocaine, ecstasy)</p> <p><input type="checkbox"/> I am currently taking anabolic steroids (for non-medical uses)</p>
<p>Your reproductive history:</p> <p><input type="checkbox"/> I suffer from severe period pains</p> <p><input type="checkbox"/> I have had pelvic surgery</p> <p><input type="checkbox"/> My menstrual cycle is unpredictable. My period often comes more than 5 days earlier or later than expected (when I am not using contraceptives)</p>	<p>Your lifestyle:</p> <p><input type="checkbox"/> I have unprotected sex with multiple partners</p> <p><input type="checkbox"/> I smoke regularly (more than 10 cigarettes per day)</p> <p><input type="checkbox"/> I cannot cope with the stress I am currently experiencing</p>	

To consider your male partner's fertility status complete the lifestyle section (except weight) for him and follow the guidance for these factors. If your partner has (or has had) undescended testicles ☐ or mumps after puberty ☐ then he needs to go and see his doctor for further investigation about his situation when you start trying to get pregnant with him.

2. What does your FertiSTAT score mean?

In the meters below circle the number that equals the boxes you have ticked for each colour category and find out what action you need to take*. If your answer falls into more than one category please read all the advice.

<p>Blue</p> <p>I only ticked Blue boxes</p> <p>You have not checked any of our risk factors but keep monitoring your fertility with FertiSTAT because your situation may change and female fertility decreases after the age of 34 years.</p> <p>1 2</p>	<p>Yellow</p> <p>I ticked one or more Yellow boxes</p> <p>You should consider changing your lifestyle habits, all these factors have an impact on your fertility, whether or not you're trying to conceive. If you're not trying to get pregnant you should know that female fertility decreases after the age of 34 years.</p> <p>1 2 3 4 5 6</p>	<p>Orange</p> <p>I ticked one or more Orange boxes</p> <p>These factors may be important to your fertility. Consider seeking medical advice if you're trying to get pregnant. Your doctor may be able to give you guidance and recommend any action if needed. If you're not trying to get pregnant you should know that female fertility decreases after the age of 34 years.</p> <p>1 2 3 4 5 6 7 8 9</p>	<p>Red</p> <p>I ticked one or more Red boxes</p> <p>If you're trying to get pregnant, you need to go and see your doctor for further investigation about your situation. Drug and anabolic steroid use for non-medical reasons reduces fertility and you should consider changing these lifestyle habits. If you're not trying to get pregnant you should know that female fertility decreases after the age of 34 years.</p> <p>1 2 3 4 5</p>
--	--	---	--

*The more ticks you have within each colour category the greater the need to take action if you are trying to get pregnant.

www.fertistat.com ©Cardiff University with guidance from ACT

Figure 6.1. The FertiSTAT.

Semi-structured interview.

The semi-structured interview (see Appendix J for the full interview schedule) was developed based on the literature on health tool evaluation and risk perception. The broad topics addressed by the interview were the same across participants but individual questions were adapted based on participant status (i.e., woman of reproductive age, GP or public health professional). The semi-structured interview addressed six main topics: (1) *Practicality*. This section was about practical aspects of using the FertiSTAT, including ease of use of the tool and comprehension of the instructions (e.g., “How did you find following the instructions?”). (2) *Acceptability*. This section was about how acceptable and believable the FertiSTAT (and information contained within the FertiSTAT) was (e.g., “How believable was the information (e.g., risk factors) presented in the FertiSTAT?”). (3) *Perception of the FertiSTAT’s effects and impact*. This section was about what participants thought was the likely impact of the FertiSTAT (e.g., “What do you think or feel are the advantages or disadvantages to women in general in using the FertiSTAT?”). (4) *Endorsement*. This section was concerned with whether participants would support the use and dissemination of the FertiSTAT (e.g., “What would you tell other women/ colleagues about the FertiSTAT?”). (5) *Wider application and implementation*. This section assessed how participants felt the FertiSTAT would best be used (e.g., “How do you think the FertiSTAT would fit with other methods of testing fertility?”). (6) *Norms about preparing for pregnancy*. The focus of this section varied according to participant status. For GPs and public health professionals, the questions were about what information and advice participants normally gave patients who were preparing for pregnancy (e.g., lifestyle advice, folic acid supplementation). For women of reproductive age, the questions were about what participants would do in preparation to start trying to get pregnant if they wanted to have a child.

The interview also included two questions measuring women’s beliefs about susceptibility to pregnancy-related health complications, developed based on previous research and the HBM (Abraham et al., 2005; Rosenstock et al., 1990). Specifically, women were first asked about other women’s susceptibility to pregnancy complications (“Suppose a woman is trying to get pregnant and does not follow the National Health Service [NHS] recommendations about fertility and trying to get pregnant, how do you think it would affect her pregnancy and/or her baby?”). Women were then asked about

their own susceptibility to pregnancy complications (“Suppose you were trying to get pregnant and did not follow these recommendations, how do you think it would affect the pregnancy and/or the baby?”).

Background information questionnaire.

For women of reproductive age, the background information questionnaire measured background factors (e.g., age), childbearing intentions and actions, and current health status. For the GPs and public health professionals the questionnaire measured background factors and professional characteristics (e.g., years working in current role, use of health awareness tools in workplace, number of patients seen in practice per year).

Procedure

Data collection was performed by two researchers (the author of the present thesis, BF, and another researcher LB)⁸. The study received approval from the Ethics Committee of the School of Psychology, Cardiff University. The advertisement to members of Cardiff University and the email sent to eligible panellists comprised study information and an email address to contact to take part. Five women responded to the Cardiff University advertisement and agreed to take part in the study. A total of 95 panel members (12.06% of the panel) met the screening criteria of being a childless woman aged 26-44 and these were emailed with study information and eligibility criteria. Five emails were undeliverable. Nine women from the panel (9.47% of those emailed) agreed to take part in the study. GPs and public health professionals were emailed with study information and an email address to contact to take part. Before commencing the study participants were given detailed study information and informed consent was obtained.

The study involved five main phases, as shown in Figure 6.2. During phase 1, participants undertook the think-aloud warm-up task. In phase 2, participants commenced the actual think-aloud task using the FertiSTAT. In phase 2a the women of

⁸ Qualitative data collection and data analysis are frequently performed by two researchers such that the consistency and replicability of the results can be verified. Researchers involved in analysing the qualitative data are recommended to be present during data collection as data collection is an integral part of becoming familiar with the content of the data and forming initial analytic interests or thoughts (Braun & Clarke, 2006).

reproductive age ($n = 14$) completed the FertiSTAT. In phase 3, all participants took part in the semi-structured interview, with each interview lasting approximately 30 minutes. In the fourth and final phase, participants completed the background information questionnaire.

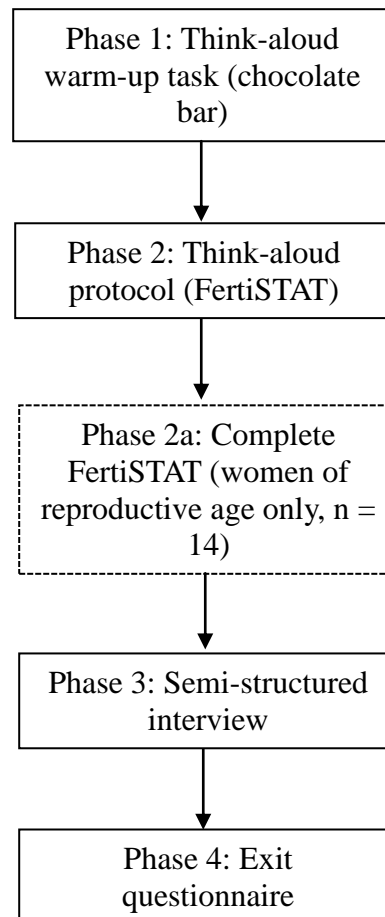


Figure 6.2. Flow-chart outlining study procedure. Dashed line indicates element completed only by women of reproductive age.

Data Analyses

The think-aloud protocol and semi-structured interviews were audiotaped for transcription. The data were anonymised and transcribed by an independent transcriber. The data from the think-aloud protocol and semi-structured interviews were analysed using thematic analysis, which identifies and analyses patterns, known as themes, within the data (Braun & Clarke, 2006). Data analysis was performed by the two

researchers involved in data collection (BF and LB; see footnote 8 for the rationale). The thematic analysis was carried out according to the six phases recommended by Braun and Clarke (2006). The first phase of the analysis involved reading and becoming familiar with the data. In the second phase, each researcher (BF and LB) separately derived codes for the data according to the ideas or meanings perceived in the data of each group of participants (women of reproductive age, GPs, and public health professionals). The proportion of shared and unique codes between researchers was used to assess consistency and replicability of the coding. Codes generated that had the same name (e.g., “empowerment” and “empowering”) or meaning (e.g., “motivates action” and “encourages action”) were considered to be shared, all others were considered to be unique codes. When unique codes were derived, each unique code was discussed to reach a consensus on whether it conveyed a unique idea or meaning perceived in the data (yes = retain code, no = discard code). The unique codes were separated into two groups according to which author derived them and the groups of codes were examined to determine whether they represented underlying themes. If the groups of unique codes represented different underlying themes, this might indicate that the authors were sensitive to different types of theme.

In the third phase the codes for each group of participants were organised into potential underlying main themes. In the fourth phase, the potential themes for each group of participants were reviewed by checking that the codes for each theme formed a coherent pattern and that the themes reflected the meanings in the dataset as a whole. In the fifth phase, the themes were defined and named. The sixth and final phase comprised the write-up of the thematic analysis (Braun & Clarke, 2006).

In the Results section, quotations are used to illustrate the meanings that participants attached to a theme. Quotations are presented using the following notation system:

- i) [...] omission within the textual data. Some part of the quotation is not used in the illustrative text because it is irrelevant to the argument.
- ii) (text) addition to the textual data. Where quotations were not grammatical additional text was added in parenthesis for ease of reading and comprehension of the illustrative text.

Each quotation was followed by participants' unique identification number and group (in parentheses).

Results

Part I: Sample Characteristics

Characteristics of women of reproductive age.

Characteristics of the women are displayed in Table 6.1 (non-riers; NT) and Table 6.2 (riers; T). As shown in Table 6.1, mean age of the non-riers was 33.6 years ($SD = 5.5$; range = 27 – 42 years). The majority of the non-riers had at least a university education ($n = 9$, 90%), were married or cohabiting ($n = 7$, 70%) and wanted children in the future ($n = 6$, 60%). Nine (90%) of the non-riers scored positive for at least one infertility risk factor on the FertiSTAT, with five women having at least one lifestyle risk, five women having at least one reproductive risk that they might want to discuss with a doctor when ready to conceive, and two women having a reproductive risk that would definitely warrant seeking medical advice now. Two of the non-riers (20%) reported that they had very good or excellent health with the rest reporting fair or good health and two of the non-riers reported having a serious medical illness or chronic disease (data not shown in Table).

Table 6.2 shows that the mean age of the riers was 35.3 ($SD = 6.4$; range = 30 – 43 years). Three out of the four riers (75%) had at least a university education and all were married or cohabiting. Three women had been trying to get pregnant for less than 12 months (range three to eight months) and one woman had been trying for three years, with two women having sought medical advice in relation to their fertility. Three of the riers scored positive for at least one infertility risk factor on the FertiSTAT, with one woman having lifestyle risks, two women having reproductive risks that she might want to discuss with a doctor, and one woman having a reproductive risk that would definitely warrant seeing a doctor about. One woman reported having excellent health with the rest reporting fair or good health and one woman reported having a serious medical illness or chronic disease (data not shown in Table).

Characteristics of general practitioners and public health professionals.

Table 6.3 presents the sample characteristics of the 10 professionals. For confidentiality reasons the organisations for whom the public health professionals (HP) worked are not named. As described in Table 6.3, two public health professionals worked for charities that provided advice, information and support for infertility and sexual health. The third public health professional worked for an inter-governmental organisation that provided advice, information and support on international health issues.

On average the GPs had been qualified for 8 years ($SD = 11.0$; range = 1 – 32 years) and the public health professionals had been working at their organisations for 10.7 years ($SD = 5.0$; range = 6 – 16 years). The public health professionals worked full time whilst the GPs worked on average 3.2 days ($SD = 1.8$) per week in practice (remaining time spent in academic posts). Each year, the GPs estimated that they saw on average 4785 patients (range = 2800 – 8500), with an estimated mean of 23 patients consulting for pre-conception advice prior to trying to get pregnant (range = 2 – 100) and 26 patients consulting for difficulties getting pregnant (range = 10 – 50). Five (71.4%) GPs had undertaken specialist training (e.g., family planning, substance misuse). Overall, five GPs stated that that they currently used health promotion tools in their medical consultations whilst all three public health professionals indicated that their organisation promoted health awareness tools (e.g., tools for reducing alcohol consumption, assessing cardiovascular risk).

Table 6.1.

Sample characteristics and FertiSTAT risk profiles of the women not trying to get pregnant (non-triers; n=10).

Non-triers	Age	University education	Married/cohabitating	Want children	Ideal age to start trying (years)	FertiSTAT (number of risks)		
						Lifestyle risks (yellow)	Reproductive risks, might want to discuss with doctor (orange)	Reproductive risks, definitely need to see doctor (red)
NT01	29	No	Yes	No	NA	1	0	0
NT02	36	Yes	Yes	Yes	38	0	0	0
NT03	41	Yes	Yes	No	NA	0	2	1
NT04	27	Yes	Yes	Yes	32	0	1	0
NT05	36	Yes	No	No	NA	1	3	0
NT06	*	Yes	Yes	Yes	*	0	0	2
NT07	42	Yes	No	Yes	Undecided	1	1	0
NT08	33	Yes	Yes	Yes	35	2	0	0
NT09	29	Yes	Yes	Yes	Undecided	1	0	0
NT10	29	Yes	No	Undecided	Undecided	0	1	0

Note. A score of 0 in all FertiSTAT risk categories means the participant scored no risk factors. NA = not applicable.

*Did not disclose.

Table 6.2.

Sample characteristics and FertiSTAT risk profiles of the women trying to get pregnant (triers; n=4).

Women trying to get pregnant	Age	University education	Married/ cohabitating	Time trying (months)	Medical advice sought	FertiSTAT (number of risks)		
						Lifestyle risks (yellow)	Reproductive risks, might want to discuss with doctor (orange)	Reproductive risks, definitely need to see doctor (red)
T01	30	Yes	Yes	8	Early Pregnancy Unit (previous miscarriage)	0	2	0
T02	38	No	Yes	3	None	2	2	0
T03	43	Yes	Yes	36	General Practitioner	0	0	1
T04	30	Yes	Yes	6	None	0	0	0

Table 6.3.

Sample characteristics of the general practitioners and public health professionals (n=10).

Professionals	Age	Gender	Professional status/ organisation	Years qualified	Estimated average no. patients seen per year	Estimated no. patients consulting for pre-conception advice	Estimated no. patients consulting for difficulties conceiving
GP01	30	F	General Practitioner	1.50	2800	10	10
GP02	33	F	General Practitioner	2.50	3800	20	50
GP03	58	F	General Practitioner	32.00	6000	10	17
GP04	34	F	General Practitioner	10.00	8500	2	23
GP05	39	M	General Practitioner	3.00	5000	100	25
GP06	31	F	General Practitioner	1.00	2800	6	26
GP07	34	F	General Practitioner	6.00	4600	15	30
				Years working in organisation			
HP01	60	F	Charity that provides advice, information and support for people experiencing infertility	10	NA	NA	NA
HP02	53	F	Sexual health charity	16	NA	NA	NA
HP03	59	F	Inter-governmental organisation that provides guidance on international health issues	6	NA	NA	NA

Note. No. = number, GP = general practitioner, HP = public health professional, NA = non-applicable, M = male, F = female.

Part II: Thematic Analysis

As shown in Table 6.4, a total of 132 codes were generated across participant groups. Of the 43 codes generated for women of reproductive age, 33 (76.74%) were shared between BF and LB; of the 45 codes generated for the GPs, 39 (86.67%) were shared; and of the 44 codes generated for the public health professionals, 31 (70.45%) were shared. Of the total codes ($n = 132$), 13 unique codes were generated by BF and 16 unique codes were generated by LB (total unique codes $n = 29$). There was no apparent underlying theme or pattern to the unique codes derived by each author, providing no indication that the authors were sensitive to different types of theme. After discussing whether each unique code conveyed a unique idea or meaning perceived in the data, all 29 unique codes were retained.

From the individual codes, it was possible to derive six themes in each group of participants, with 100% of the shared and unique codes perceived to belong to at least one of the derived themes. Therefore the total number of themes derived for the whole sample was 18, comprised of a total of 132 codes ($n = 43$ codes for women of reproductive age, $n = 45$ codes for GPs, $n = 44$ codes for public health professionals). There was 100% agreement between the authors on the organisation of codes into themes for each participant group. Theme maps displaying the codes representing each theme are shown in Appendices K, L and M.

Table 6.4.

Coding the data and deriving themes in the thematic analysis.

	Participant n	Quotations n	Codes n	Themes n
Total	24	1,998	132	18
Women of reproductive age	14	1,014	43	6
General Practitioners	7	636	45	6
Public health professionals	3	348	44	6

The themes for each group of participants are listed in Table 6.5. In the following section, themes are described separately for each group of participants: (a)

women of reproductive age, (b) GPs, and (c) public health professionals. A final section summarises the main similarities and differences in the themes between groups of participants.

Table 6.5.

Themes for each group of participants

Women reproductive age	General Practitioners	Public health professionals
Attention grabbing	Busy but draws me in	Busy but draws me in
Credible tool	Facilitates the doctor-patient relationship	Trade-off of use for professionals and women
Empowering	Trade-off of use for GPs	External influences and norms
Norms impact on decision-making	Trade-off of use for women	Knowing but not doing
Knowing means feeling	Motivates action but needs more signposting	Motivates action but needs more signposting
Current health messaging is not effective	Multiple applications and ways to disseminate	Multiple applications and ways to disseminate

Themes for women of reproductive age.

Thematic analysis of the data for women of reproductive age revealed six key themes: (a) Attention grabbing, (b) credible tool, (c) empowering, (d) norms impact on decision-making, (e) knowing means feeling, and (f) current health messaging is not effective.

Attention grabbing (9 codes). Women’s initial reaction to the FertiSTAT was that it was visually pleasing and well laid-out. The colour scheme was felt to be a good way to represent level of risk: “I liked the colour scale ‘cos that’s quite easy to kind of see straight away the more important ones” (T01, trier); “red is a danger” (NT05, not trying). Participants indicated that the FertiSTAT captured their attention (e.g., “the title

grabs you straight away”; NT08, not trying) and made them want to read more. For example:

It’s tidy, it’s arranged neatly, I wouldn’t look away [...] it’s quite, draws you [...] it tells you exactly what it is, stands out immediately, so that’s helpful as well. (NT01, not trying).

Some women felt the FertiSTAT was initially overwhelming because it contained a lot of information and was “quite busy” (NT06, not trying). After familiarising themselves with the tool, participants seemed to find the tool straightforward and easy to use; for example, “Once you kind of figure out what you’re doing it’s perfectly easy to navigate” (NT10, not trying).

Women also felt that the structure of the FertiSTAT made it a concise and compelling tool to use. For example:

It’s well structured ‘cos you’ve got your questions there and then at the bottom there’s the feedback immediately [...] sometimes you look at things like that and there’d be pages and pages of things to get through which might put you off using it [...] (the FertiSTAT) gives you an immediate sort of feedback and all on one A4 side (NT08, not trying).

Credible tool (5 codes). The FertiSTAT was perceived to be a credible tool that provided impartial and objective information about fertility. The origin of the FertiSTAT was seen as scientific (“you see a tool that’s come from [...] scientific research”; NT08, not trying) which gave women confidence in the information provided by the tool (“if these statements are being put down then it’s because research has shown that they can affect fertility”; NT08, not trying). Women felt that nowadays they were bombarded with health messages that persecuted them for their lifestyle choices without providing any explanation or scientific justification. For example, one participant who was a current smoker felt that the FertiSTAT provided a comprehensive assessment of fertility as opposed to making a judgement based on just one aspect of a person’s lifestyle:

(The FertiSTAT) doesn't seem to judge people too much either [...] it's [...] taken loads of things into consideration, not just 'oh you smoke' (NT01, not trying).

The FertiSTAT was widely seen as the first step for assessing fertility before seeking medical assessments such as ovulation tests (e.g., "I think (the FertiSTAT) should be coming before (ovulation tests) because you need to be doing (the FertiSTAT) first, to increase your chances of ovulating and cycling correctly" T02, trier). Additionally, women expressed doubt at the credibility of shop-bought fertility testing kits (e.g., "I think a lot of things you can buy in a shop, in my opinion, are trying to make money from you" NT05, not trying).

Empowering (5 codes). Women felt that the FertiSTAT empowered them to take action to improve their fertility and chances of conception. Many women said that they had been thinking about seeking medical help in relation to their fertility for a while and that the FertiSTAT prompted them to do so (e.g., "you take period pains for granted and you don't even pay any attention and maybe you should pay a bit more attention to it or maybe see the doctor about it, which is something I've been thinking about for a while" NT05, not trying). The apparent delay in health action also applied to lifestyle changes. For example, one woman who was trying to get pregnant talked about difficulties in motivating herself to lose weight ("we know all these things [...] it's putting it into practice, my husband and I both keep saying we should really do something about it because obviously we're trying for children and we don't want to be overweight parents" T01, trier).

Women felt that the FertiSTAT would give them confidence to speak to a doctor about their fertility concerns. When talking about engaging with medical professionals for fertility-related issues, some women described this as quite a daunting prospect, making reference to the fear of the "white coat" and the belief that "doctors hate patients who go and read things on the internet" (NT07, not trying). The FertiSTAT was believed to provide a justification for going to see a doctor as well as having the potential to facilitate the relationship between doctors and patients. For example:

(The FertiSTAT) breaks the ice doesn't it, it kind of enables them to think 'right, there's a question there that I have' and to feel confident about talking to a

medical professional about it because y’know [...] maybe the woman or the man thinks ‘oh well, we won’t get laughed at now ‘cos we’ve seen that this is a factor and we’ve seen it on paper’, and I suppose it breaks down any embarrassment they may feel about it as well (NT07, not trying).

Whilst the FertiSTAT seemed to make participants feel empowered to take action to optimise their fertility, 11 out of the 14 women expressed the view that action was only necessary when they started trying to conceive. It emerged that women gave little thought to fertility before they started trying to get pregnant (e.g., “it’s not something you just think of out of the blue [...] unless you’re obviously trying to have a kid” NT04, not trying). Even the triers said they paid more attention to the FertiSTAT because they were currently trying to get pregnant (e.g., “if I probably had no thought of wanting to get pregnant in the next two or three years maybe I would have passed over (the FertiSTAT) ‘cos you don’t think about fertility really that much”; T04, trier).

In general women assumed that they would have no problems in getting pregnant and that a ‘dawning of awareness’ of potential fertility problems only comes when efforts to conceive are unsuccessful. For example:

At the beginning you think (conception is) going to happen, you wouldn’t automatically look, but I think once, if it doesn’t happen straight away to you, you do start looking for things and you think ‘oh gosh’, and then you read that you’re not meant to go and see your GP for the first year or something, it does make you think ‘oh, there’s not much you can do but try’ (T04, trier).

Some women felt that the FertiSTAT was applicable only if and when their efforts to conceive were unsuccessful (e.g., “it’s a good tool for somebody who’s already not conceiving and wondering why” NT10, not trying). On reflection, women acknowledged that the FertiSTAT could benefit women who were not currently trying to get pregnant (“this is something you could do even if you’re not actively trying to get pregnant [...] if you were interested in just looking after your fertility” NT09).

Norms impact on decision-making (8 codes). Ten out of the 14 women made reference to personal and social norms that seemed to affect their decision-making about fertility and preparing for pregnancy. Personal norms referred to behaviours, events and

characteristics that women perceived as usual for them (e.g., I am healthy, I never get ill), whilst social norms referred to perceived behaviour and beliefs in others (e.g., other people engage in this behaviour often).

One participant who was trying to get pregnant talked about her struggle to lose weight and her reluctance to seek advice from a doctor. She made reference to personal norms of not needing the doctor often and social norms of women having pregnancies frequently without medical input:

Myself and my husband we don't go to the doctors very much, and so I don't think we, because women do it (pregnancy) so much I don't think I felt I needed to go because I thought well I don't go to the doctor unless it's extreme [...] I think it was that kind of don't want to be seen as wasting time at the doctors, when they're very busy, on something that women do every day (T01, trier).

When asked about their beliefs about susceptibility to pregnancy-related health complications, women were doubtful as to their own and others' risk of poor obstetric outcomes. Women described social norms of pregnancy occurring despite unhealthy maternal lifestyle, which led them to doubt whether NHS fertility recommendations were of any benefit:

I'm kind of sceptical about how much of a difference all of this stuff makes if it's only in moderation, mainly because I know, for example, my mum and plenty of my friends' parents and stuff may have smoked and drank when there were no sort of regulations (NT02, not trying).

I know people who've had quite unhealthy lifestyles whilst being pregnant, sometimes because they didn't know they were pregnant, and they just turned out fine (NT09, not trying).

Social norms of pregnancy occurring despite suboptimal health seemed to contribute to a reluctance to modify one's own risk factors. For example, when talking about difficulties motivating herself to lose weight, one trier said:

It's difficult 'cos I also have friends, who have children, who are quite overweight, more so than myself and my husband so you think 'oh well they've managed it (to get pregnant)' (T01, trier).

The personalised risk information provided by the FertiSTAT seemed to challenge norms and encourage women to apply risks to themselves. For example, in relation to the age risk factor (fertility declines > age 34), several women described their surprise at learning of the threshold for age affecting fertility and started to consider how this risk factor might impact their own chances of getting pregnant. For example:

I think I already knew about the age thing but I think having it in writing and saying it decreases after the age of 34 did give me a bit of a shock, 'cos I've got a lot of friends who are older mothers being late 30's so I'd always assumed that I was fine for it [...] but that kind of, not scared me, but I did kind of think, 'oh, maybe I should get moving' (T01, trier).

