Assessing Fertility Knowledge: Development and Validation of the Male and Female Fertility Knowledge Inventories

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Author Note

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Abstract

Infertility and involuntary childlessness remain global public health issues. Previous research reveals poor understandings of fertility. Health behaviour change interventions, such as those based on the Information-Motivation-Behavioural Skills Model, state that information is a prerequisite to health behaviour change, yet previous measurement of fertility knowledge is poor, with limitations in construct operationalisation, item generation, and theoretical and psychometric analysis. Moreover, scales do not differentiate between male and female infertility risks. This research aimed to develop two psychometrically sound scales specific to measuring knowledge about male and female fertility using Classical Test Theory and established scale development protocol. A three-stage approach was adopted, where analysis and refinement of scale items occurred sequentially in three groups including fertility health professionals (*n*=8), laypeople (*n*=13), and people of reproductive age (*n*=226). From the original 36 items in each item pool, following data analysis, results yielded a 14-item, three-factor solution for the Male Fertility Knowledge Inventory (MFKI) and a 15-item, four-factor solution Female Fertility Knowledge Inventory (FFKI). The MFKI and FFKI had acceptable internal consistency ($\alpha = .78,\ \alpha = .77$, respectively) and partial support for concurrent validity. Convergent and divergent validity were not supported; future research should determine constructs that are appropriate to further validate these scales. While the scales may undergo further refinement in the future, their development allows researchers to measure knowledge of male and female fertility separately and to determine their importance in fertility decision-making. The scales may be used in clinical practice as screening tools to identify people at risk of infertility and involuntary childlessness.

Conference presentation based on the data from this thesis

Citation for the presentation listed below, for a copy of the submitted abstract please refer to Appendix A.

XXXX. (2018, July). What people of reproductive age know about male and female fertility: development and validation of the Male and Female Fertility Knowledge Measures. *The University of Adelaide Undergraduate Research Conference 2018*. Conference conducted at The University of Adelaide, South Australia, Australia.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made.

I give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

October 2018

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Many thanks to XXXX for being an unfailingly supportive supervisor. Many thanks to my mum, dad, brother and friends for listening to many hours of Honours chatter. Many thanks to John for your attention to detail.

To my grandpa, who would be sure to make a note of this.

Chapter 1 Introduction

1.1 Infertility and Involuntary Childlessness

In Australia, one in six couples experience fertility problems in their reproductive lifetime (ABS, 2009). While lifestyle factors including diet, weight and medical treatments are associated with infertility, the increased tendency of delayed childbearing also poses difficulties for couples hoping to have their first child in their early to late 30s, the timing of which coincides with age-related decline in male and female fertility (ABS, 2010) (Figure 1). Infertility and delayed childbearing can result in couples having less than their desired number of children, or being unable to have children altogether, an experience described as involuntary childlessness.

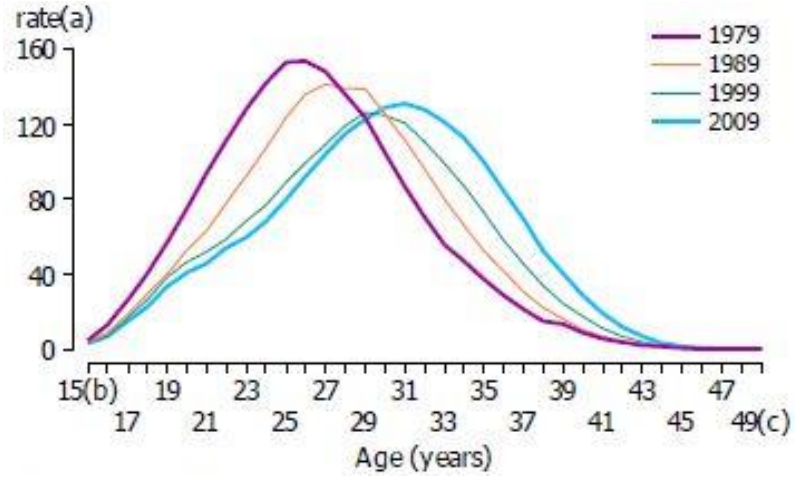

Figure 1. Fertility rates between 1979 and 2009 in Australia, revealing the tendency for women in the 2009 cohort to delay childbearing when compared to cohorts from 1979, 1989 and 1999. *Notes.* (a) indicates babies per 1,000 women; (b) includes births to mothers aged less than 15 years; (c) includes births to mothers aged 50 years and over (ABS, 2010).