Women felt that it was a norm for fertility to be considered a women's issue and expressed a desire for men to be more involved in fertility (e.g., "when talking about fertility it's always the focus is on the woman but then it can just as easily be the man that's the person who might end up as being proved to have the problem" NT07, not trying). At the same time, women felt that fertility was a secretive topic ("it's a subject nobody talks about" T04, trier). The FertiSTAT was seen as having the potential to make fertility a more 'talked about' topic and initiate much needed discussions about fertility (e.g., "I definitely think (the FertiSTAT) would be helpful because I think it's a time that someone wants information because you're just not given any information and you don't really speak to anyone about it"; T04, trier).

Knowing means feeling (9 codes). Knowing means feeling refers to how gaining knowledge about fertility can trigger emotions and feelings about fertility, such as fear, worry or relief. The interviews highlighted gaps in women's knowledge about fertility. For example, women had often heard of the risk factors on the FertiSTAT but were not aware of the critical thresholds for when these factors affect fertility (e.g., they knew that fertility declines with age but not that the decline occurs after age 34). Participants also seemed to rank risk factors in terms of their importance; most women

were aware that smoking and drinking affected fertility but had given little consideration to other factors (e.g., “you assume things like smoking is not a good thing to do [...] weight I hadn’t thought about, stress was probably something I hadn’t thought about before” T01, trier). In addition, only four women (two who were not trying to get pregnant, two women who were trying to get pregnant) reported being aware of the NHS recommendations for fertility and trying to get pregnant.

After using the FertiSTAT, women reported feeling able to make an informed decision as opposed to being coerced into making health changes (e.g., “(The FertiSTAT) enables people to address (risks) and make choices”; “it’s not sort of ordering you what to do”; NT07 and NT01 respectively, not trying). However, even when women were aware that they had a fertility risk factor, they often held beliefs about being insusceptible to fertility problems. For example, one woman over the age of 34 believed that the fact that she did not tick any of the lifestyle or reproductive risk factors on the FertiSTAT compensated for age-related fertility decline:

Because I am over 34 obviously (the FertiSTAT has) brought attention to something I did already know, that my fertility will decrease, but at the same time that’s at the moment not a major problem because I don’t have any of these (other) risk factors (NT02, not trying).

Women felt that knowing more about their fertility could trigger an emotional reaction, whether the reaction was reassurance or concern. For example, some women reported that the FertiSTAT reassured them about their fertility (e.g., “it’s quite a reassuring thing to know that I don’t seem to tick any of those bad boxes” NT10, not trying). Other women expressed a mixture of relief at not having ticked the most severe FertiSTAT risk factors and concern that there were actions they should take to improve their chances of conceiving (e.g., “I don’t think I’ve ticked any red boxes so I don’t think I’m in that category, but I did tick blue, yellow and orange boxes so there is a variety of situations that need to be addressed” T02, trier).

Current health messaging is not effective (7 codes). In general, women felt that government health messages were overwhelming and constant, which made women pay less attention to them (e.g., “It’s general government now about everything from health to weight to drink, it’s just always there and I wonder whether I’m tuning it out now

‘cos it’s just constant”; NT05, not trying). In addition, current government health messages were not felt to elicit the emotions needed to motivate behaviour change (e.g., “A sterile kind of advert or poster in a doctors surgery or something like that [...] doesn’t have any emotion to it; I think you have to have some sort of empathy or feeling”; NT07, not trying). Participants also referred to the confusion caused by conflicting messages about health. For example, one woman described hearing mixed messages about caffeine:

People say well coffee’s good for you because it stimulates the brain and it helps you to be more productive [...] but in this instance if you’re trying to conceive then perhaps coffee isn’t the best thing to be having [...] obviously people will then get confused with the messages (NT07, not trying).

When women were aware of government recommendations for healthy lifestyle (e.g., reducing smoking and alcohol consumption), they often thought of these as beneficial for general health but not specifically for fertility. When thinking about what they would do to prepare for a future pregnancy, participants frequently indicated that they would only implement lifestyle recommendations if they encountered a problem with their fertility. For example, one woman felt that periconceptional folic acid supplementation was an indulgence (as opposed to a NICE [2008] and WHO [2007] recommendation):

I have heard of different kinds of vitamins and supplements, I think folic acid people are always talking about, I might indulge in some of those and see if they help if I was actively trying to get pregnant; I don’t think at this point because I’m not aware of any problems with myself in terms of fertility that there would be anything I would do other than just planning things with my partner (NT10, not trying).

Finally, women did not feel informed of the evidence base for fertility and pregnancy health recommendations, such as folic acid supplementation (e.g., “I don’t know what the benefits (of folic acid) are but if it’s used in NHS guidelines I’m going to assume there is some form of evidence base to support it’s use”; NT10, not trying).

Themes for general practitioners.

From the thematic analysis of the data for GPs, six key themes were derived: (a) Busy but draws me in, (b) facilitates the doctor-patient relationship, (c) trade-off of use for GPs, (d) trade-off of use for women, (e) motivates action but needs more signposting, and (f) multiple applications and ways to disseminate.

Busy but draws me in (8 codes). In general GPs indicated that the FertiSTAT captured their attention and drew them in but also that the tool contained a lot of information (e.g., “I liked the top bit which grabs your attention, the colours are well matched, the only thing I can think of is it looks a little bit busy” GP05). However, GPs felt that the risk factors (and associated guidance) included in the FertiSTAT were necessary to provide a comprehensive assessment of risk factors for fertility problems. In addition, the risk factors were perceived as credible and valid (e.g., “it’s all common sense stuff from a medical perspective”, GP04; “I think it’s brilliant, I think these are all known factors for infertility”; GP05).

GPs felt that overall the FertiSTAT would be straightforward and simple for patients to use (e.g., “I did like the overall presentation, I thought it was quite nice and it’s quite approachable and friendly” GP06). GPs felt that colour was a clear and effective way to communicate risk to people (e.g., “I think you’re learning something from the ticking of it just from the fact that you’ve got the colour coding around your responses, so how important all the different factors are you’re getting an idea of fairly quickly”; GP01).

Facilitates the doctor-patient relationship (4 codes). The FertiSTAT was seen as having the potential to facilitate the relationship between medical professionals and patients. GPs described how they often struggled to have discussions with patients about how lifestyle (e.g., being overweight, smoking) could reduce their fertility, due to fear of patients feeling judged or stigmatised. The FertiSTAT was appraised as a tool to engage patients in lifestyle conversations and take away personal judgement. For example:

The advantage is having a tool that can facilitate discussion; sometimes I worry that when you’re talking about lifestyle factors as a GP you can appear to be a

bit judgemental [...] there's something quite nice about being able to say 'it's not me that thinks this, it's this tool that tells me' (GP04).

A further perceived advantage was that the FertiSTAT gave GPs scientific justification for their advice to patients about fertility and pregnancy preparation (e.g., "The advantage is that (the FertiSTAT) backs up what you say clinically"; GP02).

GPs believed the FertiSTAT would help them engage with high-risk patients and patients with no risk factors. For example, one GP referred to how difficult it could be to reassure young people who had not yet conceived but had not been trying for long enough to meet the criteria for fertility problems. This GP perceived the FertiSTAT as a way of alleviating patients' concerns whilst assuring patients that they had been taken seriously:

What I tend to see is a lot of people who've been trying to get pregnant for four, five months and they're still not pregnant and they're young and I'm saying to them 'look [...] it's too early to be worrying about it', but I guess for those people, because obviously they've come anxious and worried, there would be a good feeling that you're taking them seriously, that you were trying to demonstrate to them that actually they were low risk [...] because they've ticked none of (the FertiSTAT risk factors) (GP01).

Six out of the seven GPs mentioned that very few women or men seek advice from medical professionals when preparing for pregnancy, which prevented GPs from discussing with patients factors that can reduce the likelihood of conception and/or a healthy pregnancy. GPs perceived a need for people to engage more with medical services in order to reduce risk of fertility problems and optimise pregnancy (e.g., "I think there is a case for having pre-pregnancy advice in primary care... I think it would be very sensible [...], I don't think there's been much of a campaign for that really, people seem to drift into pregnancy"; GP03).

Trade-off of use for general practitioners (6 codes). GPs tried to balance several competing interests when evaluating whether and how they would use the FertiSTAT in practice. For example, several participants referred to the trade-off of informing people about their fertility and causing them to worry about their fertility.

However, it was generally felt that informing people about their fertility was worthwhile because it enabled people to take early action to reduce their risk of fertility problems:

I suppose it may make people more worried, but then I suppose if we can get people thinking about these things before, not when they're thirty-nine and have been trying for five years, then that would be a good thing (GP07).

GPs also felt that the FertiSTAT could help them to assist patients in being proactive about their fertility (e.g., "I think very much that highlighting to people things that they're able to change is a good thing because that definitely is going to help them"; GP01).

Two GPs mentioned a conflict between increasing awareness of fertility and increasing their workload as practitioners (e.g., longer patient consultations due to discussions about fertility). There seemed to be a desire for a more efficient way to give patients access to preconception care advice and information ("You don't want to create work [...] you want to give people the information, it's got to be there [...] but you don't want to be discussing it with everybody either" GP03).

Trade-off of use for women (11 codes). GPs also discussed what they believed were the pros and cons of the FertiSTAT from the perspective of women of reproductive age. It was believed that people generally have poor knowledge about their fertility and indicators of fertility potential (e.g., menstrual regularity; whether they are classified as overweight) and about pregnancy preparation (e.g., taking folic acid). GPs felt that this lack of knowledge could affect people's ability to assess their fertility using the FertiSTAT (e.g., "Looking at that just makes me think will people know whether they're thirteen kilos or two stone overweight? Because people in my experience haven't got a great idea always of how healthy their current weight is"; GP01). It was felt that discussion with a medical professional may be needed to clear up any misinterpretations of the FertiSTAT risk factors.

Several GPs referred to how, in their medical experience, patients were affected by social and personal norms when making decisions about fertility and pregnancy. For example, some GPs believed that overweight patients were often unmotivated to lose weight when they knew other people who had children despite being overweight. One

GP talked about how the FertiSTAT could back practitioners up when trying to inform patients of the health consequences of being overweight:

The other thing I think (the FertiSTAT) would be very useful for is for the overweight people [...] When giving lifestyle advice to overweight people then you'd be actually saying 'well, you realise this can affect your fertility', even if they know the lady next door is twenty-five stone and has had ten kids, but that's not the point (GP03).

All GPs expressed the view that the FertiSTAT could help challenge the norm of fertility being a female-oriented issue. GPs were concerned about the tendency for men to be excluded from decision-making about fertility (e.g., "I think men are prone to being a little bit isolated when it comes to discussions about fertility", GP04). It was felt that a couple and/ or male-only version of the FertiSTAT could help get men more involved in optimising their fertility and increasing their chances of achieving their parenthood goals.

Motivates action but needs more signposting (9 codes). GPs believed that the FertiSTAT would motivate or prompt women to take action to optimise their fertility, but that more signposting (or directing) was required. For example, one suggestion was that people scoring positive for lifestyle risk factors may benefit from being directed towards a GP for advice about modifying risky behaviours. In addition, some GPs raised the issue that not all of the FertiSTAT risk factors were modifiable and that people scoring positive for these factors could feel alarmed or disheartened. Non-modifiable risk factors were those related to reproductive diagnoses and age; for example, a woman cannot change the fact that she suffers from endometriosis or is over the age of 34. GPs acknowledged that these risks could not be reversed but felt that timely identification of risks would facilitate early fertility planning and timely referral to fertility services ("There's nothing at all that is in our power to do about it other than maybe to be aware that they're perhaps going to take longer to get pregnant and to think about referring them earlier potentially"; GP01).

The FertiSTAT was widely seen as a first-line strategy for assessing risk factors for reduced fertility potential. GPs felt that the tool was a valuable resource to use with patients attending for their first consultation in relation to fertility or trying to get

pregnant. Another suggestion was that people could complete the FertiSTAT at home and discuss their FertiSTAT risk score with their GP. It was felt that the FertiSTAT would help people to identify (and modify) lifestyle factors before assessing whether they needed fertility medical tests or treatment. For example:

When patients are looking to get pregnant, the first thing to get them to do is have a look at (the FertiSTAT) [...] and see if they can come up with any lifestyle factors before you start even thinking about doing investigations (GP03).

Some GPs talked about how the FertiSTAT was beneficial to all women regardless of whether they were currently trying to get pregnant (e.g., “in an ideal world every woman in their early twenties should have an interview and be told about all this”; GP03). At the same time, GPs emphasised the potential need for input from a medical professional to avoid panic and worry among people scoring positive for FertiSTAT risk factors.

Multiple applications and ways to disseminate (7 codes). All of the GPs felt that the FertiSTAT would facilitate medical practice, with a number of applications of the tool discussed. Among the recommended uses of the FertiSTAT were educating patients about their fertility, taking a comprehensive assessment of patients’ reproductive history and lifestyle in a short time, and generating fertility risk profiles to be sent along with referrals to fertility services as a means of informing fertility specialists of the referred patient’s risk factors. In addition, the FertiSTAT was seen as a tool to broach sensitive discussions with patients about fertility risk factors. For example:

I think certainly it would be a good tool for getting people to talk about fertility issues ‘cos I think it’s quite acceptable to say to people ‘fill in this questionnaire’ about things, and I think it’s a way of broaching things that perhaps people will find difficult to talk about [...] I think people respond well to things written down (GP01).

Participants advocated multiple routes for disseminating the FertiSTAT (e.g., “I think it fits everywhere really; you could put it in the GP’s surgery, you could hand it out when you see your patients, you could put it in a magazine”; GP06). Other suggestions for dissemination included displaying the FertiSTAT in the waiting rooms of sexual health clinics, having it as a resource during consultations, distributing it through pharmacies, including it in the packets of shop-bought fertility self-tests (e.g., ovulation kits), and through public fertility education campaigns. Several GPs stated that it would be beneficial for nurses to go through the FertiSTAT with women of reproductive age during contraception counselling (family planning) or cervical screening. It was felt that this would increase women’s awareness of their fertility from a younger age and promote early screening and prevention of fertility problems.

Themes for public health professionals.

The thematic analysis of the data for public health professionals derived six key themes: (a) Busy but draws me in, (b) trade-off of use for professionals and women, (c) external influences and norms, (d) knowing but not doing, (e) motivates action but needs more signposting, and (f) multiple applications and ways to disseminate.

Busy but draws me in (13 codes). This theme emerged for both GPs and public health professionals. As with the GPs, public health professionals felt the FertiSTAT was attention grabbing, liked the use of colours to represent risk (e.g., “the colours are logical, obviously red being higher risk and blue being neutral I guess”; HP02), and felt compelled to explore the tool (e.g., “I thought it was fascinating, I immediately started taking it in, so it was something that I thought was very compelling”; HP03). One public health professional mentioned that the FertiSTAT contained a lot of information that could initially be perceived as overwhelming (“It does seem very busy to start with” HP02). However, it was felt that the amount of information was necessary to provide a thorough assessment of risk factors for fertility problems (“it’s also very thorough, so to get thorough you need quite a lot of questions” HP02). In addition, one public health professional felt that the one-page layout of the FertiSTAT was appealing and would capture women’s attention, suiting a magazine style layout (“It’s amazing how you’ve got it all on one page and the headlines sort of catches your eye, so if this was in a magazine, y’know”; HP01).

The fertility risk factors assessed by the tool were acceptable, believable and comprehensive to the public health professionals (e.g., “I can’t see that there’s anything missing otherwise I think you’d be going into almost too much detail; these are the basic indicators of a possible problem”; HP01). In general, participants expected that the FertiSTAT would be easy and clear for people to use.

Trade-off of use for professionals and women (10 codes). Public health professionals felt that the FertiSTAT would motivate women to take action to investigate their fertility (e.g., “This is what I call a ‘hook’ tool; a tool to hook people in to get them to go for medical care or consider referral for medical care” HP03). It was felt that fertility and pregnancy planning are not talked about enough and that the FertiSTAT provided an opportunity for professionals to initiate discussions about these topics with patients. One public health professional felt that women would welcome the opportunity to go through the FertiSTAT with a medical/ healthcare professional:

I think a lot of women would welcome just that moment, even to think about (fertility), ‘cos they may not have done, ‘cos that’s the other thing we find, a lot of people aren’t actually thinking about it until they’re thirty odd (HP02).

A perceived drawback of fertility educational tools, such as the FertiSTAT, was the potential to cause worry. Public health professionals expressed a need to balance educating people about their risk for fertility problems with creating fear or concern; a trade-off one participant referred to as “the balance between the fear factor and the educational” (HP03).

External influences and norms (5 codes). This theme referred to how external influences and norms might affect the use of the FertiSTAT. For example, one participant felt that the FertiSTAT should be adapted to a male-only version to accommodate single men wanting to assess their fertility. All three public health professionals mentioned the need for greater involvement of men in fertility health and decision-making (e.g., “I think it’s important to include men, they don’t often get included and actually we do know that lifestyle affects sperm count”; HP02). One participant discussed the potential impact of cultural norms on perception of the

FertiSTAT, expressing the view that in developing countries the FertiSTAT could potentially be “viewed more as a medical intervention” (HP03).

Another public health professional was concerned that GPs would vary in their acceptance of the FertiSTAT (“Certainly within GP’s services you’ve got a raft of different views and I suspect some GPs would be quite dismissive of (the FertiSTAT)” HP02).

As emerged for the GPs, public health professionals felt that social and personal norms affected women’s decision-making about fertility and pregnancy. For example, one public health professional talked about how in her experience women often feel they do not need to take folic acid supplements because they believe their diet is sufficient or they know other people who had a seemingly healthy birth despite not taking the supplements (“Women who [...] feel that their diet is good and their aunt didn’t need to take (folic acid supplements) so why do they need to take it”; HP03). One public health professional also felt that women often infer that a conception and/ or live birth is the marker of a healthy pregnancy and are not aware of the many other ways in which risk factors (such as being overweight) can affect pregnancy outcomes. For example:

Everybody’s got examples around them working out OK; ‘I know plenty of obese women who’ve had babies and it’s working out alright’, but of course you might not know that they’ve developed diabetes or they might develop diabetes or the baby went to special care (HP02).

Knowing but not doing (6 codes). This theme reflected public health professionals’ beliefs that even when people know about risks to their fertility, they often continue to engage in risky behaviours, such as unprotected sexual intercourse (e.g., “I think there isn’t a person in this country if they’ve been educated to a standard who doesn’t understand the use of condoms; how come people don’t use them?”; HP02). It was felt that by providing personalised information about risk and personalised guidance, the FertiSTAT could encourage people to change their behaviour. For example:

It’s a useful tool which basically will highlight to people that they potentially have a problem [...] or they have a lifestyle choice and it’s impacting on their

infertility, and they stop it sooner rather than later, and/ or they seek help sooner rather than later [...] the big problem is with people leaving it too late (HP01).

Lack of knowledge about fertility was felt to be contributed to by ineffective and conflicting health messaging. One public health professional discussed the example of how contraception education teaches people that it only takes one encounter of unprotected sexual intercourse to get pregnant, which means that if people do not immediately become pregnant when they stop using contraception they could start worrying about their fertility:

My anxiety about this is always that we're making lots of people think they're infertile, when they're not, because they don't get pregnant immediately [...] The message about using contraception every time means that of course when they stop (contraception) they expect to get pregnant, so it's not surprising that we almost are creating anxiety in people [...] even though the facts are correct, sometimes the messaging is misleading for people (HP02).

In addition, it was felt that people are aware of how to prevent pregnancy (e.g., use contraception) but not of how to plan for pregnancy when desired (e.g., reduce risky lifestyle behaviours, take folic acid supplements). For example: "Contraception's so good these days it's not just going to happen so you kind of have to make it happen [...] the approach to it now is that you have to make a concerted effort to plan and I don't think it's something we feel naturally okay about for some reason" (HP02).

Motivates action but needs more signposting (3 codes). Public health professionals felt that the FertiSTAT needed signposting to additional sources of guidance. It was anticipated that many of the FertiSTAT risk factors would be new information to women:

Even though these seem fairly straightforward statements to me, I think there may well be some things on here that a woman may not have considered that need to be asked [...] how do you follow that up if someone does? (HP02).

It was felt that people were often more trusting of health advice when it was corroborated by a medical professional (e.g., “there is a group of people who feel all of these things should be medicalised and it is not as valid if it doesn’t come from a doctor”; HP02). One participant felt that compared to biological tests of fertility (e.g., blood testing for hormones), the FertiSTAT could be viewed by the public as less medical (“I don’t think (the FertiSTAT) is viewed really as a medical intervention yet”; HP03).

Multiple applications and ways to disseminate (7 codes). All three public health professionals felt that the FertiSTAT could contribute to the work of their organisation and to their relationship with patients/ service users. As did GPs, public health professionals talked about finding it difficult to discuss with patients and/ or service users how their lifestyle might be affecting their fertility (e.g., “I’ve always found positive health messaging really difficult to deliver to certain people because I think they do have the negative effect of making them feel completely worthless”; HP02). The FertiSTAT was seen as a way to remove judgement and facilitate asking questions about lifestyle (e.g., “Sometimes as professionals it’s hard to raise some of these questions [...] ‘cos they might think I’m judging them, so I wonder whether (the FertiSTAT) might act as a kind of gateway almost into having a conversation”; HP02).

A recommendation among public health professionals for disseminating the FertiSTAT was including it with the fertility information on their organisation’s website. It was felt that having access to the FertiSTAT may encourage earlier help-seeking in women (e.g., “[...] as a way of getting people to go to their doctor maybe earlier”; HP01). The public health professionals shared the GPs’ view that the impact of the FertiSTAT could be maximised if the tool was used in settings that generally engage women at a younger age and before they start trying to get pregnant, such as contraception clinics, family planning clinics and during cervical screening (cervical smear testing). For example:

Ideally what we’d want is for people to come before they even start trying, so actually you could suggest that you do (the FertiSTAT) opportunistically with women if they’re coming for a smear for instance (HP02).

Participants felt that the FertiSTAT could save time and resources in assessing fertility (e.g., “There’s no reason why a provider cannot ask just one (FertiSTAT) question and you already know do I refer this person or do I just say go back and keep trying”; HP03).

Summary: common themes.

As shown in Table 6.5, an over-arching theme was that the FertiSTAT captured attention and compelled participants to explore the tool. Participants shared the view that colour was a good way to represent risk; for example, items colour-coded red on the FertiSTAT were accurately perceived as representing high-risk.

Another common theme was that the FertiSTAT would facilitate much-needed discussions about fertility health among professionals and patients. Women of reproductive age conveyed this idea from the perspective of being empowered by the FertiSTAT to seek medical help in relation to their fertility health. GPs and public health professionals felt that the FertiSTAT would help them to discuss fertility health issues with patients/ service users but balanced this advantage against trade-offs such as increased workload and creating worry about fertility among women.

All participants felt that education about fertility was lacking and that public fertility knowledge was poor. The FertiSTAT was seen as a credible and comprehensive tool that could inform people about their fertility health and actions needed to optimise their chances of conceiving when desired. Participants felt that fertility educational initiatives should be better timed to target women as soon as they enter the reproductive years, to increase their opportunities to make informed decisions and positive health behaviour changes.

GPs and public health professionals shared two further themes. Firstly, GPs and public health professionals believed that the FertiSTAT would motivate women to take action to safeguard their fertility, but that the tool may be more effective by signposting women to further sources of guidance to help them deal with risks. For example, it was felt that people scoring positive for lifestyle risk factors on the FertiSTAT may not know the best way to modify these habits (e.g., smoking) and would benefit from being directed to a GP for advice. Further, a concern was that women scoring positive for non-modifiable risk factors (e.g., being older) may feel alarmed unless they received guidance from a medical professional about their available options for dealing with the

risk. As such, in general professionals seemed to feel that it should be emphasised that women should speak to their doctor about their FertiSTAT risk score if they had any queries or concerns. These concerns did not seem to be validated by the women in the sample. For example, after using the FertiSTAT, women seemed to feel empowered to take action to reduce their risk for fertility problems, whether that action was making lifestyle changes of their own accord or being empowered to speak to a doctor.

The second shared theme among GPs and public health professionals related to the perception that there were multiple applications for the FertiSTAT as well as a multitude of routes for disseminating the tool. The FertiSTAT was seen as having the potential to facilitate practice, with all professionals viewing the tool as an educational aid about risks to fertility. Participants advocated disseminating the tool at primary-care level, commercial-level (e.g., pharmacies), and at the wider level of public education campaigning.

Discussion

The present study evaluated the feasibility and acceptability of the FertiSTAT among women to whom the tool is targeted as well as among medical and public health professionals. The FertiSTAT was perceived as an educational tool that could improve knowledge about fertility, encourage fertility help-seeking, facilitate discussion about fertility health among patients and professionals and ensure timely assessment of fertility problems. The FertiSTAT was seen as having a place in medical and public health practice as well as being a self-assessment tool for women to complete individually.

Fertility was a difficult topic to discuss in medical practice from the perspectives of patients and professionals. Women worried about being judged or not taken seriously by GPs and at the same time GPs worried about coming across as judgemental. In particular, GPs were often hesitant to discuss with patients how their lifestyle could affect their fertility, for fear of causing offence about these sensitive issues. This finding is in line with previous research showing that GPs find discussions about lifestyle factors (e.g., obesity) difficult and awkward (Foster et al., 2003). Women in the present sample were also concerned that they would be seen as wasting time if they discussed concerns about their fertility or pregnancy planning with a doctor, as has been reported in previous studies (Mazza & Chapman, 2013). However, GPs and public health

professionals actually expressed a wish for more women to engage with them when planning a pregnancy, to reduce the number of women who have risk factors for fertility problems but are not taking action to reduce their risk. The FertiSTAT was seen as having the potential to overcome difficulties in discussing fertility, empowering women to raise concerns about fertility with their doctor and enabling professionals to discuss fertility risk information without personal judgement or prejudice.

Professionals perceived multiple other uses for the FertiSTAT, including enabling a quick and comprehensive assessment of fertility and identifying patients who might need earlier referral to fertility specialist services due to the presence of a known clinical cause of infertility or history of predisposing factors for infertility (e.g., endometriosis, NICE, 2013). These uses would support NICE's (2013) initiative to detect infertility risk factors early on and prevent subsequent fertility problems. However, professionals in the present sample were concerned that patients did not generally consult them until they already started trying (unsuccessfully) to conceive. Consistent with this, many women in the present sample said that they were unlikely to take steps to optimise their fertility until they were prompted or cued by unsuccessful attempts to get pregnant. This is in line with previous research showing that women become more likely to seek medical advice about their fertility when they have tried to conceive unsuccessfully (White et al., 2006). Infertility is set apart from other diseases in that the symptom of being infertile is not an immediately noticeable health problem but a lack of becoming pregnant after regular unprotected sexual intercourse (White et al., 2006). As such, many people may not be cued into realising there is a problem with their fertility until they have already started trying (unsuccessfully) to conceive. This is problematic because delaying action reduces the likelihood of achieving one's parenthood goals. For example, a woman who needs fertility treatment but is overweight has a lower chance of the treatment working (NICE 2013), whereas if she had lost weight prior to treatment then she would likely have had better outcomes (and possibly not needed treatment at all, Clark et al., 1995, 1998). Professionals in the present sample advocated using the FertiSTAT during routine visits to practice nurses (e.g., cervical screening). It was felt that this would allow women the opportunity to complete the FertiSTAT at the optimal time to modify any risks for fertility problems; i.e., when they are younger and have not yet started trying to get pregnant.

The present findings suggested that personal and social norms impact women's beliefs about their susceptibility to fertility problems. Women in the present sample

doubted that their chance of pregnancy would be affected if their own risky behaviour was not modified because of normative experiences of others conceiving despite adverse health conditions (e.g., smoking). This finding builds on results about perceived susceptibility presented in previous chapters of the current thesis. Chapter 2 and Chapter 4 showed that mental models of susceptibility are associated with behaviours to optimise fertility and pregnancy. The present study advances these findings by providing insight into the beliefs that may underpin mental models of susceptibility. The present findings support the notion that feeling very healthy or witnessing other people giving birth despite suboptimal health can lead women to infer that they are immune to fertility problems. What women in the present sample said about their normative experiences was consistent with what professionals picked up on in their own work. Professionals had observed that patients' normative experiences often made them reluctant to follow medical advice for optimising fertility. This could have implications in the acceptability of the FertiSTAT; according to the HBM women are less likely to follow guidance provided by a health awareness tool such as the FertiSTAT if they feel invulnerable to fertility problems (Abraham & Sheeran, 2005; Rosenstock, 1966, 1990). However, the personalised risk information provided by the FertiSTAT seemed to help women to apply risks to their situation. Women indicated that seeing their personalised risk score ("having it in writing") helped them to realise that risk factors were personally relevant and could affect their chance of pregnancy.

The current results highlight the need to improve people's understanding of risk reduction. Infertility, like other major diseases (e.g., cancer, diabetes, cardiovascular disease), affects a statistical minority of people, and will not affect everyone with an infertility risk factor (e.g., ONS, 2012b; Boivin et al., 2007). As such, statistically most people are likely to know other people who engage in risky health behaviours and yet go on to conceive a child, which may foster the belief that actions to reduce risk are not really needed. What people do not seem to be aware of is that preventive health action does reduce their risk for fertility problems and pregnancy complications. When their babies are born with health complications, people report feeling guilt and regret at not having prepared for pregnancy (e.g., by losing weight, taking folic acid; Lavender et al., 2010; Lawson & Rajaram, 1994). Many parents report that they had assumed they were immune to adverse pregnancy outcomes because they were healthy and express a desire to have been better informed about their risk (Chaplin et al., 2005). The aim of fertility educational campaigns should be not to coerce people into changing their behaviour but

to educate people about how to find out if they are at risk and what they can do to reduce their risk. The empirically-validated risk information provided by the FertiSTAT may help people to make informed decisions about taking action to safeguard their fertility.

All participants indicated a need for more involvement of men in fertility health assessment and preparing for pregnancy. Participants felt it was a societal norm for fertility to be a mainly female issue and for men to be inadvertently excluded from fertility-related issues that do concern men, such as the importance of lifestyle changes to optimise fertility and chances of conceiving. When the FertiSTAT was developed, the evidence base for male risk factors for fertility problems was less substantial and did not present a consistent picture of risk compared to the evidence base for female risk factors (Bunting & Boivin, 2010). As such, the FertiSTAT was developed for use by women with a section for her to assess her male partner's fertility. An important direction for future research may be to evaluate the acceptability and feasibility of adapting the FertiSTAT for use by men. In addition, it may be necessary for medical professionals and fertility educational campaigns to challenge the norm that fertility is a female-only issue.

In conclusion, the findings of the present study indicated that the FertiSTAT was perceived as an acceptable, credible and scientifically-justified tool among women of reproductive age, GPs and public health professionals. The next step for research is to evaluate the impact of using the FertiSTAT on (1) fertility decision-making (e.g., help-seeking, making lifestyle changes) and (2) outcomes (e.g., conception rates, incidence of fertility problems). Further, there is an apparent need for educational campaigns about fertility health, with an emphasis on timely identification and reduction of risks.

Chapter 7: General Discussion

The aim of the studies presented in this thesis was to examine the role of health-related cognitions in how ready people are to optimise their fertility and pregnancy. This research has made progress on explaining fertility and pregnancy related behaviour and in identifying targets for public health campaigns to promote informed decision-making about fertility and pregnancy. A mixed-methods approach was adopted with methodologies including cross-sectional and prospective survey research, a randomised controlled trial, and a qualitative investigation (semi-structured interview and think-aloud protocol). The current chapter will present an overview of the main findings and implications of the studies conducted, review the methodological strengths and limitations of the research, and discuss recommendations for future research.

The Role of Health-Related Cognitions In Willingness To Optimise Fertility and Pregnancy

The vast majority of men and women aspire to be parents one day (Berrington, 2004; Lampic et al., 2006; Testa & Touleman, 2006). However, many people inadvertently put their parenthood goals at risk by engaging in behaviours that reduce fertility and/ or the chance of having a healthy pregnancy (e.g., unhealthy lifestyle, nonadherence to folic acid supplementation). Perhaps what makes this more alarming is that even when practical barriers to health action are removed (e.g., cost, access), people still fail to take up health recommendations for optimising fertility and pregnancy (e.g., Robbins et al., 2005; Seck & Jackson, 2008). The findings of the studies presented in the current thesis imply that what people know and believe about fertility and pregnancy and their risk for adverse outcomes affects whether they will take action to reduce their risk. Specifically, knowledge about fertility was poor (51.9% average correct score on fertility knowledge questions; Chapter 2), which was associated with being less likely to take action to improve chances of conceiving. However, findings indicated that even when people knew about factors that put fertility or pregnancy at risk, they often did not apply these risks to themselves because they had mental models of being insusceptible to risk. These mental models seemed to arise due to norms of being healthy (and therefore 'immune' to risk) or of other people having seemingly healthy births despite suboptimal health conditions (Chapter 4 and Chapter 6). The present findings shed light on the

information people use to make judgements about risk related to fertility and pregnancy and demonstrate important gaps in people's understanding of risk. It seems that when making judgements about their level of risk for fertility problems and/ or pregnancy complications, people do not rely solely on facts about risk (e.g., "Doctors say that smoking affects fertility; I smoke therefore I am at risk for fertility problems"). Instead, they make inferences based on personal experiences of risk behaviour and perceived outcomes (e.g., "My friend smoked and still got pregnant, therefore smoking will not affect my chances of getting pregnant"). These real life experiences may be more potent and have more of an influence on risk judgements related to fertility and pregnancy in comparison with cold facts.

The present set of studies provided support for the predictions of the HBM in the context of fertility and pregnancy optimising behaviour. Specifically, how susceptible people felt to fertility problems and/ or pregnancy-related complications was associated with how ready people were to take action to optimise fertility and pregnancy. However, findings suggested that readiness to act may be better understood by considering the interaction among health-related cognitions. There was an apparent interplay between what people knew about fertility and how at risk they personally felt for fertility problems, with people being most likely to intend to optimise their fertility when they were knowledgeable about fertility and felt susceptible to fertility problems (Chapter 2). Improving knowledge alone is unlikely to optimise fertility and pregnancy related behaviour. Previous research in other health contexts shows that people can be knowledgeable about a disease yet they still underestimate their risk for the disease, even when they have a risk factor for the disease (Cioe, Crawford & Stein, 2014). Further, feeling that one is not at risk for a disease can prevent people from learning new knowledge about the disease (Cherven et al., 2014). As such it is imperative that educational campaigns address beliefs about risk and susceptibility before trying to teach people facts about disease (Cherven et al., 2014; Cioe et al., 2014), as campaigns are unlikely to change behaviour if individuals do not have the appropriate mental models to accept these facts as applicable to their situation (Silverman et al., 2001).

The present research did not provide support for the use of the TPB in explaining significant variance in participation in an outdoor physical activity programme. This may have been due to conceptual factors (e.g., the absence of implementation intentions) and methodological issues (e.g., high drop-out rates, the fact the fact that participants were randomly assigned to an exercise or waitlist condition).

Given the benefits of physical activity for general health (e.g., Shaw et al., 2006), and for optimising fertility and pregnancy (e.g., Palomba et al., 2008), establishing the factors that retain people in physical activity interventions is a worthy direction for future research.

The present thesis examined the association between health cognitions and willing to optimise health in the context of fertility. Previous research has shown that health cognitions such as knowledge and perceived susceptibility influence health-optimising behaviours in other areas. For example, people who feel insusceptible to disease are less likely to optimise their health and reduce their risk of health problems in the context of smoking (Norman et al., 1999), cancer screening (Kim et al., 2008), and sexual health (Bryan et al., 1997). However, aspects of the fertility context may be qualitatively different to other health domains. The symptom of being infertile is relatively ‘hidden’ compared to symptoms of other diseases. Infertility is not signalled by an obvious physical symptom (e.g., a lump, physical disability, pain) but by an absence of conception after 12 months of trying (White et al., 2006). In the absence of ‘visible’ signs or cues of fertility problems, in the individual as well as in other people, it may be especially possible for people to feel insusceptible to developing fertility problems and to avoid taking action to optimise their fertility. Interventions to improve awareness of susceptibility to disease may need to take into account the type and characteristics of the target disease, as it may be more difficult for people to realise their susceptibility in the absence of external cues (Abraham & Sheeran, 2005; Rosenstock, 1990).

Targets for Public Health Campaigns to Improve Fertility and Pregnancy Related Health Behaviour

There is a clear need for education about optimising fertility and pregnancy. The studies presented in this thesis suggest two key areas of development for educational initiatives. Firstly, fertility and pregnancy **education should be directed towards individuals in a more timely manner**. Currently, young people are not educated about fertility health, with the national curriculum teaching pupils about how to prevent pregnancy but not how to prevent fertility problems if and when they later want to conceive (Department for Education, 2000). This has likely contributed to the low levels of knowledge about

reproductive health issues among young people (Sydsjö et al., 2006), with Chapter 2 and Chapter 6 of the present thesis showing that low fertility knowledge continues into adulthood. Many people are likely to remain unknowledgeable about fertility health until they try unsuccessfully to conceive and seek help from a doctor, at which point investigations into reasons for lack of conception begin and people are informed of how they can optimise their chances of conceiving (NICE, 2013). Even then, 44% of those having problems conceiving will not actually seek help, which translates to 32 million women worldwide trying unsuccessfully to get pregnant and not receiving any medical advice about how to optimise their chances (Boivin et al., 2007). Lack of education about fertility has likely contributed to the fact that people do not seem to be aware that medical help-seeking is an effective means of optimising their chances of conceiving when they have concerns about their fertility. Indeed, the findings of Chapter 6 suggested that women did not consider seeking medical help as a norm for dealing with concerns about fertility, with women describing how getting pregnant was something they should take care of themselves as opposed to seeking medical advice, not knowing when they should go to the doctor in relation to fertility, and fears of not being taken seriously. Informing people about how they can optimise their fertility, including how and when to seek medical help, would allow individuals to make informed decisions about their fertility and about fertility help-seeking. To inform women about optimising fertility from a younger and more timely age, GPs and public health professionals in the study in Chapter 6 advocated integrating fertility health education into routine practice visits such as smear tests or contraception visits. Future research should investigate the benefits and barriers to integrating fertility health education into routine primary care and ascertain how acceptable and feasible such an intervention would be to patients and relevant primary care professionals (e.g., practice nurses).

The second area of development for fertility and pregnancy education relates to **the type of information that is delivered**. Previous campaigns to educate people about fertility and pregnancy have focused mainly on improving knowledge about risk factors (e.g., Ray et al., 2004; Robbins et al., 2005), to modest effect. The findings of the present thesis imply that it should not just be about giving people facts about risks but also educating people about why these risks are applicable to their situation. If people do not feel that risks for a health problem are applicable to their situation, they are less receptive to education about the health problem (Cherven et al., 2014). Men and younger people may be particularly likely to feel insusceptible to risk (Chapter 5) and

should be the targets of timely educational interventions. Personalised health information may be effective at helping people to apply risks to their situation and makes people far more likely to change their behaviour (Noar et al., 2007; Sohl & Moyer, 2007). The results of Chapter 6 provided a preliminary indication that a personalised fertility awareness tool (the FertiSTAT; Bunting & Boivin, 2010) was acceptable among women of reproductive age and the tool seemed to help women to apply fertility risks to their situation. The HBM would predict that if an individual sees risks to fertility as personally applicable and relevant then they are more likely to feel susceptible to fertility problems, which makes the individual more likely to take action to optimise their fertility. It is timely to evaluate the effect of the FertiSTAT on beliefs about susceptibility and the likelihood of preventive health action.

Several ethical considerations warrant discussion. First is the debate surrounding the balance between informing people about risk for fertility problems and coercing them into conforming to pronatalist norms, which means doing everything possible to have a child (Park, 2002; Remennick, 2000). A second issue is causing people to worry about their fertility unnecessarily when around 80% of women below the age of 40 will conceive within a year (Dunson et al., 2004). The aim of fertility educational campaigns should be not to persuade individuals to do everything they can to optimise their fertility or to scare people into believing they are infertile, but to provide people with information relevant to making a decision about whether and what action to take to optimise their fertility. In line with this ethic the studies presented in the current thesis aimed to identify cognitive factors related to how likely people are to optimise their fertility in order to suggest targets to public health interventions aimed at improving awareness and promoting informed decision-making about fertility and pregnancy.

A third related ethical consideration concerns the medicalisation of pregnancy, which refers to a process by which medical intervention in childbearing increases and has been linked to decreased maternal satisfaction with the childbirth experience (Christiaens & Bracke, 2007). Medicalisation is typically viewed as the replacement of natural elements of childbearing with medical alternatives (e.g., giving birth in a hospital rather than at home; Christiaens & Bracke, 2007). Health interventions during pregnancy such as folic acid supplementation could be perceived as contributing to the medicalisation of pregnancy (De Jong-van den Berg et al., 1999). However, folic acid is a necessary supplement during pregnancy, not a substitute for a 'natural' alternative, and national guidelines state that the level of folate necessary to reduce risk of NTDs

cannot be obtained from diet alone (NICE, 2008 a, b; WHO, 2007). In addition, the findings of previous research and the studies presented in this thesis suggest that many people hold erroneous beliefs about being immune to adverse health outcomes that make them feel there is no benefit to following medical guidelines, such as folic acid supplementation (e.g., Chaplin et al., 2005). Without accurate risk information to challenge beliefs about being immune, individuals are not able to make informed decisions about whether to follow medical advice during pregnancy.

Key Methodological Considerations

Among the studies presented in the current thesis two common methodological issues arose: sampling issues and research design. The following sections discuss these issues and make suggestions for how the limitations could be overcome.

Sampling issues.

A main sampling issue of the present set of studies is the recruitment of participants via online sources. Online survey methodologies have limitations; for example participants tend to be more educated (Bunting et al., 2013). However, online methodology can be useful in recruiting hard-to-reach populations. As shown in previous research (e.g., Bunting & Boivin, 2007; Morgan et al., 2006), few people engage with medical services when they are trying to conceive, even when they have not managed to conceive after a year of trying (Boivin et al., 2007). Lack of help-seeking, coupled with the secrecy often surrounding a couple's efforts to conceive, can make it difficult to know how to access people who are trying to conceive to recruit them into research. Online methodologies are effective at accessing hidden populations such as people trying to conceive who are not yet engaged in the medical process. Indeed, the IFDMS survey from which archival data in Chapter 2 were drawn recruited a total of 10,045 people (8355 women and 1690 men) who were trying to conceive, from 79 countries (Bunting et al., 2013).

The studies in the present thesis were likely affected by volunteer bias; a common issue in research whereby a study can only recruit participants who are actually willing to participate in the study (Heiman, 2002). Differences between participants who are willing to participate in the study and those who are not may affect the results; for example, volunteers tend to be more interested in the topic of the study

(Heiman, 2002). In the present set of studies, the characteristics of the study samples were comparable to population data on key variables including demographic profile and fertility risk status. People who took part in the present studies may have been more concerned about their fertility and/ or health. Although perceived susceptibility to fertility and/or pregnancy-related complications was likely to be higher in the present samples than in the general population, it was not expected that the nature of the relationship between perceived susceptibility and fertility/ pregnancy optimising behaviour would differ, as this is not predicted by the HBM (Abraham & Sheeran, 2005; Rosenstock, 1990).

A final sampling issue was that the studies in Chapter 2 and Chapter 6 included only female participants. The exclusion of men from these studies was not intended to encourage the perception that fertility is primarily a female issue, but rather was due to methodological factors. In Chapter 2, the presence of infertility risk factors in the sample was determined according to the empirically-established risk indicators and critical thresholds specified by the FertiSTAT, which assesses risk factors for reduced female fertility. At the time of developing the FertiSTAT the evidence base for male fertility was less substantial than the female evidence base and did not present a consistent picture of risk (Bunting & Boivin, 2010), and so a male equivalent of the FertiSTAT does not yet exist. The study in Chapter 6 evaluated the FertiSTAT, which as mentioned is a tool that assesses risk factors for female fertility, so again it was not valid to include men in the study. However, that is not to say that the issues addressed in Chapter 2 and Chapter 6 do not concern men. The studies were about what makes people more likely to intend to optimise their fertility (i.e., make lifestyle changes, seek medical help in relation to fertility; Chapter 2) and how people evaluate a tool that allows them to assess risk factors that could reduce their fertility potential (Chapter 6), which are issues relevant to men and women. According to the NICE (2013) fertility guideline, the success of efforts to conceive depends on the actions of both members of the couple. Indeed, lifestyle changes are recommended to men and women who want to conceive, as factors such as alcohol consumption and smoking affect semen quality, and both members of the couple are encouraged to seek medical help when efforts to conceive are unsuccessful (NICE, 2013). Clearly it is important to determine the factors that make men more likely to take steps to optimise their fertility when they are trying to conceive. Further, whilst there was insufficient empirical support to develop a male-specific tool at the time when the FertiSTAT was developed (Bunting & Boivin, 2010),

future research should aim to build a more consistent picture of male infertility risk factors and look into developing such a tool for men. Indeed, in the interviews evaluating the FertiSTAT in Chapter 6, there was agreement among women, GPs and public health professionals that fertility and chances of conceiving would be optimised if men were more involved in fertility health issues.

Design issues.

Several design issues of the present studies warrant discussion. The studies in Chapter 2 and Chapter 4 were cross-sectional so causality among perceived susceptibility and fertility/ pregnancy optimising behaviour (i.e., intentions to optimise fertility [Chapter 2], adherence to folic acid supplementation guidelines [Chapter 4]) cannot be determined. Cross-sectional designs are useful for identifying the correlates of a behaviour that can be tested in prospective research and for establishing which factors are relevant to follow up in prospective research. Given the lack of research on the role of perceived susceptibility in fertility/ pregnancy optimising behaviour, a cross-sectional design was considered to be acceptable for the aim of Chapter 2 and Chapter 4, which was to investigate the association between perceived susceptibility and fertility/ pregnancy optimising behaviour. The HBM and prospective research suggest that perceived susceptibility has a causal influence on fertility and pregnancy optimising behaviour. For example, one RCT evaluated the effect of presenting pregnant women who were frequently exposed to passive smoking with information about how passive smoking was affecting the health of their unborn infant (Kazemi et al., 2012). After the intervention, compared to the control group women in the intervention group rated their infants as more susceptible to the health effects of passive smoking and subsequently reduced their exposure to passive smoking. Future prospective research is needed to investigate the causal link between perceived susceptibility and fertility/ pregnancy optimising behaviour (i.e., making lifestyle changes, seeking fertility medical help, adhering to health guidelines).

The study in Chapter 3 employed a prospective RCT design, which enabled causal conclusions to be drawn about the association between intentions to participate in physical activity at baseline and actual participation at three stages of the physical activity programme. The RCT design also made it possible to evaluate the impact of the physical activity programme on anthropometric outcomes, physical fitness, mood, stress

and the TPB variables. However, high drop-out from the physical activity programme meant that the study was underpowered to detect statistically significant effects in analyses of data from the RCT. Drop-out from physical activity programmes is high (Gidlow et al., 2005) and undermines the power of studies aiming to evaluate the efficacy of physical activity programmes. Replication of the study with a larger sample would allow a more reliable test of the variation in outdoor physical activity participation explained by the TPB.

Future Research

The findings of the studies presented in the current thesis demonstrated that cognitions about fertility and pregnancy are related to how ready people are to take action to optimise fertility and pregnancy. The present research should be considered as a basis upon which to conduct prospective studies to test the causal associations among variables. Any such investigations should endeavour to use samples that are representative of the general population on relevant characteristics such as age, education, and knowledge level. Further, gaps in knowledge about fertility and misconceptions about risk for fertility problems and adverse pregnancy outcomes need to be addressed. In light of the government's drive towards early detection and prevention of fertility problems (NICE, 2013), resources may be best directed towards developing and testing timely personalised educational interventions aimed at improving knowledge and challenging erroneous beliefs about fertility and pregnancy.

The current research indicated that a personalised fertility health awareness tool, the FertiSTAT, was viewed as acceptable among women and health practitioners and as feasible to implement in practice. However, before investigating effective ways to implement the FertiSTAT in practice, prospective research is needed to test the hypothesis that using the FertiSTAT would actually make women more likely to take action to optimise their fertility. It would also be important to make testable predictions about the mechanism by which the FertiSTAT may influence behaviour. Based on the present findings and the predictions of the HBM, a proposed mechanism by which the FertiSTAT may lead to behaviour change would be via its effect on perceived susceptibility. Personalised risk information helps people to see risks as applicable to their situation and increases how susceptible they feel, which makes them more likely to

change their behaviour to reduce their risk (Kazemi et al., 2012; Noar et al., 2007; Parkes et al., 2008; Rosenstock, 1990; Sohl & Moyer, 2007).

A further target for future research is to identify what predicts drop-out (or failure to participate) in health interventions to optimise fertility and pregnancy. Disseminating health recommendations (e.g., about lifestyle) or referring people to health programmes is unlikely to change health outcomes if drop-out from such programmes is high, such as in physical activity referral schemes where 80% of people drop out (Gidlow et al., 2005). The study in Chapter 3 of the present thesis indicated that only about 7% of people who wanted to become more physically active actually achieved this health goal. The vulnerable point for people dropping out seemed to be between expressing an initial interest and enrolling in the programme. Research needs to identify situational and personal barriers that prevent people from realising their health goals and evaluate support mechanisms to reduce these barriers.

Finally, there is a need to explore variables that might moderate the association between cognitive factors and health behaviour. For example, religion or cultural values may influence beliefs about fertility and fertility treatment and norms for help-seeking behaviour. Religiosity is associated with greater ethical concerns about fertility treatment, which in turn are associated with decreased likelihood of help-seeking (Greil et al., 2010). Further, even in this day and age it seems to be a cultural norm (in developed and developing nations) for fertility to be seen as a woman's issue, with men's role in aspects such as fertility treatment being more to provide emotional support to the female partner than to actively contribute to planning and decision-making (Dooley, Nolan & Sarma, 2011; Hudson & Culley, 2013). Qualitative interviews with white British men undergoing fertility treatment with a female partner showed that men report feeling marginalised in childbearing planning including in the treatment process; for example "She decided that actually becoming a mum and getting pregnant was gonna become a full time occupation so ... I kind of saw it as that was her job, so she did all the research and talked it through with me... but in effect, she did the vast majority of it" (Hudson & Culley, 2013, p.255). This relates to the wider issue of men being underrepresented in childbearing research and there being a need for future research to find effective ways to recruit men in order to obtain a clearer picture of men's fertility decision-making and behaviour. Research should also establish whether the marginalisation of men from childbearing research and childbearing issues in general affects how likely men are to take steps to optimise their fertility (e.g., by

making lifestyle changes), as efforts to help people optimise their fertility are likely to be hampered if one member of the couple is unmotivated to change.

Conclusions

Given the increasing prevalence of behaviours that put parenthood goals at risk (e.g., unhealthy lifestyles, delaying seeking medical advice), it is becoming increasingly important to understand the factors associated with how likely people are to take steps to optimise their fertility and pregnancy. The findings of the studies presented in this thesis suggest that people's cognitions about fertility and pregnancy play a key role in whether they will take action. The role of health cognitions is a key consideration for public health campaigns to improve fertility and pregnancy related behaviour, as educational initiatives are likely to be of limited success unless misconceptions people have about fertility and pregnancy are addressed. Personalised risk awareness interventions aimed at informing people about their susceptibility to fertility problems and pregnancy complications (and what action they can take to reduce their risk) could enable people to make informed decisions about fertility and pregnancy. Prospective research is needed to test causal relations between health cognitions and action in the context of fertility and pregnancy related behaviour and examine the impact of personalised risk awareness interventions on fertility and pregnancy optimising behaviour and outcomes.

References

- Abbey, A., Andrews, F.M. & Halman, L.J. (1994). Infertility and parenthood: Does becoming a parent increase well-being? *Journal of Consulting and Clinical Psychology*, 62, 398-403.
- Abraham, C. & Sheeran, P. (2005). The Health Belief Model. In M. Conner & P. Norman (Eds.), *Predicting Health Behaviour* (pp.28-80). Berkshire, England: Open University Press.
- Adashi, E.Y., Cohen, J., Hamberger, L., Jones, H.W., de Kretser, D.M., Lunenfeld, B... van Steirteghem, A. (2000). Public perception on infertility and its treatment: an international survey. *Human Reproduction*, 15, 330-334. doi: 10.1093/humrep/15.2.330
- Aiken, L.S. & West, S.G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park: Sage.
- Ajzen, I. (1991). The Theory of Planned Behaviour. *Organizational Behavior & Human Decision Processes*, 50, 179-211. doi:10.1016/0749-5978(91)90020-T
- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the Theory of Planned Behaviour. *Journal of Applied Social Psychology*, 32, 665-683.
- Apfel, R.J. & Keylor, R.G. (2002). Psychoanalysis and infertility: myths and realities. *International Journal of Psychoanalysis*, 83, 85-104.
- Armitage, C. J. (2005). Can the Theory of Planned Behavior predict the maintenance of physical activity? *Health Psychology*, 24, 235-245.
- Armitage, C.J. & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40, 471-499.

- Arnett, J.J. (2000). Optimistic bias in adolescent and adult smokers and nonsmokers. *Addictive Behaviors*, 25, 625-632. doi:10.1016/S0306-4603(99)00072-6
- Augood, C., Duckitt, K. & Templeton, A.A. (1998). Smoking and female infertility: a systematic review and meta-analysis. *Human Reproduction*, 13, 1532-1539.
- Barbour, R.S., Macleod, M., Mires, G. & Anderson, A.S. (2012). Uptake of folic acid supplements before and during pregnancy: focus group analysis of women's views and experiences. *Journal of Human Nutrition and Dietetics*, 25, 140-147.
- Barrett, G., Smith, S.C. & Wellings, K. (2004). Conceptualisation, development, and evaluation of a measure of unplanned pregnancy. *Journal of Epidemiology & Community Health*, 58, 426-433.
- Barriball, K.L. & While, A. (1994). Collecting data using a semi-structured interview: a discussion paper. *Journal of Advanced Nursing*, 19, 328-335.
- Berrington, A. (2004). Perpetual postponers? Women's, men's and couple's fertility intentions and subsequent fertility behaviour. *Population Trends*, 117, 9-19.
- Billari, F.C., Goisis, A., Liefbroer, A.C., Settersten, R.A., Aassve, A., Hagestad, G. & Spéder, Z. (2011). Social age deadlines for the childbearing of women and men. *Human Reproduction*, 26, 616-622. doi:10.1093/humrep/deq360
- Bilzon, J.L., Scarpello, E.G., Bilzon, E. & Allsopp, A.J. (2002). Generic task-related occupational requirements for Royal Naval personnel. *Occupational Medicine*, 52, 503-510.
- Bish, A. & Michie, S. (2010). Demographic and attitudinal determinants of protective behaviours during a pandemic: A review. *British Journal of Health Psychology*, 15, 797-824.
- Bleeker, J.K., Lamers, L.M., Leenders, I.M., Kruyssen, D.C., Simoons, M.L., Trijsburg, R.W., & Erdman, R.A. (1995). Psychological and knowledge factors

- related to delay of help-seeking by patients with acute myocardial infarction. *Psychotherapy and Psychosomatics*, 63, 151-158.
- Blenner, J.L. (1990). Passage through infertility treatment: A stage theory. *Journal of Nursing Scholarship*, 22, 153-158. doi:10.1111/j.1547-5069.1990.tb00199.x
- Boivin, J., Bunting, L., Collins, J.A., & Nygren, K.G. (2007). International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care. *Human Reproduction*, 22, 1506-1512. doi:10.1093/humrep/dem046
- Booth, M.L., Bauman, A., Owen, N. & Gore, C.J. (1997). Physical activity preferences, preferred sources of assistance, and perceived barriers to increased activity among physically inactive Australians. *Preventive Medicine*, 26, 131-137.
- Boulware, L.E., Carson, K.A., Troll, M.U., Powe, N.R. & Cooper, L.A. (2009). Perceived susceptibility to chronic kidney disease among high-risk patients seen in Primary Care Practices. *Journal of General Internal Medicine*, 24, 1123-1129.
- Bowler, D.E., Buyung-Ali, L.M., Knight, T.M., & Pullin, A.S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, 10, 456.
- Brandberg, Y., Bolund, C., Michelson, H., Månsson-Brahme, E., Ringborg, U. & Sjöden, P.O. (1996). Perceived susceptibility to and knowledge of malignant melanoma: Screening participants vs the general population. *Preventive Medicine*, 25, 170-177.
- Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101.

- Brazier, J.E., Harper, R., Jones, N.M., O’Cathain, A., Thomas, K.J., Usherwood, T. & Westlake, L. (1992). Validating the SF-36 health survey questionnaire: new outcome measure for primary care. *British Medical Journal*, 305, 160–164.
- Bretherick, K.L., Fairbrother, N., Avila, L., Harbord, S.H., & Robinson, W.P. (2010). Fertility and aging: do reproductive-aged Canadian women know what they need to know? *Fertility & Sterility*, 93, 2162-2168.
doi:10.1016/j.fertnstert.2009.01.064
- Broekmans, F.J., Knauff, E.A., te Velde, E.R., Macklon, N.S. & Fauser, B.C. (2007). Female reproductive ageing: current knowledge and future trends. *Trends in Endocrinology & Metabolism*, 18, 58-65.
- Brownson, R.C., Baker, E.A., Housemann, R.A., Brennan, L.K., & Bacak, S.J. (2001). Environmental and policy determinants of physical activity in the United States. *American Journal of Public Health*, 91, 1995-2003.
- Bryan, A.D., Aiken, L.S., & West, S.G. (1997). Young women’s condom use: The influence of acceptance of sexuality, control over the sexual encounter, and perceived susceptibility to common STDs. *Health Psychology*, 16, 468-79.
- Buchan, D.S., Ollis, S., Thomas, N.E., & Baker, J.S. (2012). Physical activity behaviour: an overview of current and emergent theoretical practices. *Journal of Obesity*, 2012, 546459.
- Budescu, D.V. (1993). Dominance analysis: a new approach to the problem of relative importance of predictors in multiple regression. *Psychological Bulletin*, 114, 542-551.
- Bunting, L. (2008). *Help seeking behaviour and risk in the context of female fertility*. (Unpublished doctoral dissertation). Cardiff University, United Kingdom.
- Bunting, L. & Boivin, J. (2007). Decision-making about seeking medical advice in an

- internet sample of women trying to get pregnant. *Human Reproduction*, 22, 1662-1668. doi:10.1093/humrep/dem057
- Bunting, L. & Boivin, J. (2008). Knowledge about infertility risk factors, fertility myths and illusory benefits of healthy habits in young people. *Human Reproduction*, 23, 1858-1864. doi:10.1093/humrep/den168
- Bunting, L. & Boivin, J. (2010). Development and preliminary validation of the fertility status awareness tool: FertiSTAT. *Human Reproduction*, 25, 1722-1733. doi:10.1093/humrep/deq087
- Bunting, L., Tsibulsky, I. & Boivin, J. (2013). Fertility knowledge and beliefs about fertility treatment: findings from the International Fertility Decision-making Study. *Human Reproduction*, 28, 385-397.
- Burke, S.M., Carron, A.V., Eys, M.A., Ntoumanis, N., & Estabrooks, P.A. (2006). Group versus individual approach? A meta-analysis of the effectiveness of interventions to promote physical activity. *Sport & Exercise Psychology Review*, 2, 19-35.
- Campbell, M., Fitzpatrick, R., Haines, A., Kinmonth, A.L., Sandercock, P., Spiegelhalter, D. & Tyrer, P. (2000). Framework for design and evaluation of complex interventions to improve health. *British Medical Journal*, 321, 694-696.
- Chaplin, J., Schweitzer, R. & Perkoulidis, S. (2005). Experiences of prenatal diagnosis of spina bifida or hydrocephalus in parents who decide to continue with their pregnancy. *Journal of Genetic Counseling*, 14, 151-62.
- Chapman, S., Wong, W.L. & Smith, W. (1993). Self-exempting beliefs about smoking and health: differences between smokers and ex-smokers. *American Journal of Public Health*, 83, 215-219.
- Charter, R.A. (2003). Study samples are too small to produce sufficiently precise reliability coefficients. *The Journal of General Psychology*, 130, 117-129.

- Chatzisarantis, N.L., Hagger, M.S., & Wang, J.C. (2010). Evaluating the effects of implementation intention and self-concordance on behaviour. *British Journal of Psychology*, 101, 705-718.
- Cherven, B., Mertens, A., Meacham, L.R., Williamson, R., Boring, C., & Wasilewski-Masker, K. (2014). Knowledge and risk perception of late effects among childhood cancer survivors and parents before and after visiting a childhood cancer survivor clinic. *Journal of Pediatric Oncology Nursing*. Advance online publication. doi: 10.1177/1043454214532022
- Christensen, U., Schmidt, L., Budtz-Jørgensen, E., & Avlund, K. (2006). Group cohesion and social support in exercise classes: results from a Danish intervention study. *Health Education & Behavior*, 33, 677-689.
- Christiaens, W. & Bracke, P. (2007). Assessment of social psychological determinants of satisfaction with childbirth in a cross-national perspective. *BMC Pregnancy Childbirth*, 7, 26.
- Cioe, P.A., Crawford, S.L., & Stein, M.D. (2014). Cardiovascular risk-factor knowledge and risk perception among HIV-infected adults. *Journal of the Association of Nurses in AIDS Care*, 25, 60-69.
- Clark, A.M., Ledger, W., Galletly, C., Tomlinson, L., Blaney, F., Wang, X., & Norman, R.J. (1995). Weight loss results in significant improvement in pregnancy and ovulation rates in anovulatory obese women. *Human Reproduction*, 10, 2705-2712.
- Clark, A.M., Thornley, B., Tomlinson, L., Galletley, C., & Norman, R.J. (1998). Weight loss in obese infertile women results in improvement in reproductive outcome for all forms of fertility treatment. *Human Reproduction*, 13, 1502-1505.
- Clement Clarke International Ltd. (2004). *UK Patent No. ISO23747*. Harlow, Essex: Clement Clarke International Ltd.

- Cohen, J. (1988). *Statistical power analysis for the behavior sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155-159.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behaviour*, 24, 385-396.
- Colkesen, E.B., Nieseën, M.A., Peek, N., Vosbergen, S., Kraaijenhagen, R.A., van Kalken, C.K... Peters, R.J. (2011). Initiation of health-behaviour change among employees participating in a web-based health risk assessment with tailored feedback. *Journal of Occupational Medicine & Toxicology*, 6, 5.
doi:10.1186/1745-6673-6-5
- Conger, A.J. (1974). A revised definition for suppressor variables: a guide to their identification and interpretation. *Educational and Psychological Measurement*, 34, 35-46.
- Conner, M., Kirk, S.F., Cade, J.E. & Barrett, J.H. (2001). Why do women use dietary supplements? The use of the theory of planned behaviour to explore beliefs about their use. *Social Science & Medicine*, 52, 621-33.
- Courneya, K.S. (1995). Understanding readiness for regular physical activity in older individuals: an application of the Theory of Planned Behavior. *Health Psychology*, 14, 80-87.
- Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E... Oja, P. (2003). International Physical Activity Questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, 35, 1381-1395.

- Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *British Medical Journal*, 337, a1655.
- Crawford, J.R. & Henry, J.D. (2004). The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, 43, 245-265.
- Cupples, M.E. & McKnight, A. (1999). Five year follow up of patients at high cardiovascular risk who took part in randomised controlled trial of health promotion. *British Medical Journal*, 319, 687-688.
doi:10.1136/bmj.319.7211.687
- Curtis, K.M., Savitz, D.A. & Arbuckle, T.E. (1997). Effects of cigarette smoking, caffeine consumption, and alcohol intake on fecundability. *American Journal of Epidemiology*, 146, 32-41. doi: 10.1093/oxfordjournals.aje.a009189
- Darker, C.D., French, D.P. Eves, F.F., & Sniehotta, F.F. (2010). An intervention to promote walking amongst the general population based on an 'extended' theory of planned behaviour: A waiting list randomised controlled trial. *Psychology & Health*, 25, 71-88.
- de Graaff, A.A., Land, J.A., Kessels, A.G., & Evers, J.L. (2011). Demographic age shift toward later conception results in an increased age in the subfertile population and an increased demand for medical care. *Fertility & Sterility*, 95, 61-63.
doi:10.1016/j.fertnstert.2010.05.013
- de Groot, G.C. & Fagerström, L. (2011). Older adults' motivating factors and barriers to exercise to prevent falls. *Scandinavian Journal of Occupational Therapy*, 18, 153-160.
- De Jong-van den Berg, L.T., Van Der Zee, A.H., Schaafsma, E., De Smit, D., Anderson, C., & Cornel, M.C. (1999). Counselling; women about periconceptional use of

- folic acid: the role of the community pharmacist can be improved. *International Journal of Pharmacy Practice*, 7, 138-142.
- De Wals, P., Tairou, F., Van Allen, M.I., Uh, S.H., Lowry, R.B., Sibbald, B... Niyonsenga, T. (2007). Reduction in neural-tube defects after folic acid fortification in Canada. *New England Journal Medicine*, 357, 135-42.
- Denscombe, M. (2001). Critical incidents and the perception of health risks: the experiences of young people in relation to their use of alcohol and tobacco. *Health, Risk & Society*, 3, 293-306.
- Department for Education. (2000). *Statutory guidance: Sex and relationship education*. Retrieved from: <https://www.gov.uk/government/publications/sex-and-relationship-education>
Last accessed August 2014.
- Dooley, M., Nolan, A., & Sarma, K.M. (2011). The psychological impact of male factor infertility and fertility treatment on men: a qualitative study. *Irish Journal of Psychology*, 32, 14–24.
- Dyer, S.J., Abrahams, N., Mokoena, N.E. & van der Spuy, Z.M. (2004). ‘You are a man because you have children’: experiences, reproductive health knowledge and treatment-seeking behaviour among men suffering from couple infertility in South Africa. *Human Reproduction*, 19, 960-967.
- DiCicco-Bloom, B. & Crabtree, B.F. (2006). The qualitative research interview. *Medical Education*, 40, 314-321.
- Dillard, A.J., McCaul, K.D. & Klein, W.M. (2006). Unrealistic optimism in smokers: Implications for smoking myth endorsement and self-protective motivation. *Journal of Health Communication*, 11, 93-102.
doi:10.1080/10810730600637343

- Dündar, P.E., Özmen, D., Öztürk, B., Haspolat, G., Akyıldız, F., Çoban, S. & Cakıroğlu, G. (2006). The knowledge and attitudes of breast self-examination and mammography in a group of women in a rural area in western Turkey. *BMC Cancer*, 6, 43.
- Dunson, D.B., Baird, D.D. & Colombo, B. (2004). Increased infertility with age in men and women. *Obstetrics & Gynecology*, 103, 51-56.
- Dunson, D.B., Colombo, B. & Baird, D.D. (2002). Changes with age in the level and duration of fertility in the menstrual cycle. *Human Reproduction*, 17, 1399-1403.
- Durand, M.A., Wegwarth, O., Boivin, J. & Elwyn, G. (2012). Design and usability of heuristic-based deliberation tools for women facing amniocentesis. *Health Expectations*, 15, 32-48.
- Eisinga, R., te Grotenhuis, M. & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, 58, 637-642.
- Elwyn, G., Rix, A., Holt, T. & Jones, D. (2012). Why do clinicians not refer patients to online decision support tools? Interviews with front line clinics in the NHS. *BMJ Open*, 2, e001530.
- Ericsson KA, Simon HA. Protocol analysis: Verbal reports as data (revised edition). Cambridge, MA: MIT Press, 1993.
- ESHRE Capri Workshop Group (2005). Fertility and ageing. *Human Reproduction Update*, 11, 261-276.
- Faul, F., Erdfelder, E., Buchner, A. & Lang, A.G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149-1160.
- Field, A. (2009). *Discovering statistics using SPSS*. London: Sage.

- Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. London: Sage.
- Fonteyn, M. & Fisher, A. (1995). Use of think aloud method to study nurses' reasoning and decision making in clinical practice settings. *Journal of Neuroscience Nursing*, 27, 124–8.
- Foster, G.D., Wadden, T.A., Makris, A.P., Davidson, D., Sanderson, R.S., Allison, D.B., & Kessler, A. (2003). Primary care physicians' attitudes about obesity and its treatment. *Obesity Research*, 11, 1168-1177.
- Frishman, G.N., Spurrell, T.P. & Heber, W.W. (2001). Folic acid. Preconception knowledge and use by infertile women. *Journal of Reproductive Medicine*, 46, 1025-1030.
- Fulford, B., Bunting, L., Tsibulsky, I., & Boivin, J. (2013). The role of knowledge and perceived susceptibility in intentions to optimize fertility: findings from the International Fertility Decision-Making Study (IFDMS). *Human Reproduction*, 28, 3253–3262. doi: 10.1093/humrep/det373.
- Fulford, B., Macklon, N., & Boivin, J. (2014). Mental models of pregnancy may explain low adherence to folic acid supplementation guidelines: a cross-sectional international survey. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 176, 99-103. doi: 10.1016/j.ejogrb.2014.02.011.
- Gerend, M.A., Aiken, L.S. & West, S.G. (2004). Personality factors in older women's perceived susceptibility to diseases of aging. *Journal of Personality*, 72, 243-270.
- Gidlow, C., Johnston, L.H., Crone, D., & James, D. (2005). Attendance of exercise referral schemes in the UK: A systematic review. *Health Education Journal*, 64, 168-186.

- Gindoff, P.R. & Jewelewicz, R. (1986). Reproductive potential in the older woman. *Fertility & Sterility*, 46, 989-1001.
- Gnoth, C., Godehardt, D., Godehardt, E., Frank-Herrmann, P. & Freundl, G. (2003). Time to pregnancy: results of the German prospective study and impact on management of infertility. *Human Reproduction*, 18, 1959-1966.
- Godin, G. & Kok, G. (1996). The Theory of Planned Behavior: a review of its applications to health-related behaviours. *American Journal of Health Promotion*, 11, 87-98.
- Goldberg, B. B., Alvarado, S., Chavez, C., Chen, B.H., Dick, L.M., Felix, R.J...Chambers, C.D. (2006). Prevalence of periconceptional folic acid use and perceived barriers to the postgestation continuance of supplemental folic acid: survey results from a Teratogen Information Service. *Birth Defects Research*, 76, 193–199.
- Gollwitzer, P.M. (1999). Implementation intentions: strong effects of simple plans. *American Psychologist*, 54, 493-503.
- Gollwitzer, P.M. & Sheeran, P. (2006). Implementation intentions and goal achievement: a meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69-119.
- Green, J. & Thorogood, N. (2014). *Qualitative Methods for health Research* (3rd ed.). London: Sage.
- Greil, A., McQuillan, J., Benjamins, M., Johnson, D.R., Johnson, K.M., & Heinz, C.R. (2010). Specifying the effects of religion on medical helpseeking: The case of infertility. *Social Science & Medicine*, 71, 734-742.
- Guassora, A.D. & Tulinius, A.C. (2008). Keeping morality out and the in consultations in Danish general practice as a context for smoking cessation advice. *Patient Education and Counseling*, 73, 28-35.

- Haagen, E.C., Tuil, W., Hendriks, J., de Bruijn, R.P., Braat, D.D. & Kremer, J.A. (2003). Current internet use and preferences of IVF and ICSI patients. *Human Reproduction*, 18, 2073–2078.
- Hagger, M.S., Chatzisarantis, N.L., & Biddle, S.J. (2002). A meta-analytic review of the Theories of Reasoned Action and Planned Behavior in physical activity: predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology*, 24, 3-32.
- Hakim, C. (2000). *Work-Lifestyle Choices in the 21st Century: Preference Theory*. Oxford: Oxford University Press.
- Harrison, C.L., Lombard, C.B., Moran, L.J., & Teede, H.J. (2011). Exercise therapy in polycystic ovary syndrome: a systematic review. *Human Reproduction Update*, 17, 171-183.
- Hassan, M.A. & Killick, S.E. (2004). Negative lifestyle is associated with a significant reduction in fecundity. *Fertility & Sterility*, 81, 384-392.
- Hassmén, P., Koivula, N., & Uutela, A. (2000). Physical exercise and psychological well-being: a population study in Finland. *Preventive Medicine*, 30, 17-25.
- Hawkins, M.S., Sevvick, M.A., Richardson, C.R., Fried, L.F., Arena, V.C., & Kriska, A.M. (2011). Association between physical activity and kidney function: National Health and Nutrition Examination Survey. *Medicine and Science in Sports and Exercise*, 43, 1457-1464.
- Health and Social Care Information Centre. (2013). Statistics on smoking: England, 2013. Lifestyle Statistics. Retrieved from: www.hscic.gov.uk/catalogue/PUB11454/smok-eng-2013-rep.pdf
Last accessed August 2014.

- Health and Social Care Information Centre. (2014). Statistics on obesity, physical activity and diet: England, 2014. Lifestyle Statistics. Retrieved from: www.hscic.gov.uk/catalogue/PUB13648/Obes-phys-acti-diet-eng-2014-rep.pdf
Last accessed August 2014.
- Heaton, T.B., Jacobson, C.K. & Holland, K. (1999). Persistence and change in decisions to remain childless. *Journal of Marriage and the Family*, 61, 531-539.
- Heiman, G. W. (2002). *Research Methods in Psychology* (3rd ed.). Boston, MA: Houghton Mifflin.
- HoMedics Group Ltd. (2010). *UK Patent No. 9024SV3R*. Tonbridge, Kent: HoMedics Group Ltd.
- Hu, M.C., Davies, M. & Kandel, D.B. (2006). Epidemiology and correlates of daily smoking and nicotine dependence among young adults in the United States. *American Journal of Public Health*, 96, 299-308.
- Huber-Buchholz, M.M., Carey, D.G., & Norman, R.J. (1999). Restoration of reproductive potential by lifestyle modification in obese polycystic ovary syndrome: Role of insulin sensitivity and luteinizing hormone. *Journal of Clinical Endocrinology & Metabolism*, 84, 1470-1474.
- Hudson, N. & Culley, L. (2013). 'The bloke can be a bit hazy about what's going on': men and cross-border reproductive treatment. *Reproductive BioMedicine Online*, 27, 253-260.
- Humpel, N., Owen, N. & Leslie, E. (2002). Environmental factors associated with adults' participation in physical activity: a review. *American Journal of Preventive Medicine*, 22, 188-199.
- Humphries, D. & Krummel, D.A. (1999). Perceived susceptibility to cardiovascular disease and dietary intake in women. *American Journal of Health Behavior*, 23, 250-260.

- Hunfeld, J.A., Wladimiroff, J.W., Passchier, J., Venema-Van Uden, M.U., Frets, P.G., & Verhage, F. (1993). Emotional reactions in women in late pregnancy (24 weeks or longer) following the ultrasound diagnosis of a severe or lethal fetal malformation. *Prenatal Diagnosis*, 13, 603-612.
- Hyder, Z., Choudhury, N. & Zlotkin, S. (2008). Efficacy of iron folic acid tablets vs. a powdered mixture of mineral and vitamins to control anemia during pregnancy. *FASEB Journal*, 22, S678.19.
- Jancey, J., Lee, A., Howat, P., Clarke, A., Wang, K., & Shilton, T. (2007). Reducing attrition in physical activity programs for older adults. *Journal of Aging and Physical Activity*, 15, 152-165.
- Janz, N.K. & Becker, M.H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly*, 11, 1-47.
- Jayaweera, H. & Quigley, M.A. (2010). Health status, health behaviour and healthcare use among migrants in the UK: Evidence from mothers in the Millennium Cohort Study. *Social Science & Medicine*, 71, 1002-1010.
- Jeffery, R.W., Wing, R.R., Sherwood, N.E., & Tate, D.F. (2003). Physical activity and weight loss: does prescribing higher physical activity goals improve outcome? *American Journal of Clinical Nutrition*, 78, 684-689.
- Katapodi, M.C., Lee, K.A., Facione, N.C. & Dodd, M.J. (2004). Predictors of perceived breast cancer risk and the relation between perceived risk and breast cancer screening: a meta-analytic review. *Preventive Medicine*, 38, 388-402.
- Kazemi, A., Ehsanpour, S. & Nekoei-Zahraei, N.S. (2012). A randomized trial to promote health belief and to reduce environmental tobacco smoke exposure in pregnant women. *Health Education Research*, 27, 151-159.

- Kenfield, S.A., Stampfer, M.J., Giovannucci, E., & Chan, J.M. (2011). Physical activity and survival after prostate cancer diagnosis in the health professionals follow-up study. *Journal of Clinical Oncology*, 29, 726-732.
- Kiernan, K. & Pickett, K.E. (2006). Marital status disparities in maternal smoking during pregnancy, breastfeeding and maternal depression. *Social Science & Medicine*, 63, 335-346.
- Kim, S. E., Pérez-Stable, E.J., Wong, S., Gregorich, S., Sawaya, G.F., Walsh, J.M., & Kaplan, C.P. (2008). Association between cancer risk perception and screening behavior among diverse women. *Archives of Internal Medicine*, 168, 728-734. doi:10.1001/archinte.168.7.728
- King, A.C., Castro, C., Wilcox, S., Eyler, A.A., Sallis, J.F., & Brownson, R.C. (2000). Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. *Health Psychology*, 19, 354-364.
- Klesges, R.C., Klem, M.L., & Bene, C.R. (1989). Effects of dietary restraint, obesity, and gender on holiday eating behavior and weight gain. *Journal of Abnormal Psychology*, 98, 499-503.
- Laaksonen, D.E., Lindström, J., Lakka, T.A., Eriksson, J.G., Niskanen, L., Wikström, K...Uusitupa, M. (2005). Physical activity in the prevention of type 2 diabetes: The Finnish diabetes prevention study. *Diabetes*, 54, 158-165.
- Lacerte, P., Pradipasen, M., Temcharoen, P., Iamee, N., & Vorapongsathorn, T. (2011). Determinants of adherence to iron/folate supplementation during pregnancy in two provinces in Cambodia. *Asia-Pacific Journal of Public Health*, 23, 315-323.
- Lampic, C., Svanberg, A.S., Karlström, P., & Tydén, T. (2006). Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among

- female and male academics. *Human Reproduction*, 21, 558-564.
doi:10.1093/humrep/dei367
- Langdridge, D., Sheeran, P. & Connolly, K.J. (2007). Analyzing additional variables in the theory of reasoned action. *Journal of Applied Social Psychology*, 37, 1884-1913.
- Lavender, T., Platt, M.J., Tsekiri, E., Casson, I., Byrom, S., Baker, L. & Walkinshaw, S. (2010). Women's perceptions of being pregnant and having pregestational diabetes. *Midwifery*, 26, 589-595.
- Lawson, E.J. & Rajaram, S. (1994). A transformed pregnancy: the psychosocial consequences of gestational diabetes. *Sociology of Health & Illness*, 16, 536-562.
- Lee, C.D., Folsom, A.R., & Blair, S.N. (2003). Physical activity and stroke risk: a meta-analysis. *Stroke*, 34, 2475-2481.
- Leridon, H. (2004). Can assisted reproduction technology compensate for the natural decline in fertility with age? A model assessment. *Human Reproduction*, 19, 1548-1553.
- Linné, Y. (2004). Effects of obesity on women's reproduction and complications during pregnancy. *Obesity Reviews*, 5, 137-143.
- Lintsen, A. M., Eijkemans, M.J., Hunault, C.C., Bouwmans, C.A., Hakkaart, L., Habbema, J. D. & Braat, D.D. (2007). Predicting ongoing pregnancy chances after IVF and ICSI: a national prospective study. *Human Reproduction*, 22, 2455-2462. doi:10.1093/humrep/dem183
- Lintsen, A.M., Pasker-de Jong, P.C., de Boer, E.J., Burger, C.W., Jansen, C.A., Braat, D.D. & van Leeuwen, F.E. (2005). Effects of subfertility cause, smoking and body weight on the success rate of IVF. *Human Reproduction*, 20, 1867-1875. doi:10.1093/humrep/deh898

- LouieL81. (2012, June 23). Did everyone take folic acid before they were pregnant with their angel?? [Web log comment]. Retrieved from:
http://community.babycentre.co.uk/post/a19759125/did_everyone_take_folic_acid_before_they_were_pregnant_with_their_angel
 Last accessed August 2014.
- Lundberg, U. & Frankenhaeuser, M. (1999). Stress and workload of men and women in high-ranking positions. *Journal of Occupational Health Psychology*, 4, 142-151.
- Lundgrén-Laine, H. & Salanterä, S. (2010). Think-aloud technique and protocol analysis in clinical decision-making research. *Qualitative Health Research*, 20, 565-75.
- Maassen, G.H. & Bakker, A.B. (2001). Suppressor variables in path models: definitions and interpretations. *Sociological Methods & Research*, 30, 241-270.
- Maheshwari, A., Porter, M., Shetty, A., & Bhattacharya, S. (2008). Women's awareness and perceptions of delay in childbearing. *Fertility & Sterility*, 90, 1036-1042.
- Maheshwari, A., Stofberg, L. & Bhattacharya, S. (2007). Effect of overweight and obesity on assisted reproductive technology—a systematic review. *Human Reproduction Update*, 13, 433-444. doi:10.1093/humupd/dmm017
- Matthews, C.E., Freedson, P.S., Hebert, J.R., Stanek III, E.J., Merriam, P.A., Rosal, M.C... Ockene, I.S. (2001). Sources of variance in daily physical activity levels in the seasonal variation of blood cholesterol study. *American Journal of Epidemiology*, 15, 172-183.
- Mazza, D. & Chapman, A. (2010). Improving the uptake of preconception care and periconceptional folate supplementation: what do women think? *BMC Public Health*, 10, 786.

- McEachan, R.R., Conner, M., Taylor, N.J., & Lawton, R.J. (2011). Prospective prediction of health-related behaviours with the Theory of Planned Behaviour: a meta-analysis. *Health Psychology Review*, 5, 97-144.
- McQueen, A., Swank, P.R., Bastian, L.A. & Vernon, S.W. (2008). Predictors of perceived susceptibility of breast cancer and changes over time: A mixed modeling approach. *Health Psychology*, 27, 68-77.
- McQuillan, J., Greil, A.L., & Shreffler, K.M. (2011). Pregnancy intentions among women who do not try: Focusing on who are okay either way. *Maternal and Child Health Journal*, 15, 178-187. doi: 10.1007/s10995-010-0604-9
- Mitchell, E.W., Levis, D.M., & Prue, C.E. (2012). Preconception health: Awareness, planning, and communication among a sample of US men and women. *Maternal and Child Health Journal*, 16, 31-39.
- Morgan, M.A., Hawks, D., Zinberg, S. & Schulkin, J. (2006). What obstetrician-gynecologists think of preconception care. *Maternal and Child Health Journal*, 10, 59-65.
- Moran, L. J., Noakes, M., Clifton, P.M., Tomlinson, L., & Norman, R.J. (2003). Dietary composition in restoring reproductive and metabolic physiology in overweight women with polycystic ovary syndrome. *Journal of Clinical Endocrinology and Metabolism*, 88, 812-819.
- Morris, L.A., Swasy, J.L. & Mazis, M.B. (1994). Accepted risk and alcohol use during pregnancy. *Journal of Consumer Research*, 21, 135-144.
- MRC Vitamin Study Research Group. (1991). Prevention of neural tube defects: results of the Medical Research Council Vitamin Study. *Lancet*, 338, 131-7.
- Nascimento, S.L., Pudwell, J., Surita, F.G., Adamo, K.B., & Smith, G.N. (2014). The effect of physical exercise strategies on weight loss in postpartum women: a

systematic review and meta-analysis. *International Journal of Obesity*, 38, 626-635.

National Institute for Health and Care Excellence (NICE) (2004). *Clinical Guideline Fertility: Assessment and treatment for people with fertility problems*.

National Institute for Health and Care Excellence (NICE). (2008a). *Clinical guideline: Antenatal care*.

National Institute for Health and Care Excellence (NICE). (2008b). *Clinical guideline: Improving the nutrition of pregnant and breastfeeding mothers and children in low-income households*.

National Institute for Health and Care Excellence (NICE). (2010). *Public health guidance: Weight management before, during and after pregnancy*.

National Institute for Health and Care Excellence (NICE). (2013). *Clinical Guideline Fertility: Assessment and treatment for people with fertility problems*.

Navarrete-Muñoz, E.M., Monzó, D.G., De La Hera, M.G., M., Climent, M. D., Rebagliato, M., Murcia, M... Vioque, J. (2010). Folic acid intake from diet and supplements in a population of pregnant women in Valencia, Spain. *Medicina Clinica*, 135, 637-643.

Nejad, L.M., Wertheim, E.H. & Greenwood, K.M. (2005). Comparison of the Health Belief Model and the Theory of Planned Behaviour in the prediction of dieting and fasting behaviour. *E-Journal of Applied Psychology: Social section*, 1, 63-74.

Nilsen, R.M., Vollset, S.E., Gjessing, H.K., Magnus, P., Meltzer, H.M., Haugen, M. & Ueland, P.M. (2006). Patterns and predictors of folic acid supplement use among pregnant women: the Norwegian Mother and Child Cohort Study. *American Journal of Clinical Nutrition*, 84, 1134-41.

- Noar, S.M., Benac, C.N. & Harris, M.S. (2007). Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychological Bulletin*, 133, 673-693.
- Norman, P., Conner, M. & Bell, R. (1999). The Theory of Planned Behavior and smoking cessation. *Health Psychology*, 18, 89-94. doi:10.1037//0278-6133.18.1.89
- O'Loughlin, J., Paradis, G., Renaud, L., Meshefedjian, G. & Gray-Donald, K. (1998). Prevalence and correlates of overweight among elementary school children in multiethnic, low income, inner-city neighbourhoods in Montreal, Canada. *Annals of Epidemiology*, 8, 422-432.
- Office for National Statistics (ONS) (2012a). Births and deaths in England and Wales (Final), 2011. *Statistical Bulletin*.
- Office for National Statistics (ONS). (2012b). Breast cancer: Incidence, mortality and survival, 2010. *Breast cancer in England*.
- Office for National Statistics (ONS) (2013). Live births in England and Wales by characteristics of mother 1, 2012. *Statistical Bulletin*.
- Office for National Statistics (ONS) (2014). Marriages in England and Wales (Provisional), 2012. *Statistical Bulletin*.
- Ouellette, J.A. & Wood, W. (1998). Habit and intention in everyday life: the multiple processes by which past behavior predicts future behavior. *Psychological Bulletin*, 124, 54-74.
- Owen, N., Humpel, N., Leslie, E., Bauman, A., Sallis, J.F. (2004). Understanding environmental influences on walking: Review and research agenda. *American Journal of Preventive Medicine*, 27, 67-76.

- Cognition. (n.d.). In *Merriam-Webster's online dictionary*. Retrieved from:
<http://www.merriam-webster.com/dictionary/cognition>
 Last accessed August 2014.
- Palomba, S., Giallauria, F., Falbo, A., Russo, T., Oppedisano, R., Tolino, A... Orio, F. (2008). Structured exercise training programme versus hypocaloric hyperproteic diet in obese polycystic ovary syndrome patients with anovulatory infertility: a 24-week pilot study. *Human Reproduction*, 23, 642-650.
- Park, K. (2002). Stigma management among the voluntarily childless. *Sociological Perspectives*, 45, 21-45.
- Parkes, G., Greenhalgh, T., Griffin, M. & Dent, R. (2008). Effect on smoking quit rate of telling patients their lung age: the Step2quit randomised controlled trial. *British Medical Journal*, 336, 598-600. doi:10.1136/bmj.39503.582396.25
- Parsa, P., Kandiah, M., Mohd Zulkefli, N.A. & Rahman, H. (2008). Knowledge and behavior regarding breast cancer screening among female teachers in Selangor, Malaysia. *Asian Pacific Journal of Cancer Prevention*, 9, 221-228.
- Patterson, R.E., Kristal, A.R. & White, E. (1996). Do beliefs, knowledge, and perceived norms about diet and cancer predict dietary change? *American Journal of Public Health*, 86, 1394-1400.
- Pavey, T., Taylor, A., Hillsdon, M., Fox, K., Campbell, J., Foster, C... Taylor, R. (2012). Levels and predictors of exercise referral scheme uptake and adherence: a systematic review. *Journal of Epidemiology & Community Health*, 66, 737-744.
- Penedo, F.J. & Dahn, J.R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, 18, 189-193.

- Perri, M.G., Anton, S.D., Durning, P.E., Ketterson, T.U., Sydeman, S.J., Berlant, N.E...
Martin, A.D. (2002). Adherence to exercise prescriptions: effects of prescribing moderate versus higher levels of intensity and frequency. *Health Psychology, 21*, 452-458.
- Petty, R.E. & Cacioppo, J.T. (1986). The Elaboration Likelihood Model of persuasion. *Advances in Experimental Social Psychology, 19*, 123-205. doi:10.1016/S0065-2601(08)60214-2
- Plotnikoff, R.C., Lippke, S., Courneya, K., Birkett, N. & Sigal, R. (2010). Physical activity and diabetes: An application of the theory of planned behaviour to explain physical activity for Type 1 and Type 2 diabetes in an adult population sample. *Psychology & Health, 25*, 7-23.
- Preacher, K.J. & Hayes, A.F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891.
- Prohaska, T.R., Leventhal, E.A., Leventhal, H. & Keller, M.L. (1985). Health practices and illness cognition in young, middle aged, and elderly adults. *Journal of Gerontology, 40*, 569-578.
- Ray, J.G., Singh, G. & Burrows, R.F. (2004). Evidence for suboptimal use of periconceptional folic acid supplements globally. *British Journal of Obstetrics & Gynaecology, 111*, 399-408.
- Remennick, L. (2000). Childless in the land of imperative motherhood: Stigma and coping among infertile Israeli women. *Sex Roles, 43*, 821-841.
- Rhodes, R., de Bruijn, G., & Matheson, D.H. (2010). Habit in the physical activity domain: integration with intention temporal stability and action control. *Journal of Sport & Exercise Psychology, 32*, 84-98.

- Riddoch, C.J., Mattocks, C., Deere, K., Saunders, J., Kirkby, J., Tilling, K... Ness, A.R. (2007). Objective measurement of levels and patterns of physical activity. *Archives of Disease in Childhood*, 92, 963-969.
- Robbins, J.M., Cleves, M.A., Collins, H.B., Andrews, N., Smith, L.N., & Hobbs, C.A. (2005). Randomized trial of a physician-based intervention to increase the use of folic acid supplements among women. *American Journal of Obstetrics & Gynecology*, 192, 1126-1132.
- Rofail, D., Maguire, L., Kissner, M., Colligs, A. & Abetz-Webb, L. (2013). A review of the social, psychological, and economic burdens experienced by people with spina bifida and their caregivers. *Neurology & Therapy*, 2, 1-12.
- Rosenstock, I. M. (1966). Why people use health services. *The Milbank Memorial Fund Quarterly*, 44, 94-124. doi:10.2307/3348967
- Rosenstock, I.M. (1990). The health belief model: explaining health behavior through expectancies. In K. Glanz, F.M. Lewis & B.K. Rimer (Eds.), *Health behavior and health education: Theory, research and practice* (pp. 39-62). San Francisco: Jossey-Bass.
- Ross, C.E. & Wu, C. (1995). The links between education and health. *American Sociological Review*, 60, 719-745.
- Saelens, B.E. & Handy, S.L. (2008). Built environment correlates of walking: a review. *Medicine & Science in Sports & Exercise*, 40, S550-S566.
- Sallis, J.F., Hovell, M.F., Hofstetter, C.R., Elder, J.P., Hackley, M., Caspersen, C.J. & Powell, K.E. (1990). Distance between homes and exercise facilities related to frequency of exercise among San Diego residents. *Public Health Reports*, 105, 179-185.

- Sandlow, J.I. (2000). Shattering the myths about male infertility. Treatment of male factors may be more successful and cost-effective than you think. *Postgraduate Medicine*, 107, 235-239.
- Scholz, U., Schuz, B., Ziegelmann, J.R., Lippke, S. & Schwarzer, R. (2008). Beyond behavioural intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology*, 13, 479-494.
doi:10.1348/135910707X216062
- Seck, B. C., & Jackson, R. T. (2008). Determinants of compliance with iron supplementation among pregnant women in Senegal. *Public Health Nutrition*, 11, 596-605.
- Shannon, G.D., Alberg, C., Nacul, L. & Pashayan, N. (2013). Preconception healthcare delivery at a population level: construction of public health models of preconception care. *Maternal and Child Health Journal*. Advance online publication. doi: 10.1007/s10995-013-1393-8
- Shaw, K., Gennat, H., O'Rourke, P., & Del Mar, C. (2006). Exercise for overweight or obesity. *Cochrane Database of Systematic Reviews*, issue 4. Art. No.: CD003817.
- Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, 12, 1-36.
- Sheng, Y. & Sheng, Z. (2012). Is coefficient alpha robust to non-normal data? *Frontiers in Psychology*, 3, 34.
- Silverman, E., Woloshin, S., Schwartz, L.M., Byram, S.J., Welch, H.G. & Fischhoff, B. (2001). Women's views on breast cancer risk and screening mammography: a qualitative interview study. *Medical Decision Making*, 21, 231-240.

- Sniehotta, F.F., Scholz, U. & Schwarzer, R. (2005). Bridging the intention–behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology & Health*, 20, 143-160.
- Sohl, S.J. & Moyer, A. (2007). Tailored interventions to promote mammography screening: A meta-analytic review. *Preventive Medicine*, 45, 252-261.
- Stage, F.K. (1988). University attrition: LISREL with logistic regression for the persistence criterion. *Research in Higher Education*, 29, 343-357.
- Stevens, J. (1992) *Applied Multivariate Statistics for the Social Sciences* (2nd ed.). Hillsdalen, NJ: Erlbaum.
- Stockley, L. & Lund, V. (2008). Use of folic acid supplements, particularly by low-income and young women: a series of systematic reviews to inform public health policy in the UK. *Public Health Nutrition*, 11, 807-821.
- Stretcher, V.J. & Rosenstock, I.M. (1997). The Health Belief Model. In K. Glanz, F.M. Lewis & B.K. Rimers (Eds.), *Health behavior and health education: Theory, research and practice* (pp. 41-59). San Francisco: Jossey-Bass.
- Stringhini, S., Dugravot, A., Shipley, M., Goldberg, M., Zins, M., Kivimäki, M... Singh-Manoux, A. (2011). Health behaviours, socioeconomic status, and mortality: further analyses of the British Whitehall II and the French GAZEL prospective cohorts. *PLoS Medicine*, 8, e1000419.
- Sydsjö, G., Selling, K.E., Nyström, K., Oscarsson, C. & Kjellberg, S. (2006). Knowledge of reproduction in teenagers and young adults in Sweden. *European Journal of Contraception and Reproductive Health Care*, 11, 117-125.
- Tarrant, R. C., Younger, K. M., Sheridan-Pereira, M., & Kearney, J. M. (2011). Maternal health behaviours during pregnancy in an Irish obstetric population and their associations with socio-demographic and infant characteristics. *European Journal of Clinical Nutrition*, 65, 470-479.

- Taylor, A.H., Doust, J., & Webborn, N. (1998). Randomised controlled trial to examine the effects of a GP exercise referral programme in Hailsham, East Sussex, on modifiable coronary heart disease risk factors. *Journal of Epidemiology & Community Health*, 52, 595-601.
- Templeton, A., Morris, J.K., & Parslow, W. (1996). Factors that affect outcome of in-vitro fertilisation treatment. *Lancet*, 348, 1402-1406. doi:10.1016/S0140-6736(96)05291-9
- Testa, M.R. & Toulemon, L. (2006). Family formation in France: individual preferences and subsequent outcomes. *Vienna Yearbook of Population Research*, 4, 41-75.
- The Thessaloniki ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group (2008). Consensus on infertility treatment related to polycystic ovary syndrome. *Human Reproduction*, 23, 462-477.
- Thompson Coon, J., Boddy, K., Stein, K., Whear, R., Barton, J., & Depledge, M.H. (2011). Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science & Technology*, 45, 1761-1772.
- Thorsen, L., Skovlund, E., Strømme, S.B., Hornslien, K., Dahl, A.A., & Fosså, S.D. (2005). Effectiveness of physical activity on cardiorespiratory fitness and health-related quality of life in young and middle-aged cancer patients shortly after chemotherapy. *Journal of Clinical Oncology*, 23, 2378-2388.
- Timmermans, S., Jaddoe, V.W., Mackenbach, J.P., Hofman, A., Steegers-Theunissen, R.P. & Steegers, E.A. (2008). Determinants of folic acid use in early pregnancy in a multi-ethnic urban population in The Netherlands: The Generation R study. *Preventive Medicine*, 47, 427-32.

- Tough, S., Tofflemire, K., Benzie, K., Fraser-Lee, N. & Newburn-Cook, C. (2007). Factors influencing childbearing decisions and knowledge of perinatal risks among Canadian men and women. *Maternal & Child Health Journal*, 11, 189-198. doi:10.1007/s10995-006-0156-1
- Tucker, P. & Gilliland, J. (2007). The effect of season and weather on physical activity: A systematic review. *Public Health*, 121, 909-922.
- Tuomainen, H., Cross-Bardell, L., Bhoday, M., Qureshi, N. & Kai, J. (2013). Opportunities and challenges for enhancing preconception health in primary care: qualitative study with women from ethnically diverse communities. *BMJ Open*, 3, e002977.
- Utting, D. & Bewley, S. (2011). Family planning and age-related reproductive risk. *The Obstetrician & Gynaecologist*, 13, 35-41. doi:10.1576/toag.13.1.35.27639
- van Noord-Zaadstra, B.M., Looman, C.W., Alsbach, H., Habbema, J.D., te Velde, E.R. & Karbaat, J. (1991). Delaying childbearing: effect of age on fecundity and outcome of pregnancy. *British Medical Journal*, 302, 1361-1365. doi: 10.1136/bmj.302.6789.1361
- van Someren, M.W., Barnard, Y.F. & Sandberg, J.A. (1994). *The think aloud method: A practical guide to modelling cognitive processes*. London: Academic Press.
- Wallace, B.A. & Cumming, R.G. (2000). Systematic review of randomized trials of the effect of exercise on bone mass in pre- and postmenopausal women. *Calcified Tissue International*, 67, 10-18.
- Ware, J.E. & Sherbourne, C.D. (1992). The MOS 36-Item Short-Form Health Survey (SF-36): I. conceptual framework and item selection. *Medical Care*, 30, 473-83.
- Wasser, S. K., & Isenberg, D. Y. (1986). Reproductive failure among women: Pathology or adaptation? *Journal of Psychosomatic Obstetrics and Gynaecology*, 5, 153-175.

- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales. *Journal of Personality and Social Psychology*, 54, 1063-1070.
- White, L., McQuillan, J., Greil, A.L. & Johnson, D.R. (2006). Infertility: Testing a helpseeking model. *Social Science & Medicine*, 62, 1031–1041.
doi:10.1016/j.socscimed.2005.11.012
- Williams, T., & Clarke, V.A. (1997). Optimistic bias in beliefs about smoking. *Australian Journal of Psychology*, 49, 106-112.
doi:10.1080/00049539708259861
- Williams, P. & Lord, S.R. (1997). Effects of group exercise on cognitive functioning and mood in older women. *Australian and New Zealand Journal of Public Health*, 21, 45-52.
- Witte, K. & Allen, M. (2000). A meta-analysis of fear appeals: implications for effective public health campaigns. *Health Education & Behavior*, 27, 591-615.
- World Health Organisation (WHO). (2007). Standards for maternal and neonatal care. Prevention of neural tube defects. Geneva, Switzerland: World Health Organization. Retrieved from:
http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/neural_tube_defects.pdf
Last accessed August 2014.
- World Health Organisation. (WHO) (2011). Prevalence of insufficient physical activity. Retrieved from: http://www.who.int/gho/ncd/risk_factors/physical_activity/en/
Last accessed August 2014.
- World Health Organization (WHO). (2013). Meeting to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity. WHO Headquarters, Geneva, Switzerland: World Health Organisation.

Retrieved from:

http://apps.who.int/iris/bitstream/10665/78067/1/9789241505000_eng.pdf?ua=1

Last accessed August 2014.

- Wright, C.E., Zborowski, J.V., Talbott, E.O., McHugh-Pemu, K., & Youk, A. (2004). Dietary intake, physical activity, and obesity in women with polycystic ovary syndrome. *International Journal of Obesity*, 28, 1026-1032.
- Yohannes, A.M., Yalfani, A., Doherty, P., & Bundy, C. (2007). Predictors of drop-out from an outpatient cardiac rehabilitation programme. *Clinical Rehabilitation*, 21, 222-229.
- Yu, E.S., Chen, E.H. Kim, K.K., & Abdulrahim, S. (2002). Smoking among Chinese Americans: Behavior, knowledge, and beliefs. *American Journal of Public Health*, 92, 1007-1013.
- Zegers-Hochschild, F., Adamson, G.D., de Mouzon, J., Ishihara, O., Mansour, R., Nygren, K... van der Poel, S. on behalf of ICMART and WHO (2009). The International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) Revised Glossary on ART Terminology, 2009. *Human Reproduction*, 24, 2683-2687.
doi:10.1093/humrep/dep343
- Zunft, H.J., Friebe, D., Seppelt, B., Widhalm, K., Remaut de Winter, A.M., Vaz de Almeida, M.D... Gibney, M. (1999). Perceived benefits and barriers to physical activity in a nationally representative sample in the European Union. *Public Health Nutrition*, 2, 153-160.

Appendices

Appendix A: International Fertility Decision-Making Study (IFDMS) Survey Items Used in Analyses in Chapter 2

Only variables relevant to the research question in Chapter 2 are presented.

FERTILITY DECISION-MAKING SURVEY (FD-MS)	
<p>Thank you for clicking on the link to complete the Fertility Decision-Making survey.</p> <p>We are interested in understanding decision-making about parenting and fertility.</p> <p>We are currently recruiting men and women (aged 18 years or older) who are married or living with a partner and actively trying to conceive for more than 6 months.</p> <p>If you do not wish to answer any questions or want to withdraw from completing the study at any time please close the window.</p> <p>Please read the following three statements.</p> <p>In order to be eligible to complete the survey your answer to each statement must be <u>YES</u>. If for <u>any</u> of these statements your answer is <u>NO</u> then please exit the survey by closing the window.</p>	
I am 18 years of age or older	YES <input type="radio"/>
AND	
I am currently married or living with my partner	YES <input type="radio"/>
AND	
I am currently trying to conceive for more than 6 months and I am <u>not yet pregnant</u>	YES <input type="radio"/>
<p><i>If your answer to any of these statements is <u>NO</u> then please exit the survey by closing the window.</i></p> <p><i>The survey will remain on the website for the next 6 months (from July 2009) so if your situation changes and you wish to complete the survey, please return to the website to do so.</i></p>	
<p>This study is being conducted by Cardiff Fertility Studies at Cardiff University.</p> <p>The survey was developed by Dr. Jacky Boivin (lead researcher at Cardiff Fertility Studies) in collaboration with Merck Serono S.A.</p> <p>The project is sponsored by Merck Serono S.A.</p>	
FD-MS	

Have you ever consulted a medical doctor to help you get pregnant?

Please Note: For some web-browsers clicking on the appropriate answer to the above question will open a new window displaying the Fertility Decision Making Survey. If this happens please use the new window to complete the survey and close this old window as you will no longer need it to complete the survey.

If **YES**, please click here

If **NO**, please click here

FERTILITY DECISION MAKING SURVEY

Thank you for agreeing to participate in the Fertility Decision-Making survey

The goal of our project is to better understand decision-making around fertility and efforts to become a parent. By fertility we mean the ability to conceive, that is, the ability of a woman to get pregnant and of a man to father a child.

The survey is divided into five parts that ask about your background (e.g., age, education), current health (e.g., lifestyle habits such as smoking), beliefs about parenthood (e.g., the factors that influenced your decision to try for a baby) and knowledge of fertility and fertility medical services (e.g., how to access medical help). Some questions concern personal topics, for example, how long you have been trying to conceive. These questions are needed because we are asking people with many different social and personal circumstances to do the survey and these questions can help us better understand the factors that influence decision-making.

This is an international survey. Therefore the wording of questions and response scales has been prepared in a way that can be understood by people from many countries.

For all questions select the answer that best describes your own situation, thoughts or feelings. There are no right or wrong answers. This survey is anonymous, which means that no one can trace your answers back to you.

DO NOT PUT YOUR NAME anywhere on this survey.

You are free to omit any questions you do not wish to answer or withdraw from the study at any time by closing the window.

This study has received ethical approval from School of Psychology Ethics Committee, Cardiff University. If you have any questions about this project then please contact the principal investigator Dr Jacky Boivin (Boivin@cardiff.ac.uk).

There will be a summary of the results of the study provided to the webmaster once we have completed everything, so please look on the website in due course to obtain more information.

Thank you very much for helping us with this important international project on decision-making about fertility health and efforts to become a parent.

This study is being conducted by Cardiff Fertility Studies at Cardiff University.
The survey was developed by Dr. Jacky Boivin (lead researcher at Cardiff Fertility Studies) in collaboration with Merck Serono S.A.
The project is sponsored by Merck Serono S.A.

[Note Text]

PART I: About your background

3. How old are you? (STATE IN YEARS) _____

4. What is the highest level of education you have achieved?
(Please tick the highest category that applies):

- ☐ No education
- ☐ Primary school/elementary school
- ☐ Secondary school/high school
- ☐ Post-secondary school (e.g., BTEC, NVQ, HND, HNC)
- ☐ Undergraduate college or university (e.g., BA, BSc, BBA)
- ☐ Graduate and post-graduate school (e.g., MA, MBA, PhD)

5. How long have you and your partner been living together? Years Months

PART III: About fertility and trying to get pregnant

1. How long have you and your partner been trying to get pregnant? Years Months

6. Do you suspect that you have a fertility problem?
(If NO, go to question 7)
- Yes No
☐ ☐

7. Do you suspect that your partner has a fertility problem?
(If NO, go to question 8)
- Yes No
☐ ☐

9. Below are some statements concerning fertility. Please indicate whether you believe the statements are true or false of fertility by ticking the appropriate box. If you do not know the answer please tick 'Do not know'.			
	TRUE <input type="radio"/>	FALSE <input type="radio"/>	DO NOT KNOW <input type="radio"/>
A woman is less fertile after the age of 36 years.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A couple would be classified as infertile if they did not achieve a pregnancy after one year of regular sexual intercourse without using contraception.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Smoking decreases female fertility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Smoking decreases male fertility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you have a healthy lifestyle you are fertile.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
About one in ten couples are infertile.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a man produces sperm he is fertile.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
These days, a woman in her forties has a similar chance of getting pregnant, as a woman in her thirties.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a man has had mumps after puberty he is more likely to later have a fertility problem.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A woman who never menstruates is still fertile.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a woman is overweight by more than 2 stone (13 kilos or 28 pounds) then she may not be able to get pregnant.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a man can achieve an erection then it is an indication that he is fertile.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who have had a sexually transmitted disease are likely to have reduced fertility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

PART IV: Knowledge, beliefs, experiences and intentions about fertility medical services

3. The list below shows non-medical and medical options people have tried to improve their chances of getting pregnant/becoming a parent. For each option please indicate whether you have (a) heard of the option and (b) used the option.

If you have NOT USED the option, then (c) indicate how likely or unlikely you are to use the option.

Fertility advice from friends/family

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Alternative or complementary therapies (e.g., acupuncture, herbal medicines, reflexology, homeopathy)

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Non-medical methods to know when is the most fertile time of the month (e.g., mucus test, ovulation testing kits)

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Fertility advice and/or treatment from a traditional healer or practitioner

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Fertility advice and/or treatment from a spiritual/faith/religious leader

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Lifestyle change (e.g., quit smoking, lose weight)

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Fertility information from a pharmaceutical manufacturer

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Fertility advice from a pharmacist

(a) Have you heard of this option?

Yes
☐

No
☐

(b) Have you tried this option?

Yes
☐

No
☐

(c) How likely are you to use this option?

Not at all likely
☐

Slightly likely
☐

Moderately likely
☐

Very likely
☐

Extremely likely
☐

Fertility advice from a general medical doctor, general medical practitioner, other healthcare professional or gynaecologist**(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**Fertility advice from a fertility expert or specialist****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**Diagnostic or medical tests to find out whether a fertility problem exists or what is the cause of a fertility problem****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**Fertility medication to increase the quality of the man's sperm****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**Fertility injections to make the woman produce eggs****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**Surgery/operation to repair damage to the reproductive system of the woman or of the man****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**Insemination of sperm (This is a treatment where the man's sperm is put directly into the woman's womb)****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐**In vitro fertilisation or IVF (This is a treatment where an egg and sperm are joined outside the body and then placed in the womb)****(a) Have you heard of this option?**Yes
☐No
☐**(b) Have you tried this option?**Yes
☐No
☐**(c) How likely are you to use this option?**Not at all
likely
☐Slightly
likely
☐Moderately
likely
☐Very
likely
☐Extremely
likely
☐

PART V: About your social situation and your health and attitudes to general medical care

2. Do you have paid work?

Yes

No

☐

☐

3. Does your partner have paid work?

Yes

No

☐

☐

5. During the last 12 months, how often did it happen that...

...you had trouble paying the bills?

☐ Never

☐ Not very often

☐ Fairly often

☐ Very Often

☐ Do not know

6. During the last 12 months, how often did it happen that...

...you did not have enough money to buy food, clothes, or other things your household needed?

☐ Never

☐ Not very often

☐ Fairly often

☐ Very Often

☐ Do not know

14. How much do you weigh?

Stones

Pounds

Kilos

(Answer in either stones, pounds OR kilos):

15. What is your height?

Feet

and Inches

OR metres & centimetres

(Answer in feet and inches, OR metres and centimetres):

16. Do you smoke?

Yes

No

☐

☐

(If NO, go to Question 17)

If YES, how many cigarettes per day?

(state number)

Debrief form

Thank you for taking the time to complete this important survey.

Many individuals can benefit from seeking medical advice in order to conceive. However, many couples are either not seeking advice or are not receiving the medical help or treatment they require. We are interested in people's perceptions and reasons for and against seeking medical help. Specifically we are concerned with people's intentions to seek medical advice and/or treatment if conception is unsuccessful. Two theories have proposed ways in which people change or adopt new behaviours, and have been used to predict and understand peoples' decision making in other health areas, such as the decision to quit smoking or the decision to start (or increase) exercising on a daily basis. These theories predict that an individual's belief about medical treatment, their evaluations about what medical treatment can achieve and their perceptions and values of the people close to them will have an influence on whether or not they would seek medical advice. Other theories suggest that decision-making is determined by a process of stages. Such theories predict that an individual must progress through each of the stages in order to achieve success in adopting a new behaviour. There is no time limit for each stage and some individual's may progress through certain stages quicker than others. Such a theory may be able to account for why a number of individuals are not seeking medical advice when conception is unsuccessful.

Thank you again for your time. It was important to ask you a range of personal questions about you and we would like to assure you that all the data you have just provided us will be held anonymously.

There will be a summary of the results of the study provided to the webmaster once we have completed everything, so please look on the website in due course to obtain more information.

If you would like more information about fertility health issues or would like information about fertility medical care then please see the following websites:

www.fertility.com (except residents of Australia)
www.icsi.ws

US residents should consult www.fertilitylifelines.com

If you have any concerns about your health please contact your family doctor or local General Practitioner.

If you have any further questions about this research then please contact the principal investigator:

Dr Jacky Boivin
School of Psychology
Cardiff University
Tower Building, Park Place
Cardiff, Wales
CF10 3AT
boivin@cardiff.ac.uk

Dr Jacky Boivin is interested in the psychosocial aspects of reproductive health. She has conducted many studies in this area on issues such as the link between stress and fertility, differences between men and women in emotional reactions to fertility problems, whether counselling helps people cope with fertility issues, how children conceived with fertility treatment develop, and much more. This research has been carried out with the help of women from many countries worldwide. You can see some of the published reports of this work on Dr Boivin's website at the School of Psychology, Cardiff University; <http://www.cardiff.ac.uk/psych/home/boivin/indexmain.html>

This study has received ethical approval from School of Psychology Ethics Committee, Cardiff University. If you would like more information about this research, or have any issues or concerns regarding the survey, please contact the Psychology Ethics Committee Secretary (e-mail: psychethics@cf.ac.uk or call +44 (0) 2920 874007).

Appendix B: Cardiff Fitness Survey

Only variables relevant to the research question in Chapter 3 are presented. Questions asked only to women (menstrual characteristics) are indicated.

Consent form

Your participation in this survey is completely voluntary and you can withdraw from the study at any time by closing the survey window. You may omit any questions you do not wish to complete. This survey is anonymous, unless you provide us with your email address at the end of the survey when we ask for it. Because the survey is online there is a small negligible chance that your answers could be traced back to you. Data gathered in this study will be used for research purposes only and will be accessible to researchers only.

To participate in the survey, please read the following two statements. In order to be eligible to complete this survey your answer to each statement must be YES. If your answer to each statement is YES please tick the boxes and then click on the link that applies to you.

I am aged between 18 and 50 years:

☐ Yes

AND

I declare that I understand the statement above and I freely consent to participate in this study:

☐ Yes

Thank you for agreeing to complete the Cardiff Fitness Survey. There are seven sections to the survey and the survey should take about 15 minutes to complete.

In order to understand current fitness levels, experiences and opinions about fitness, we will first ask you some questions about yourself (e.g. background, health, and stress levels). For each question, please tick the response that applies to you.

Section 1. About your background.

In order to understand current fitness levels, it is important to know a bit about your background.

1. How old are you? Please answer in years: _____ Years
2. What is the highest level of education you have achieved? (Please tick the highest category that applies):
 - ☐ No education
 - ☐ Primary school
 - ☐ Secondary school
 - ☐ Post-secondary school (e.g. BTEC, NVQ, HND, HNC)
 - ☐ Undergraduate college or university (e.g. BA, BSc, BBA)
 - ☐ Graduate and post-graduate school (e.g. MA, MBA, PhD)
3. What is your relationship status? (Please tick the box that applies):
 - ☐ In a relationship - living with partner
 - ☐ In a relationship - not living with partner
 - ☐ Single (not in a relationship)
5. Do you have any children?:
 - ☐ Yes
 - ☐ No

Section 2. About your health and medical history.**We ask about general health because it can affect fitness and ability to engage in fitness activities.**

1. In general would you say your health is:
- ☐ Poor
☐ Fair
☐ Good
☐ Very good
☐ Excellent
3. How much do you weigh? (Answer either in stones, pounds OR kilos):
- | Stones | Pounds | Kilos |
|--------|--------|-------|
| _____ | _____ | _____ |
4. What is your height? (Answer in feet and inches, Feet and Inches OR metres and centimetres):
- | Feet | and Inches | OR Metres | and Centimetres |
|-------|------------|-----------|-----------------|
| _____ | _____ | _____ | _____ |
5. Do you smoke?:
- ☐ Yes
☐ No
- If YES, how many cigarettes per day? (state number)
- _____
6. How many units of alcohol do you drink per week (1 unit = a small glass of wine, 1/2 pint of beer, single measurement of a spirit)?:
- _____

Women only:

We ask about menstrual cycle characteristics because these can be affected by fitness level.

The following questions are about the characteristics of your menstrual cycle and about your health. Please respond YES or NO to each question:

- | | Yes | No |
|--|-----------------------|-----------------------|
| 8. Does your menstrual cycle last less than 21 days when you are not using contraceptives? (NB cycle refers to the time from the first day of your period to the day before your next period): | <input type="radio"/> | <input type="radio"/> |
| 9. Does your menstrual cycle last more than 35 days when you are not using contraceptives? (NB cycle refers to the time from the first day of your period to the day before your next period): | <input type="radio"/> | <input type="radio"/> |
| 10. Do you suffer from severe period pains? | <input type="radio"/> | <input type="radio"/> |
| 11. Have you had pelvic surgery? | <input type="radio"/> | <input type="radio"/> |
| 12. Is your menstrual cycle unpredictable, i.e. your period often comes more than 5 days earlier or later than expected when you are not using contraceptives? | <input type="radio"/> | <input type="radio"/> |
| 13. Do you have a period when you are not using contraceptives? | <input type="radio"/> | <input type="radio"/> |
| 14. Do you suffer from endometriosis? | <input type="radio"/> | <input type="radio"/> |
| 15. Have you ever had Pelvic Inflammatory Disease? | <input type="radio"/> | <input type="radio"/> |

Section 3. About mood.

Current mood and feelings can affect people's willingness or desire to engage in fitness activities.

This section consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way **during the past week**. Use the following scale to record your answers.

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Interested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Distressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Strong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Guilty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Scared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Hostile	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Enthusiastic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Proud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Irritable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Alert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Ashamed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Inspired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Determined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Attentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Jittery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 5. About reactions to stress and stressful life events.

It is important for us to ask you about current levels of stress and experiences of stressful life events so that we can better understand how this affects people's readiness or ability to engage in fitness activities.

The questions below ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by ticking **how often** you felt or thought a certain way.

	Never	Almost never	Sometimes	Fairly often	Very often
6. In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. In the last month, how often have you felt nervous and "stressed"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. In the last month, how often have you felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. In the last month, how often have you felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. In the last month, how often have you found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. In the last month, how often have you been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. In the last month, how often have you felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. In the last month, how often have you been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 6. About your fitness experiences.

In this section we first ask about the practical aspects of fitness and then ask about your fitness level.

8. Do you feel you are meeting your fitness goals? ☐ Yes
☐ No

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The following questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and garden work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

9. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics or fast bicycling?

_____ Days

No vigorous physical activities (Tick and skip to question 10)

☐

10. How much time in total did you usually spend doing vigorous physical activities on one of those days? Please answer in hours and minutes per day:

Hours:

Minutes:

Don't know/Not sure

☐

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

11. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or heavy cleaning (e.g. washing windows, vacuuming)? Do not include walking.

_____ Days

No moderate physical activities (Tick and skip to question 12)

☐

12. How much time in total did you usually spend doing moderate physical activities on one of those days? Please answer in hours and minutes per day:

Hours:

Minutes:

Don't know/Not sure

☐

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise or leisure.

13. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____ Days

No walking (Tick and skip to question 14 on next page)

☐

14. How much time in total did you usually spend walking on one of those days? Please answer in hours and minutes per day:

Hours:

Minutes:

Don't know/Not sure

☐

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

15. During the last 7 days, how much time in total did you usually spend sitting on a week day? Please answer in hours and minutes per day:

Hours:	Minutes:	Don't know/Not sure
_____	_____	<input type="radio"/>

16. During the last 7 days, how much time in total did you usually spend sitting on a weekend day?

Hours:	Minutes:	Don't know/Not sure
_____	_____	<input type="radio"/>

Section 7. Attitudes, social pressure and opportunities related to fitness.

In this last section we are interested in your personal opinions regarding regular exercise. By regular exercise we mean participating in an exercise programme for at least 1 hour, 3 times a week for a period of 6 weeks.

Please answer each of the following questions by providing answers in the textboxes and by ticking on the scale the response that best describes your opinion. Some of the questions may appear similar, but they do address different aspects of the same issue. Please read each question.

3. My exercising for at least 1 hour, 3 times per week for 6 weeks would be:

Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Good
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unpleasant
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Harmful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Beneficial
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Enjoyable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not enjoyable
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Valuable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Worthless
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

5. The people who are important to me think that I should exercise for at least 1 hour, 3 times per week for 6 weeks:
6. The people who are important to me would encourage and support me exercising for 1 hour, 3 times per week for 6 weeks:
7. The people in my life whose opinion I value participate in exercise for at least 1 hour, 3 times per week for a period of 6 weeks:
8. The people who are important to me have exercised for at least 1 hour, 3 times per week for a period of 6 weeks:

	Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Disagree
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	True	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	False
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
For me, exercising for at least 1 hour, 3 times per week for 6 weeks is:	Very easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very difficult
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
I am confident that I can exercise for at least 1 hour, 3 times per week for 6 weeks:	Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Disagree
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
I am in control of exercising for at least 1 hour, 3 times per week for 6 weeks:		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
How much control do you have over whether you can exercise for at least 1 hour, 3 times per week for 6 weeks?	Full control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	No control
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
I intend to exercise for at least 1 hour, 3 times per week for 6 weeks:	Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unlikely
		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

We are currently running a six-week fitness program that will involve exercising for an hour three times per week. The classes are usually paid but we are offering you the opportunity to take part **free of cost** for the full six weeks.

Fitness is very important for multiple aspects of health and wellbeing. The fitness classes that we are offering are designed to suit your individual needs and are aimed towards people who want to become fitter, whatever their fitness level, to improve health. Class times are flexible which means they can fit around your schedule and other commitments.

Would you participate in a fitness program that would involve exercising for an hour, three times per week for six weeks?

- ☐ Yes
- ☐ No

Thank you for showing interest in our fitness program.

We have two programs designed for specific needs.

If you are currently trying to get pregnant or are planning to get pregnant within the next two years, please read the details of the **FERTILITY FITNESS** program to read about getting fit for pregnancy.

If you are not currently trying to get pregnant, please read the details of the **STANDARD FITNESS** program to read about a fitness program with fitness activities aligned with your current fitness level.

***Please only enter your email address FOR ONE of the fitness programs.
Then click next.***

FERTILITY FITNESS:

This six-week group outdoor fitness program is designed for women of all fitness levels who are currently trying to get pregnant or planning to get pregnant within the next two years. The Fertility Fitness program is free and will begin January 21st, 2012.

Previous research has found that regular exercise and healthy eating are very important for health in general as well as for fertility. Even amongst women who have not been diagnosed with a fertility problem, regular exercise and healthy eating have been found to reduce the time needed to get pregnant and to increase the chance of getting pregnant naturally.

During the six-week Fertility Fitness program you will be introduced to a range of activities designed to progressively increase fitness in a stimulating way. You will also receive advice and guidance about healthy eating from a registered Dietician. Comprehensive fitness assessments will take place every two weeks to help you map progress in fitness levels. The specific details of the fitness program will be adapted based on the results of the present Cardiff Fitness Survey. Therefore the full details of the program will be sent to you on January 16th, 2012, at which point you can make your final decision about taking up the fitness program.

If you would be interested in participating in the Fertility Fitness program scheduled to start in January 21st, 2012, please provide us with your email address and we will contact you with full details of the program on January 16th.

Enter email address here: _____

STANDARD FITNESS:

This six-week group outdoor fitness program is designed for anyone who wants to improve their fitness, health and well-being, whatever their fitness level. The Standard Fitness program is free and will begin January 21st, 2012. Previous research has found that regular exercise and healthy eating are very important for multiple aspects of health.

During the six-week Standard Fitness program you will be introduced to a range of activities designed to progressively increase fitness in a stimulating way. You will also receive information and guidance about healthy eating. Comprehensive fitness assessments will take place at regular intervals to help you map progress in fitness levels. The specific details of the fitness program will be adapted at an individual-level to suit the fitness needs of those participating in the program. The full details of the program will be sent to you on January 16th, 2012, at which point you can make your final decision about taking up the fitness program.

If you would be interested in participating in the Standard Fitness program scheduled to start in January 21st, 2012, please provide us with your email address and we will contact you with full details of the program on January 16th.

Enter email address here: _____

Debrief form

The factors associated with fitness and exercise behaviour.

Thank you very much for taking part in this study.

The data collected as part of this study will be used to examine people's opinions and experiences in relation to fitness and the barriers that people may encounter in becoming more fit. We are also investigating the factors that affect intentions to participate in fitness activities. Previous research has suggested that people's attitudes, beliefs about what important others expect of them and feelings of control influence the likelihood that they will carry out a healthy behaviour. In this study we are interested in whether your attitudes towards fitness, beliefs about how important others feel about you participating in fitness and whether you feel able to participate in fitness influence your intentions to participate in fitness.

We are also examining whether background characteristics (e.g. current levels of physical activity), psychological factors (e.g. how stressed you feel and your reactions to stressful situations) and health affect intentions to become more fit. We expect that positive attitudes towards fitness, beliefs that important others favour participation in fitness and feelings of control over participating in fitness will increase people's intentions to participate in fitness. Further, we predict that stress and health problems will make people less likely to participate in fitness.

The issues addressed in the present study may have caused you to want to seek advice about lifestyle or other health issues. If so, we recommend that you speak to your GP about these or find out more about a range of health issues on the NHS Healthy Choices Website. The link to this website is shown below:

<http://www.nhs.uk/Pages/HomePage.aspx>

NHS Direct telephone number: 0901 226 1789

The data you have provided will be held anonymously and it will not be possible to trace the information back to you, unless you provided us with your email address when we requested it.

If you require further information or would like to contact the researchers involved in this study, please refer to the contact information provided below.

Contact details for the researcher and supervisor:

Name of researcher:

Bethan Fulford (postgraduate student)
School of Psychology,
Cardiff University,
Tower Building,
Park Place,
Cardiff,
CF10 3AT
Email: fulfordb@cardiff.ac.uk

Name of supervisor:

Professor Jacky Boivin
School of Psychology,
Cardiff University,
Tower Building,
Park Place,
Cardiff,
CF10 3AT
Email: boivin@cardiff.ac.uk
Tel: 02920 875289

For further information or complaint, please contact the Psychology Ethics Committee Secretary:
Email: psychethics@cf.ac.uk Phone: 02920 874007

Address: Psychology Ethics Committee Secretary Cardiff University
Tower Building, Park Place
CF10 3AT.

Appendix C: Folic Acid Supplementation Survey for Women in Week 18 or Less of Pregnancy

Only variables relevant to the research question in Chapter 4 are presented.

	Questions	Response options
Screening question		
1	In which week of pregnancy are you? <i>Exclude those who are more than 18 weeks pregnant</i>	<5; 5-18; >18; I'm not pregnant
Pregnancy planning		
2	Just before I became pregnant with my current pregnancy...	I was sexually active, not using contraception, and trying to get pregnant; I did not plan to get pregnant
3	How many times have you given birth before?	Never given birth before; once; twice; three times; four times; five times or more
4	Since becoming pregnant, which of the following measures are you taking? Please answer yes, no or not relevant to each option.	Given up/reduced smoking; Given up/reduced alcohol intake; Taking pregnancy multivitamins; Taking folic acid supplements; Eating more healthily; Losing weight; Exercising/exercising more; Cutting out/reducing caffeine; Seeking medical or health advice from my doctor/gynaecologist; Other action not listed; Taking no steps to improve my health
Attitude and knowledge towards pregnancy vitamins including folic acid supplements		
5	Which of the following supplements are you currently taking? Please answer yes or no to each option.	A pregnancy multivitamin; Folic acid supplement; None
6	<i>[For those who indicate they are taking a pregnancy multivitamin supplement or folic acid supplement in Q.16]</i> When did you start taking pregnancy multivitamins or folic acid supplements?	Whilst I was still using contraception (but thought I may want to start a family); From the moment I stopped using contraception and started trying for a baby; When I knew I was pregnant; After pregnancy was confirmed by my doctor; When my gynaecologist recommended them; Can't remember; Other
7	Which of the following have you heard of?	Folate Folic acid Metafolin None of the above
8	We are interested in people's beliefs about health. How likely do you think it is that taking folic acid before getting pregnant could reduce the risk of health issues for the offspring?	1 = not at all likely 2 = Slightly likely 3 = Moderately likely 4 = Very likely 5 = Extremely likely

Appendix C: Folic acid supplementation survey (pregnant women)

General Health		
9	Have you ever had a miscarriage?	Yes; No
10	Have you ever had or do you currently have a serious medical illness or chronic disease?	Yes; No
11	Before my pregnancy I was more than 13 kilos (28 pounds/2 stone) overweight	Yes; No
12	Do you currently smoke?	Yes; No
13	How many units of alcohol do you currently drink per week? Number of units (1 unit = a small glass of wine, 300ml of beer, small measure of a spirit)	1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; more than 14; don't know; don't drink alcohol
Demographic information		
14	How old are you?	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45
15	What is your relationship status?	Single (not in a relationship); In a relationship, not married and not living with partner; Co-habiting (living with partner but not married); Married
16	What is the highest level of education you have achieved? (Please tick the highest category that applies):	No education; Primary school; Secondary school; Post-secondary school vocational training; University (e.g. BSc, BA, MSc, PhD)
17	What is your approximate household income?	Less than 12,000 Euros; 12,000 - 24,000 Euros ; 24,000 - 36,000 Euros ; 36,000 - 48,000 Euros ; 48,000 - 60,000 Euros ; 60,000 -72,000 Euros ; More than 72,000 Euros
18	Were you born in this country?	Yes; No
19	What is your employment status?	Employed; Self-employed; Studying full-time; Unemployed; Housewife/househusband; Retired

Appendix D: Folic Acid Supplementation Survey for Women Planning a Pregnancy

Only variables relevant to the research question in Chapter 4 are presented.

	Questions	Response options
Screening question		
1.	Are you currently and actively planning to become pregnant in the next 3 months (i.e. sexually active, no longer using contraceptives, no longer taking birth control pills) <i>Exclude all those who answer No</i>	Yes; No
2.	How long have you been trying to get pregnant? <i>Exclude all those who have been trying to get pregnant for more than 6 months</i>	1 Month or less; 2-3 Months; 4-6 Months; More than 6 months
Pregnancy planning		
3	How many times have you given birth before?	Never given birth before; once; twice; three times; four times; five times or more
4	What measures are you taking to prepare for this pregnancy? Please answer yes, no or not relevant to each option.	Given up/reduced smoking; Given up/reduced alcohol intake; Taking pregnancy multivitamins; Taking folic acid supplements; Eating more healthily; Losing weight; Exercising/exercising more; Cutting out/reducing caffeine; Seeking medical or health advice from my doctor/gynaecologist; Other action not listed; Taking no steps to improve my health
Attitude and knowledge towards pregnancy vitamins including folic acid supplements		
5	Which of the following supplements are you currently taking? Please answer yes or no to each option.	A pregnancy multivitamin; Folic acid supplement; None
6	<i>[For those who indicate they are taking a pregnancy multivitamin supplement or folic acid supplement in Q.13]</i> When did you start taking pregnancy multivitamins or folic acid supplements?	Whilst I was still using contraception (but thought I may want to start a family); From the moment I stopped using contraception and started trying for a baby; When my gynaecologist recommended them; Can't remember; Other
7	Which of the following have you heard of?	Folate Folic acid Metafolin None of the above

Appendix D: Folic acid supplementation survey (planning a pregnancy)

8	<p>We are interested in people's beliefs about health.</p> <p>How likely do you think it is that taking folic acid before getting pregnant could reduce the risk of health issues for the offspring?</p>	<p>1 = not at all likely</p> <p>2 = Slightly likely</p> <p>3 = Moderately likely</p> <p>4 = Very likely</p> <p>5 = Extremely likely</p>
General Health		
9	Have you ever had a miscarriage?	Yes; No
10	Have you ever had or do you currently have a serious medical illness or chronic disease?	Yes; No
11	Before my pregnancy I was more than 13 kilos (28 pounds/2 stone) overweight	Yes; No
12	Do you currently smoke?	Yes; No
13	<p>How many units of alcohol do you currently drink per week?</p> <p>Number of units (1 unit = a small glass of wine, 300ml of beer, small measure of a spirit)</p>	<p>1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; more than 14; don't know; don't drink alcohol</p>
Demographic information		
14	How old are you?	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45
15	What is your relationship status?	<p>Single (not in a relationship);</p> <p>In a relationship, not married and not living with partner;</p> <p>Co-habiting (living with partner but not married);</p> <p>Married</p>
16	What is the highest level of education you have achieved? (Please tick the highest category that applies):	<p>No education;</p> <p>Primary school;</p> <p>Secondary school;</p> <p>Post-secondary school vocational training;</p> <p>University (e.g. BSc, BA, MSc, PhD)</p>
17	What is your approximate household income?	<p>Less than 12,000 Euros;</p> <p>12,000 - 24,000 Euros ;</p> <p>24,000 - 36,000 Euros ;</p> <p>36,000 - 48,000 Euros ;</p> <p>48,000 - 60,000 Euros ;</p> <p>60,000 -72,000 Euros ;</p> <p>More than 72,000 Euros</p>
18	Were you born in this country?	Yes; No
	What is your employment status?	<p>Employed;</p> <p>Self-employed;</p> <p>Studying full-time;</p> <p>Unemployed;</p> <p>Housewife/househusband;</p> <p>Retired</p>

**Appendix E: Principal Component Analysis Indicator Loadings for the
Composite Variables: Perceived Health and Adversity**

Table E1.

Principal component analysis indicator loadings for the perceived health component

Indicator	Perceived health component
General perceived health	0.74*
No miscarriage history	0.74*

*Variable loads on the component (>0.30).

Table E2.

Principal component analysis indicator loadings for the demographic and behavioural adversity components

Indicator	Component	
	Demographic adversity	Behavioural adversity
Age < 25 years	0.65*	-0.05
Unplanned pregnancy (amongst currently pregnant women)	0.62*	-0.12
Not married or living with partner	0.61*	0.06
Lower education	0.49*	0.12
Migrant status (not born in country of residence)	0.16	-0.45*
Currently drink	0.01	0.72*
Currently smoke	0.28	0.68*

*Variable loads on the component (>0.30).

Appendix F: Correlations Between Perceived Health, Adversity, Perceived Susceptibility, and Folic Acid Uptake

Table F1.

Correlations between perceived health, adversity, perceived susceptibility, and folic acid uptake

Variable	1	2	3	4	5	6
1.Perceived health	-					
2. Contextual adversity	.052	-				
3.Perceived susceptibility	-.143***	-.232***	-			
4.Folic acid for pre-conception preparation	-.127**	-.233***	.376***	-		
5.Current folic acid uptake	-.128**	-.209***	.331***	.637***	-	
6.Folic acid for post-conception preparation	-.102	-.333***	.424***	.715***	.628***	-

*p <0.05. **p <0.01. ***p <0.001.

Appendix G: Cardiff University Parenthood Planning Survey: Time 1

Only variables relevant to the research question in Chapter 5 are presented. Questions asked only to women are indicated.

Consent form

<p>Thank you for considering participation in the 'Starting Families Study'.</p> <p>The goal of this project is to better understand the range of factors that influence how people decide when to start a family. By doing this research we hope to achieve a comprehensive account of personal, social and health factors that lead to the decision to have a first child.</p> <p>We are currently recruiting:</p> <ul style="list-style-type: none">• Men and women• Aged 18 years and older <p>That currently:</p> <ul style="list-style-type: none">• Do not have children• Are not expecting a child• Are not trying to get pregnant/father a child• Are planning to have a child in the future <p>The survey is divided into six parts that ask questions about your background (e.g., age, education), childbearing intentions and desires, social factors (e.g., opinions of those around you), individual factors (e.g., reasons for when to start a family), health factors (e.g., knowledge of fertility issues) and finally a section about where you are now. The survey takes between 15 and 20 minutes to complete. Because your impressions of when is the best time to start a family may change over time, we will ask you to allow us to email you in three months to complete another questionnaire on this topic. However, if you would rather not be contacted again you can just fill out the survey today.</p> <p>Any information provided by you will be held anonymously unless you provide your email. If you provide an email, your email will be held according to the Data Protection Act and will be deleted after we have sent the second email in three months making your responses fully anonymous. All data will be stored on computers that are password-protected. You can contact the research team and ask for your information to be deleted/destroyed at any time up until the data has been anonymised.</p> <p>The project has received ethical approval from the School of Psychology Ethics Committee, Cardiff University. If you have any questions about this project then please contact the principal investigator Dr Natasha Kalebic at kalebicnl@cardiff.ac.uk</p> <p>Participation in this study is entirely voluntary and you are free to omit any questions you do not wish to answer or withdraw from the study at any time by closing the window.</p> <p>After completing the survey you will be provided with additional information about the aims of the study.</p> <p>THANK YOU FOR YOUR PARTICIPATION IN THIS IMPORTANT STUDY</p> <p>I am over the age of 18 and consent to participation</p> <p><input checked="" type="radio"/> Yes</p>

	Yes	No
Do you have any children?	<input type="radio"/>	<input type="radio"/>
Are you currently pregnant or expecting a child?	<input type="radio"/>	<input type="radio"/>
Are you currently trying to get pregnant/father a child?	<input type="radio"/>	<input type="radio"/>
Do you intend to have a child in the future?	<input type="radio"/>	<input type="radio"/>

Part 1: About your background		
1. Are you?	Male	Female
	<input type="radio"/>	<input type="radio"/>
2. How old are you?	<input type="text"/>	
5. What is your employment status?	<input type="radio"/> Full time employment <input type="radio"/> Part time employment <input type="radio"/> Unemployed <input type="radio"/> Student <input type="radio"/> Retired <input type="radio"/> Other	
6. What is the highest level of education you have achieved? (Please tick the highest category that applies.)	<input type="radio"/> No education <input type="radio"/> Primary/Elementary school <input type="radio"/> Secondary/High school <input type="radio"/> Post secondary school/trade or technical college (e.g. BTEC) <input type="radio"/> Undergraduate college or University <input type="radio"/> Graduate or Postgraduate <input type="radio"/> Other	
7. Are you currently in a relationship?	Yes	No
	<input type="radio"/>	<input type="radio"/>
If you are in a relationship, is your partner same-sex?	Yes	No
	<input type="radio"/>	<input type="radio"/>

Part 2: Childbearing desires, intentions and timing

10. When do you plan to **actively start trying** to have your first child?

Please state in months or years **from today**.

By actively trying we mean not just planning on having a child at some point but actually trying to get pregnant/father a child.

Years

Months

Part 5: Health factors			
1. Below are some statements relating to the physical side of starting a family. Please indicate to what extent you agree or disagree with each statement using the scale: Strongly disagree to strongly agree.			
5. Please read the following statements and indicate whether you think each statement is true or false (or mark 'do not know' if you are unsure).			
	True	False	Do not know
A woman's age is an important consideration in being able to get pregnant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A man's age is an important consideration in being able to father a child	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A pregnancy after the age of 35 would be more physically demanding for a woman than a pregnancy before the age of 35.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A pregnancy after the age of 35 would be more emotionally demanding for a woman than a pregnancy before the age of 35.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A pregnancy after the age of 35 is more likely to result in complications such as increased risk of Down Syndrome or premature birth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Any decline in female fertility could be compensated by medical treatment (e.g. IVF or fertility drugs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Any decline in male fertility could be compensated by medical treatment (e.g. IVF or fertility drugs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A woman in her 40s has as much chance of getting pregnant as a woman in her 30s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A woman in her 30s has as much chance of getting pregnant as a woman in her 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

As explained at the beginning of the survey, we would like to contact you in three months time to see if your opinions and impressions of when the best time is to start a family have changed. If you are happy for us to do this please provide an email address below.

Email address:

Debrief form

Decision making about starting families.

Thank you for taking the time to complete this important survey.

Previous research has informed us that there are many preconditions that people feel they need to fulfill before they make the decision to start a family. These preconditions range from social considerations such as close friends having children to personal and individual considerations such as being with the right partner along with health considerations such as having children before a certain age. While there have been numerous studies examining these preconditions, thus far research has not told us whether individuals place more emphasis on social, individual or health factors or whether there is equal importance placed on all three factors.

The present study aims to achieve a comprehensive account of how social, personal and health factors interact and influence an individual's decision making about when to start a family.

The data you have provided will be held anonymously unless you provided your email address. Email addresses will be held according to the Data Protection Act. After completion of the research (i.e., after the three month follow-up study) your email address will be deleted. You have the right to withdraw your data at any time up until the data has been completely anonymised by contacting us via the contact details below.

If you would like more information about fertility health issues or would like information about fertility medical care then please see the following websites:

<http://www.fertility.com/>

<http://www.icsi.ws/>

<http://www.fertilitylifelines.com/>

(Cardiff University is not responsible for the content of these external internet sites)

If you have any further questions about this research then please contact Dr Natasha Kalebic or Professor Jacky Boivin:

Dr Natasha Kalebic
Data Manager
School of Medicine
Heath Park
Cardiff
CF14 4YU

Professor Jacky Boivin
School of Psychology
Cardiff University
Tower Building, Park Place,
Cardiff, Wales
CF10 3AT
Email: cardifffertilitystudies@cardiff.ac.uk

Psychology Ethics Committee details:
Email: psychethics@cardiff.ac.uk (Phone: +44 (0)2920870360)

**Appendix H: Cardiff University Parenthood Planning Survey: Time 2 Version A:
Survey for Individuals Who Have Never Given Birth/ Fathered a Child, Do Not
Have Any Adopted Children, and Are Not Currently Pregnant/ Expecting a Child**

Only variables relevant to the research question in Chapter 5 are presented. Questions asked only to women are indicated.

Consent form

Thank you for considering participation in part two of the 'Starting Families Study'.

We would like to invite you to participate in part two of the Starting Families Study. By doing this research we hope to achieve a comprehensive account of personal, social and health factors that influence decisions about having children, how these factors change over time, and the impact these changes may have on decision-making about having children.

The survey takes approximately 15 minutes to complete. You can read specific information about the survey below.

The survey is divided into five sections that ask questions about your background (e.g. employment), childbearing intentions and desires, social factors (e.g. opinions of those around you), individual factors (e.g. reasons for when to have children), health factors (e.g. knowledge of fertility issues), and where you are now. We also ask about the emotions you have experienced recently (e.g. anxiety), as these may be linked to views or decisions about having children.

Your participation in this survey is entirely voluntary and you can withdraw from the study at any time by closing the survey window. You may omit any questions you do not wish to complete. Data provided by you will be held confidentially, such that only Professor Jacky Boivin and the researcher Bethan Fulford (postgraduate student of the School of Psychology, Cardiff University) can trace this data back to you individually. Please note that data analysis is carried out using a code number that you have been assigned such that your email address is not stored in the same file as the data. Data will be anonymised at the end of the study (i.e. after the follow-up study in two years) and after this point no one will be able to trace the information back to you. The anonymous data will be retained indefinitely in accordance with the Data Protection Act 1998 and stored on a computer that is password-protected and belongs to Professor Jacky Boivin. You can contact Professor Jacky Boivin and ask for your information to be deleted/destroyed at any time up until the data has been anonymised.

The project has received ethical approval from the School of Psychology Ethics Committee, Cardiff University. If you have any questions about this project then please contact the principal investigator, Professor Jacky Boivin at cardiffertilitystudies@cardiff.ac.uk.

After completing the survey you will be provided with additional information about the aims of the study and invited to leave your email address for future study information. However, if you would rather not be contacted again you can just fill out the survey today.

To participate in the survey, please read the following statement. In order to be eligible to complete this survey your answer to the statement must be YES. If your answer to the statement is YES please tick the box and then click 'next':

I declare that I understand the information above and I freely consent to participate in this study:

☐ Yes

There are two versions of the survey depending on participants' parenting experiences (version A and version B).

To make sure that you complete the appropriate survey version for your situation, please read the statements under version A and version B below.

Once you have read the statements, tick the box next to the survey version that applies to you:

☐ **SURVEY VERSION A**

Do this survey if...

(*women*) You have never given birth, you do not have any adopted children and you are not currently pregnant, or;

(*men*) You have never fathered a child, you do not have any adopted children and you are not expecting a child

☐ **SURVEY VERSION B:**

Do this survey if...

(*women*) You have given birth or you have adopted children or you are currently pregnant, or;

(*men*) You have fathered a child or you have adopted children or you are expecting a child

Section 1: About your background.

Are you:

- ☐ Male
☐ Female

As a reminder, all questions in this survey are voluntary and you may omit any questions you do not wish to complete.

What is your date of birth? Please select the day, month and year from the drop-down lists below.

Day

Month

Year

What is your employment status?

- ☐ Full time employment
☐ Part time employment
☐ Unemployed
☐ Student
☐ Retired
☐ Other

What is the highest level of education you have achieved? (Please tick the highest category that applies)

- ☐ No education
☐ Primary school
☐ Secondary school
☐ Post-secondary school/trade or technical college (e.g. BTEC)
☐ University graduate (e.g. BSc, BA)
☐ Postgraduate University (e.g. MSc, PhD)

What is your relationship status?

- ☐ Single (not in a relationship)
☐ In a relationship, not living with partner
☐ In a relationship, living with partner
☐ Other

Is your partner of the same-sex as you?

☐ Yes

☐ No

Section 2: About having children.

At the time of the first survey in March 2011, none of the participants in the study had children or were trying to conceive.

In this section we ask about your efforts (if any) to conceive. By conceive we mean you trying to become a parent, with or without a partner, and with or without fertility medical treatment.

Please tick which of the following statements best applies to you:

- ☐ I am currently trying to conceive (with or without a partner)
- ☐ I have tried to conceive in the past (with or without a partner) and I am not currently trying
- ☐ I have never tried to conceive

If you are currently trying to conceive, how long have you been trying? If you are not currently trying to conceive, please skip this question and click next.

Please answer in years and months.

Years

Months

The following questions are about your beliefs about biological infertility. By biological infertility we mean being biologically unable to get pregnant or father a child.

How likely do you think you are to be biologically infertile?
Please use the response scale: not at all likely to extremely likely.

- Not at all likely Slightly likely Moderately likely Very likely Extremely likely
- ☐ ☐ ☐ ☐ ☐

How likely do you think other women/ men your age are to be biologically infertile?
Please use the response scale: not at all likely to extremely likely.

- Not at all likely Slightly likely Moderately likely Very likely Extremely likely
- ☐ ☐ ☐ ☐ ☐

How disruptive would biological infertility be to your life? Please use the response scale: not at all disruptive to extremely disruptive.

- Not at all disruptive Slightly disruptive Moderately disruptive Very disruptive Extremely disruptive
- ☐ ☐ ☐ ☐ ☐

Section 3: Childbearing desires and intentions.

Do you wish to have children in the future?

☐ Yes

☐ No

Section 5: Health factors.

Please read the following statements and indicate whether you think each statement is true or false (or mark 'do not know' if you are unsure).

A woman's age is an important consideration in being able to get pregnant

- ☐ True
- ☐ False
- ☐ Do not know

A man's age is an important consideration in being able to father a child

- ☐ True
- ☐ False
- ☐ Do not know

A pregnancy after the age of 35 would be more physically demanding for a woman

- ☐ True
- ☐ False
- ☐ Do not know

A pregnancy after the age of 35 would be more emotionally demanding for a woman

- ☐ True
- ☐ False
- ☐ Do not know

A pregnancy after the age of 35 is more likely to result in complications such as increased risk of Down Syndrome or premature birth

- ☐ True
- ☐ False
- ☐ Do not know

Any decline in female fertility could be compensated by medical treatment (e.g. IVF or fertility drugs)

- ☐ True
- ☐ False
- ☐ Do not know

Any decline in male fertility could be compensated by medical treatment (e.g. IVF or fertility drugs)

- ☐ True
- ☐ False
- ☐ Do not know

A woman in her 40s has as much chance of getting pregnant as a woman in her 30s

- ☐ True
- ☐ False
- ☐ Do not know

A woman in her 30s has as much chance of getting pregnant as a woman in her 20s

- ☐ True
- ☐ False
- ☐ Do not know

Debrief form

Thank you very much for taking part in this study.

The aim of this study is to better understand the factors that are important to people when making decisions about having children. These factors may be social considerations such as close friends' opinions about having children, personal and individual considerations such as being with the right partner, and health considerations such as wanting to have children

before a certain age. By asking you about your impressions of issues related to having children at several points in time, we hope to investigate whether these impressions influence when people have children.

In this survey we measured your beliefs about the likelihood of fertility problems. Previous research has suggested that people's beliefs about the likelihood of health conditions influence their decisions about health. We will examine whether beliefs about fertility problems are linked to decision-making about having children.

We asked you about your impressions of oocyte freezing, as views towards fertility preservation techniques such as this may be related to decision-making about having children. Further, we asked some questions about the emotions you have experienced recently because these also may be linked to attitudes and decisions about having children.

The data you have provided will be held confidentially. Email addresses will be held according to the Data Protection Act. After completion of the study (i.e. after the follow-up study in two years) we will delete your email address. At this point the data will be anonymous. You have the right to withdraw your data without explanation up until the data has been anonymised, by contacting Professor Jacky Boivin.

If you would like more information about fertility health issues or about fertility medical care then please see the following websites:

www.fertility.com (except residents of Australia)

Australia residents should consult: <http://ivf.com.au>

US residents should consult: www.fertilitylifelines.com

(Cardiff University is not responsible for the content of these external internet sites)

If participation in this study has caused concern about your health or wellbeing then please contact your GP in the usual way.

If you have any further questions about this research then please contact Professor Jacky Boivin or Bethan Fulford:

Name of Researcher	Name of supervisor
Bethan Fulford Postgraduate student	Jacky Boivin Professor of Health Psychology
School of Psychology	School of Psychology
Cardiff University	Cardiff University
Tower Building	Tower Building
Park Place	Park Place
Cardiff	Cardiff
CF10 3AT	CF10 3AT
Tel: 029 2087 0477	Tel: 029 2087 5289
Email: fulfordb@cardiff.ac.uk	Email: boivin@cardiff.ac.uk

For complaint please contact the School of Psychology Ethics Committee:

Secretary of the Ethics Committee
School of Psychology
Cardiff University
Tower Building
Park Place
Cardiff
CF10 3AT
Tel: 029 2087 0360
Email: psychethics@cardiff.ac.uk

**Appendix I: Cardiff University Parenthood Planning Survey: Time 2 Version B:
Survey for Individuals Who Have Given Birth/ Fathered a Child, or Have Adopted
Children, or Are Currently Pregnant/ Expecting a Child**

Only variables relevant to the research question in Chapter 5 are presented. Questions asked only to women are indicated.

Consent form

Thank you for considering participation in part two of the 'Starting Families Study'.

We would like to invite you to participate in part two of the Starting Families Study. By doing this research we hope to achieve a comprehensive account of personal, social and health factors that influence decisions about having children, how these factors change over time, and the impact these changes may have on decision-making about having children.

The survey takes approximately 15 minutes to complete. You can read specific information about the survey below.

The survey is divided into five sections that ask questions about your background (e.g. employment), childbearing intentions and desires, social factors (e.g. opinions of those around you), individual factors (e.g. reasons for when to have children), health factors (e.g. knowledge of fertility issues), and where you are now. We also ask about the emotions you have experienced recently (e.g. anxiety), as these may be linked to views or decisions about having children.

Your participation in this survey is entirely voluntary and you can withdraw from the study at any time by closing the survey window. You may omit any questions you do not wish to complete. Data provided by you will be held confidentially, such that only Professor Jacky Boivin and the researcher Bethan Fulford (postgraduate student of the School of Psychology, Cardiff University) can trace this data back to you individually. Please note that data analysis is carried out using a code number that you have been assigned such that your email address is not stored in the same file as the data. Data will be anonymised at the end of the study (i.e. after the follow-up study in two years) and after this point no one will be able to trace the information back to you. The anonymous data will be retained indefinitely in accordance with the Data Protection Act 1998 and stored on a computer that is password-protected and belongs to Professor Jacky Boivin. You can contact Professor Jacky Boivin and ask for your information to be deleted/destroyed at any time up until the data has been anonymised.

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After completing the survey you will be provided with additional information about the aims of the study and invited to leave your email address for future study information. However, if you would rather not be contacted again you can just fill out the survey today.

To participate in the survey, please read the following statement. In order to be eligible to complete this survey your answer to the statement must be YES. If your answer to the statement is YES please tick the box and then click 'next':

I declare that I understand the information above and I freely consent to participate in this study:

☐ Yes

There are two versions of the survey depending on participants' parenting experiences (version A and version B).

To make sure that you complete the appropriate survey version for your situation, please read the statements under version A and version B below.

Once you have read the statements, tick the box next to the survey version that applies to you:

☐ **SURVEY VERSION A**

Do this survey if...

(women) You have never given birth, you do not have any adopted children and you are not currently pregnant, or;

(men) You have never fathered a child, you do not have any adopted children and you are not expecting a child

☐ **SURVEY VERSION B:**

Do this survey if...

(women) You have given birth or you have adopted children or you are currently pregnant, or;

(men) You have fathered a child or you have adopted children or you are expecting a child

Section 1: About your background.

Are you:

- ☐ Male
☐ Female

As a reminder, all questions in this survey are voluntary and you may omit any questions you do not wish to complete.

What is your date of birth? Please select the day, month and year from the drop-down lists below.

Day

Month

Year

What is your employment status?

- ☐ Full time employment
☐ Part time employment
☐ Unemployed
☐ Student
☐ Retired
☐ Other

What is the highest level of education you have achieved? (Please tick the highest category that applies)

- ☐ No education
☐ Primary school
☐ Secondary school
☐ Post-secondary school/trade or technical college (e.g. BTEC)
☐ University graduate (e.g. BSc, BA)
☐ Postgraduate University (e.g. MSc, PhD)

What is your relationship status?

- ☐ Single (not in a relationship)
☐ In a relationship, not living with partner
☐ In a relationship, living with partner
☐ Other

Is your partner of the same-sex as you?

☐ Yes

☐ No

Section 2: About having children.

At the time of the first survey in March 2011, none of the participants in the study had children or were trying to conceive.

In this section we ask about your efforts (if any) to conceive. By conceive we mean you trying to become a parent, with or without a partner, and with or without fertility medical treatment.

Are you currently pregnant/ expecting a child?

- ☐ Yes
☐ No

How many children do you have? If you are currently pregnant or expecting a child, please do not include this pregnancy.

- ☐ None
☐ One
☐ Two
☐ Three or more

Please tick which of the following statements best applies to you:

- ☐ I am currently trying to conceive (with or without a partner)
☐ I have tried to conceive in the past (with or without a partner) and I am not currently trying
☐ I have never tried to conceive; all my pregnancies were unplanned or my children are adopted

If you are currently trying to conceive, how long have you been trying? If you are not currently trying to conceive, please skip this question and click next.

Please answer in years and months.

Years	<input type="text"/>
Months	<input type="text"/>

The following questions are about your beliefs about biological infertility. By biological infertility we mean being biologically unable to get pregnant or father a child.

**How likely do you now think you are to be biologically infertile?
Please use the response scale: not at all likely to extremely likely.**

- | | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Not at all likely | Slightly likely | Moderately likely | Very likely | Extremely likely |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**How likely do you think other women/ men your age are to be biologically infertile?
Please use the response scale: not at all likely to extremely likely.**

Not at all likely

☐

Slightly likely

☐

Moderately likely

☐

Very likely

☐

Extremely likely

☐

**How disruptive would biological infertility be to your life? Please use the response scale: not at all disruptive to
extremely disruptive.**

Not at all disruptive

☐

Slightly disruptive

☐

Moderately disruptive

☐

Very disruptive

☐

Extremely disruptive

☐

Section 3: Childbearing desires and intentions.

We are interested in your views about having another child. If you are currently pregnant or expecting a child, please answer in relation to having another child after this current pregnancy.

Do you wish to have another child in the future? If you are currently pregnant or expecting a child, please answer in relation to having another child after this current pregnancy.

☐ Yes

☐ No

Section 5: Health factors.

Please read the following statements and indicate whether you think each statement is true or false (or mark 'do not know' if you are unsure).

A woman's age is an important consideration in being able to get pregnant

- ☐ True
- ☐ False
- ☐ Do not know

A man's age is an important consideration in being able to father a child

- ☐ True
- ☐ False
- ☐ Do not know

A pregnancy after the age of 35 would be more physically demanding for a woman

- ☐ True
- ☐ False
- ☐ Do not know

A pregnancy after the age of 35 would be more emotionally demanding for a woman

- ☐ True
- ☐ False
- ☐ Do not know

A pregnancy after the age of 35 is more likely to result in complications such as increased risk of Down Syndrome or premature birth

- ☐ True
- ☐ False
- ☐ Do not know

Any decline in female fertility could be compensated by medical treatment (e.g. IVF or fertility drugs)

- ☐ True
- ☐ False
- ☐ Do not know

Any decline in male fertility could be compensated by medical treatment (e.g. IVF or fertility drugs)

- ☐ True
- ☐ False
- ☐ Do not know

A woman in her 40s has as much chance of getting pregnant as a woman in her 30s

- ☐ True
- ☐ False
- ☐ Do not know

A woman in her 30s has as much chance of getting pregnant as a woman in her 20s

- ☐ True
- ☐ False
- ☐ Do not know

Debrief form

Thank you very much for taking part in this study.

The aim of this study is to better understand the factors that are important to people when making decisions about having children. These factors may be social considerations such as close friends' opinions about having children, personal and individual considerations such as being with the right partner, and health considerations such as wanting to have children

before a certain age. By asking you about your impressions of issues related to having children at several points in time, we hope to investigate whether these impressions influence when people have children.

In this survey we measured your beliefs about the likelihood of fertility problems. Previous research has suggested that people's beliefs about the likelihood of health conditions influence their decisions about health. We will examine whether beliefs about fertility problems are linked to decision-making about having children.

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Australia residents should consult: <http://ivf.com.au>

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(Cardiff University is not responsible for the content of these external internet sites)

If participation in this study has caused concern about your health or wellbeing then please contact your GP in the usual way.

If you have any further questions about this research then please contact Professor Jacky Boivin or Bethan Fulford:

Name of Researcher	Name of supervisor
Bethan Fulford Postgraduate student	Jacky Boivin Professor of Health Psychology
School of Psychology	School of Psychology
Cardiff University	Cardiff University
Tower Building	Tower Building
Park Place	Park Place
Cardiff	Cardiff
CF10 3AT	CF10 3AT
Tel: 029 2087 0477	Tel: 029 2087 5289
Email: fulfordb@cardiff.ac.uk	Email: boivin@cardiff.ac.uk

For complaint please contact the School of Psychology Ethics Committee:

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School of Psychology
Cardiff University
Tower Building
Park Place
Cardiff
CF10 3AT
Tel: 029 2087 0360
Email: psychethics@cardiff.ac.uk

Appendix J: Semi-Structured Interview Schedule

Questions in italic font were different for women of reproductive age, general practitioners (GPs) and public health professionals.

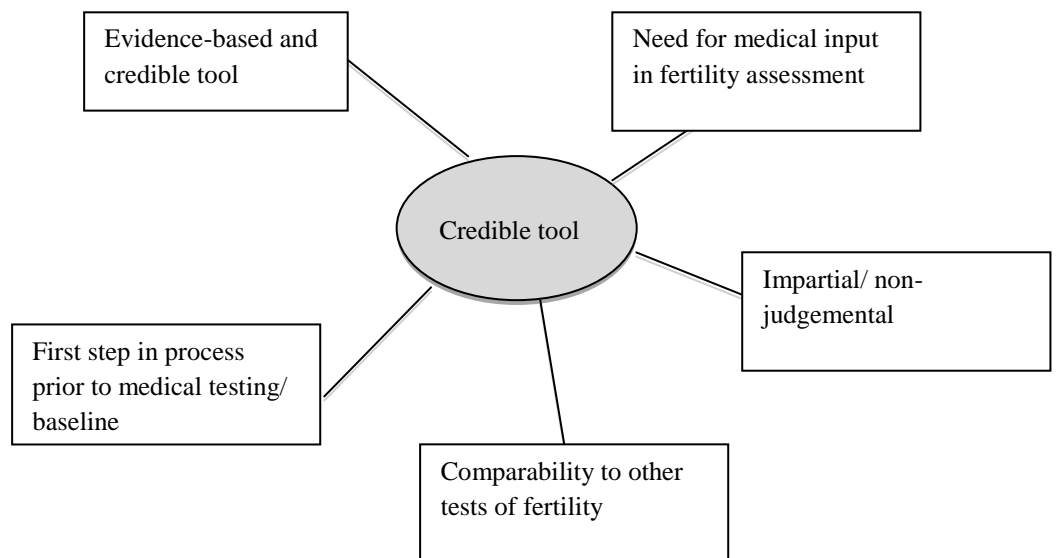
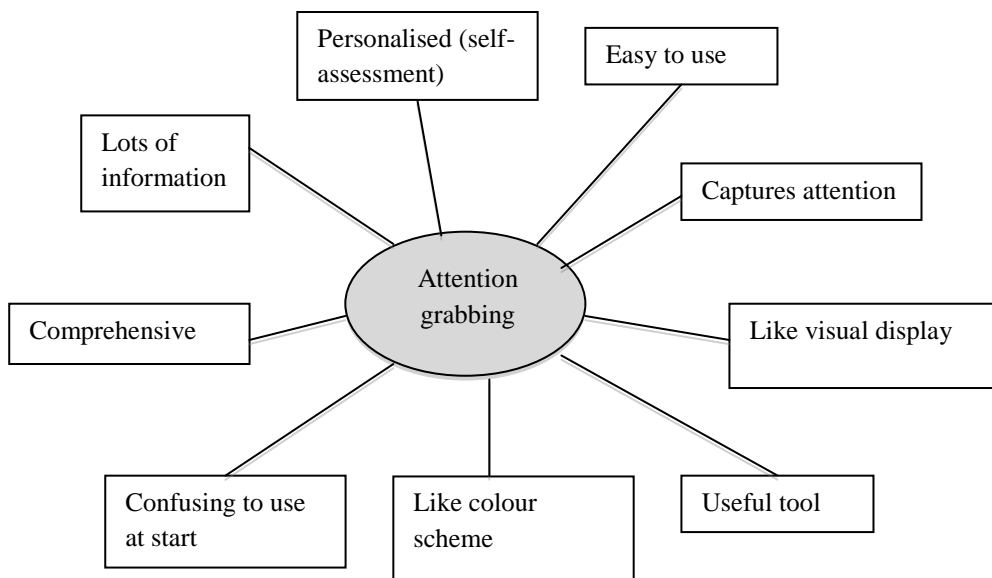
Question number	Asked to which participants	Section
		Section 1: Practicality of the FertiSTAT
1	All	What were your impressions of the visual layout of the FertiSTAT?
		Ease of use
2	All	How did you find following the instructions? [Prompt: Is there anything you found easy or difficult?]
		Comprehension
3	All (adapted)	<i>Women of reproductive age: Could you summarise what you thought the FertiSTAT was asking you to do?</i> <i>GPs & public health professionals: Could you summarise what you thought the FertiSTAT was asking users to do?</i>
4	All	Is there anything else you would like to tell us about the visual display of the FertiSTAT?
		Section 2: Acceptability
5	All	What were your impressions of the content (e.g., risk factor questions, critical thresholds, guidance, male questions) of the FertiSTAT?
6	All	How believable was the information (e.g., risk factors) presented in the FertiSTAT?
7	GPs & public health professionals	<i>GPs & public health professionals: How comprehensive was the information (e.g. any risks missing) presented in the FertiSTAT?</i>
8	GPs & public health professionals	<i>GPs & public health professionals: What do you think the FertiSTAT could add to current (medical) practice? Is there a place for the tool in your work?</i>
9	All	What would have been your reaction to the FertiSTAT if you had seen it in a magazine
		Section 3: Perception of the FertiSTAT effects and impact
10	All (adapted)	<i>Women of reproductive age: What do you now know about your fertility?</i> <i>GPs & public health professionals: What do you now know about factors that affect female fertility (if anything different)?</i>
		Feeling/emotional reactions & thinking/practical reactions
11	Women of reproductive age	<i>Women of reproductive age: How has the FertiSTAT made you think or feel about your fertility/chances of getting pregnant?</i>

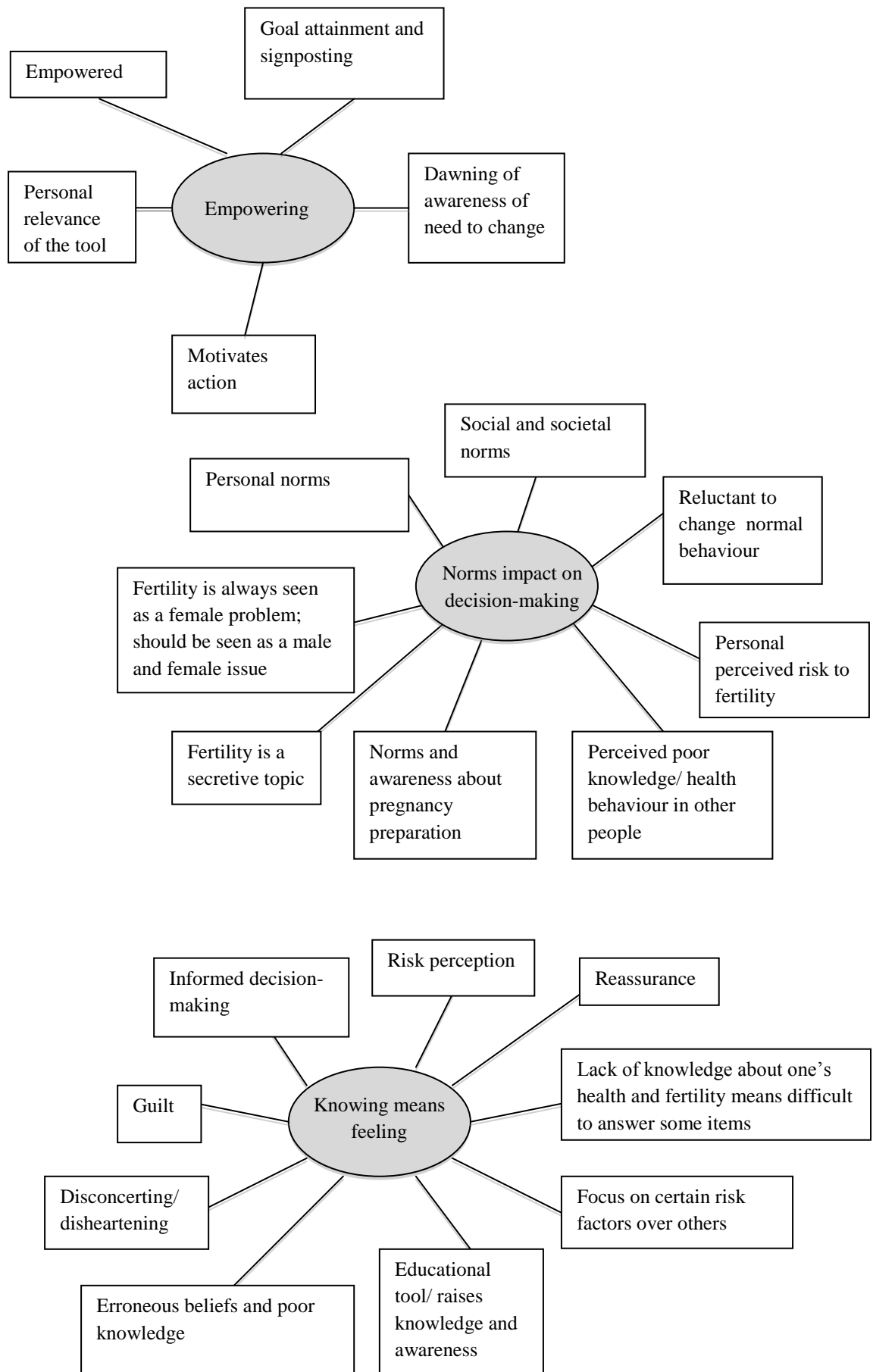
12	All (adapted)	<p><i>Women of reproductive age: What do you think or feel are the advantages or disadvantages to you in using the FertiSTAT?</i></p> <p><i>GPs & public health professionals: What do you think or feel are the advantages or disadvantages to you as a health professional/ your organisation in using the FertiSTAT?</i></p>
13	All	What do you think or feel are the advantages or disadvantages to women in general in using the FertiSTAT?
14	Women of reproductive age	<i>Women of reproductive age: What have you learnt about what action you would need to take and when?</i>
Section 4: Endorsement		
15	All (adapted)	<p><i>Women of reproductive age: What would you tell other women about the FertiSTAT?</i></p> <p><i>GPs & public health professionals: What would you tell other colleagues/ medial practitioners about the FertiSTAT?</i></p>
16	GPs & public health professionals	<i>GPs & public health professionals: What do you think about the actions recommended by the FertiSTAT guidance?</i>
Section 5: Wider application and implementation		
17	All	What would the value be in having a couple and/or a male FertiSTAT?
18	All	Are you aware of any over-the-counter methods for testing your fertility? If yes, what methods?
19	All	How do you think the FertiSTAT would fit with these other methods?
20	Women of reproductive age	<i>Women of reproductive age: Would you have any preference of method if you wanted to test your fertility?</i>
21	GPs & public health professionals	<i>GPs & public health professionals: How best can the FertiSTAT be disseminated (e.g. where, how)?</i>
22	Public health professionals	<i>Public health professionals: Would there be a place for the FertiSTAT in the materials you promote for your organisation?</i>
23	All	Is there anything else you would like to tell us about the FertiSTAT?
Section 6: Norms about preparing for pregnancy		
24	Women of reproductive age	<p><i>Women of reproductive age: If you wanted to have a child, is there anything that you would do in preparation to start trying to get pregnant?</i></p> <p><i>[Prompt: Is there anything you would add to your lifestyle?]</i></p>
25	Women of reproductive age	<i>Women of reproductive age: The NHS give lots of recommendations about fertility and people trying to get pregnant, have you heard of any?</i>
26	Women of reproductive age	<p><i>Women of reproductive age: [The NHS recommendations about fertility and pregnancy preparation were first briefly outlined to participants, including reducing negative lifestyle habits such as smoking, increasing healthy behaviours such as exercise, and taking folic acid supplements]</i></p> <p><i>What do you think of these recommendations?</i></p>

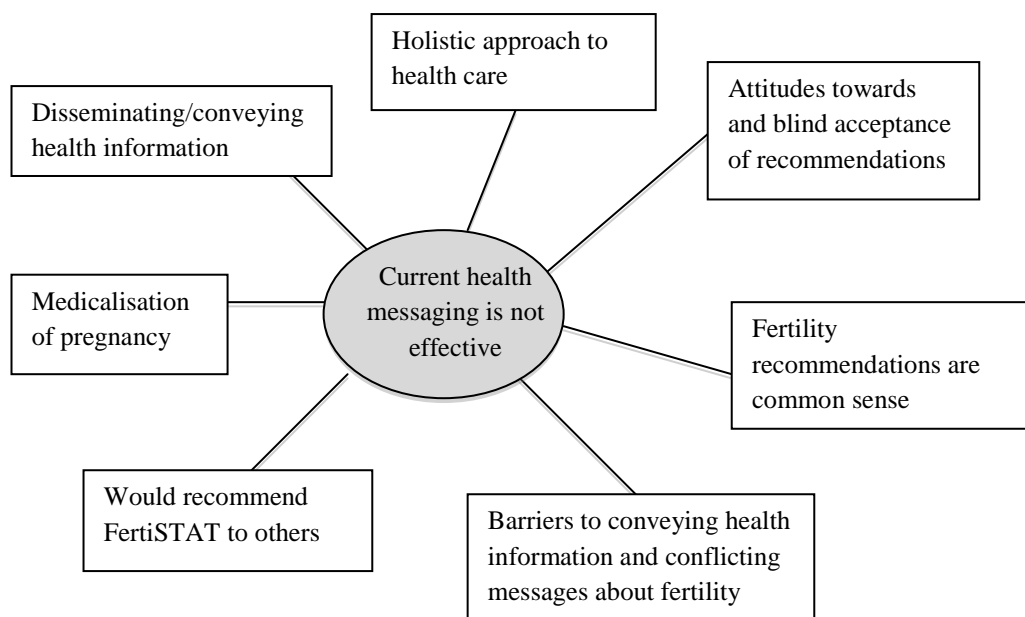
27	GPs & public health professionals	<i>GPs: What information do you provide patients who come and see you with the intention of starting to try to get pregnant?</i> <i>Public health professionals: What services/information do you provide users of your organisation who are trying to get pregnant?</i>
28	Public health professionals	<i>Public health professionals: Do you think there is a need for a national campaign to raise awareness about fertility health issues?</i>
29	Public health professionals	<i>Public health professionals: Do you think there is a need for a national campaign to raise awareness about fertility health issues?</i>
30	Public health professionals	<i>Public health professionals: Would your organisation be interested in /support /endorse a campaign to raise awareness about fertility</i>
		Perceived susceptibility to pregnancy-related complications (others, self)
31	Women of reproductive age	<i>Women of reproductive age: Suppose a woman is trying to get pregnant and does not follow these recommendations, how do you think it would affect her pregnancy and/or her baby?</i>
32	Women of reproductive age	<i>Women of reproductive age: Suppose you were trying to get pregnant and did not follow these recommendations, how do you think it would affect the pregnancy and/or the baby?</i>
		Beliefs about folic acid supplementation
33	Women of reproductive age	<i>Women of reproductive age: Have you heard about the government recommendations for folic acid? What do you think these are?</i> <i>[Prompt: In terms of the timing and dosage of supplementation?]</i>
34	All	<i>[The government recommendations for folic acid supplementation were first outlined to participants who had not heard of the recommendations; specifically that the government currently recommends that women who are trying to get pregnant take 400 micrograms of folic acid supplement per day]</i> <i>What do you think about the government's guidelines on folic acid?</i>
35	GPs & public health professionals	<i>GPs & public health professionals: Adherence to folic acid supplementation recommendations is around 30%; what do you think can be done to increase adherence?</i>

Appendix K: Theme Maps Displaying the Codes ($n = 43$) Representing Each Theme ($n = 6$) For Women of Reproductive Age ($n = 14$)

Themes are contained in circles, codes are contained in rectangles

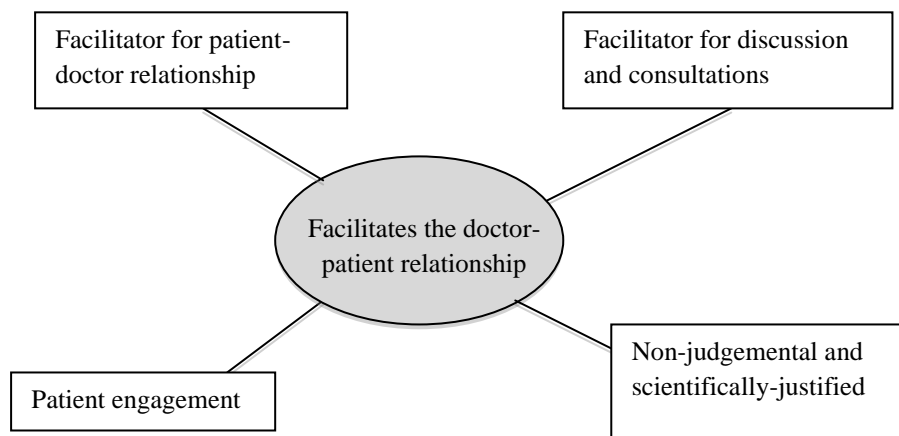
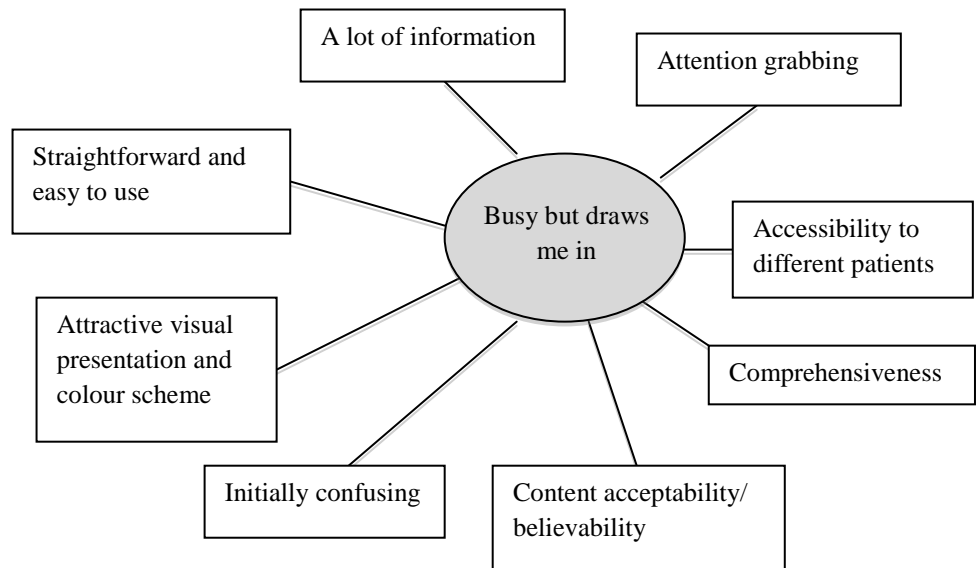


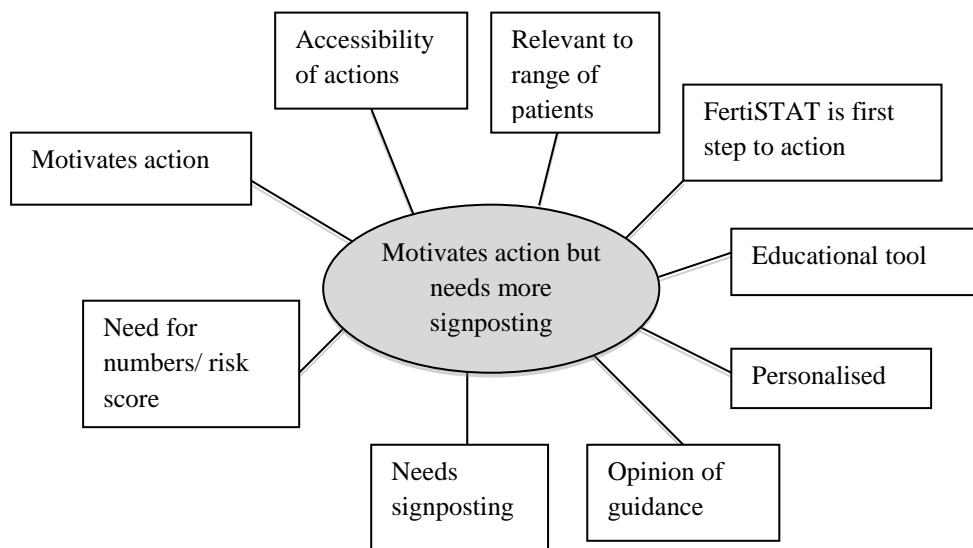
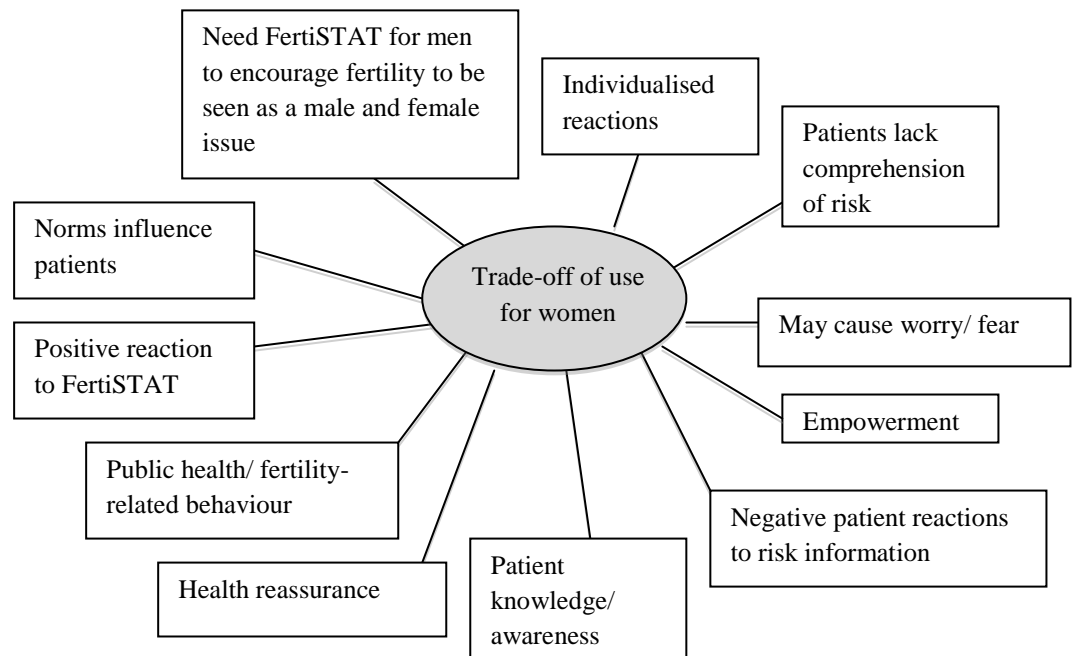
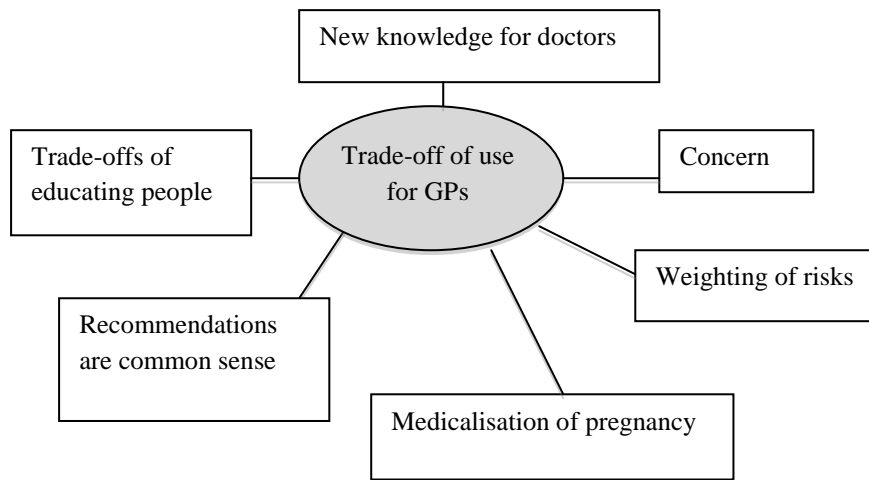


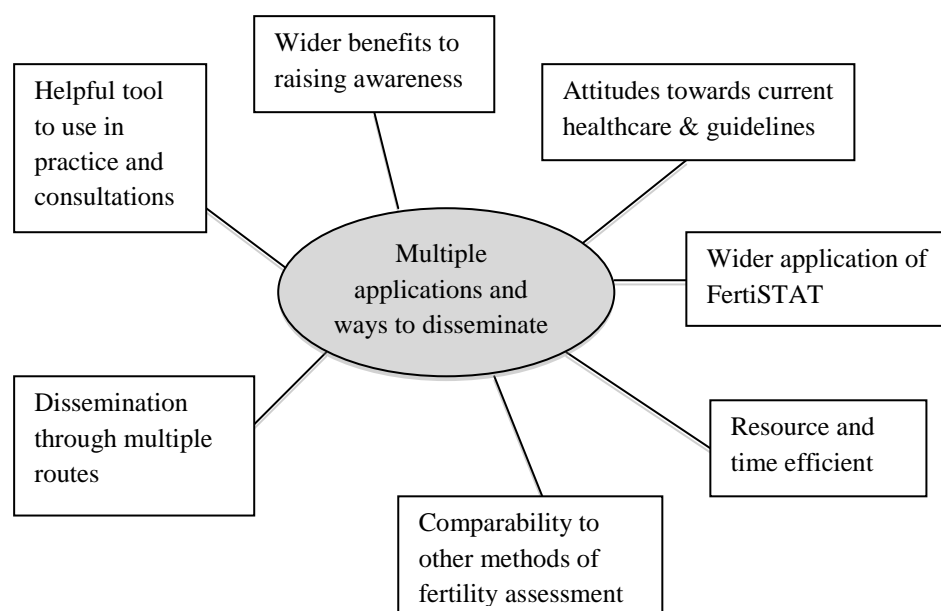


Appendix L: Theme Maps Displaying the Codes ($n = 45$) Representing Each Theme ($n = 6$) For General Practitioners ($n = 7$)

Themes are contained in circles, codes are contained in rectangles







Appendix M: Theme Maps Displaying the Codes ($n = 44$) Representing Each Theme ($n = 6$) For Public Health Professionals ($n = 3$)

Themes are contained in circles, codes are contained in rectangles