Reasons for delayed childbearing in high income countries are diverse, with increased accessibility to education meaning that desires to advance in a professional career, establish financial stability and self-development often requisite to childbearing for both men and women (Abiodun, Alausa, & Olasehinde, 2016; Hammarberg et al., 2017; Mogilevkina, Stern, Melnik,

Getsko, & Tyden, 2016). However, people also have poor knowledge of their own fertility potential and overestimate their fertility. Daniluk and Koert (2012) found that over 40% of women rated themselves as being "fairly" or "very knowledgeable" about fertility, and 54% rated themselves as having at least some knowledge ($p < .05$). Similarly, Abiodun et al. (2016) identified that 51.7% of men and women perceived themselves as being "very educated" about fertility. However, both studies revealed a poor understanding of age-related fertility decline and the success of In Vitro Fertilisation (IVF). This replicates previous findings revealing poor knowledge of the effect of age, lifestyle choices, infertility treatments (Abiodun et al., 2016; Bretherick, Fairbrother, Avila, Harbord, & Robinson, 2010; Bunting & Boivin, 2008; Daumler, Chan, Lo, Takefman, & Zelkowitz, 2016; Lampic, Svanberg, Karlstrom, & Tyden, 2006; Swift & Liu, 2014), myths and misconceptions related to infertility (Bunting & Boivin, 2008; Daniluk & Koert, 2012). Consequently, delayed childbearing and poor understanding of fertility contributes to a discrepancy between people's ideal social and biological reproductive ages, leading to greater risk of infertility and involuntary childlessness.

1.2 Psychological Burden of Infertility and Involuntary Childlessness

The psychological burden associated with infertility and involuntary childlessness can be significant, and historically, disproportionately falls on women. In this sociocultural context, infertility or involuntary childlessness can lead to experiences of depression comparable to individuals with chronic disease, dissatisfaction with life, insecurity, inferiority and grief (Galhardo, Pinto-Gouveia, Cunha, & Matos, 2011; Gana & Jakubowska, 2016; Miles, Keitel, Jackson, Harris, & Licciardi, 2009; Peterson, Sejbaek, Pirritano, & Schmidt, 2014). Infertile and involuntarily childless men are also reported to have poorer subjective quality of life and self-esteem when compared to fathers (Klemetti, Raitanen, Sihvo, Saarni, & Koponen, 2010; Wischmann, Korge, Scherg, Strowitzi, & Verres, 2012). Therefore, such reproductive issues are

associated with significant psychological and financial burden, which has implications for the provision and costs of healthcare education and services.

1.3 The Role of Knowledge in Fertility Decision-Making

Many fertility issues are preventable, or at least modifiable, and therefore efforts to minimise a couple's risk of involuntary childlessness can be approached through behaviour change interventions. To date, the role of knowledge in fertility related decision-making is poorly understood. Some cross-sectional studies reveal no association between fertility understandings and childbearing intentions but are criticised for their atheoretical approach (Daniluk & Koert, 2015). Additionally, the multifactorial decision-making process related to career, education, financial security and health has been cited as a reason for failing to detect the contribution of fertility knowledge to childbearing behaviours (Maeda, Nakamura, Kobayashi, et al., 2016). Nevertheless, interventions aimed at increasing knowledge of childless men and women have been shown in the short-term to increase confidence in their own fertility and decrease intentions to delay childbearing (Daniluk & Koert, 2015; Williamson, Lawson, Downe, & Pierson, 2014). In the wider health literature, there is support for knowledge in predicting and promoting good health behaviour. For example, increasing knowledge of signs, symptoms and preventable causes of breast cancer can lead to reduced delay in help seeking and improved outcomes (Grunfeld, Hunter, Ramirez, & Richards, 2003). Acknowledging the value of knowledge in the wider health literature, that fertility decision-making remains relatively poorly understood, and evidence to suggest fertility knowledge plays a role in childbearing intentions and behaviour, there is merit in considering an approach to behaviour change that can improve people's fertility decision-making.

1.3.1 Information-Motivation-Behavioural Skills (IMB) Model.

One approach to behaviour change and health promotion is the IMB Model, consisting of three stages: (1) elicitation of existing information, motivation and behavioural skills in a population, (2) implementation of an intervention designed to address the population's identified

deficits, and (3) evaluation of the intervention to determine sustained effects on the three determinants of the targeted health behaviour (Fisher, Fisher, & Harman, 2003). These determinants are explored within the context of involuntary childlessness and infertility in Figure 2. While knowledge in and of itself is not enough to enact behaviour change, it is an influential component in health decision-making and behaviour and reflects the multifactorial decision-making process of childbearing previously mentioned, making the IMB Model highly applicable to fertility behaviour. In this regard, there is significant need to accurately quantify people's understanding of fertility to determine what they know, and to evaluate the effectiveness of interventions that are designed to deliver appropriate information and improve people's understanding of fertility. Furthermore, scales that measure understandings of fertility must be developed and tested to ensure they accurately quantify people's knowledge.

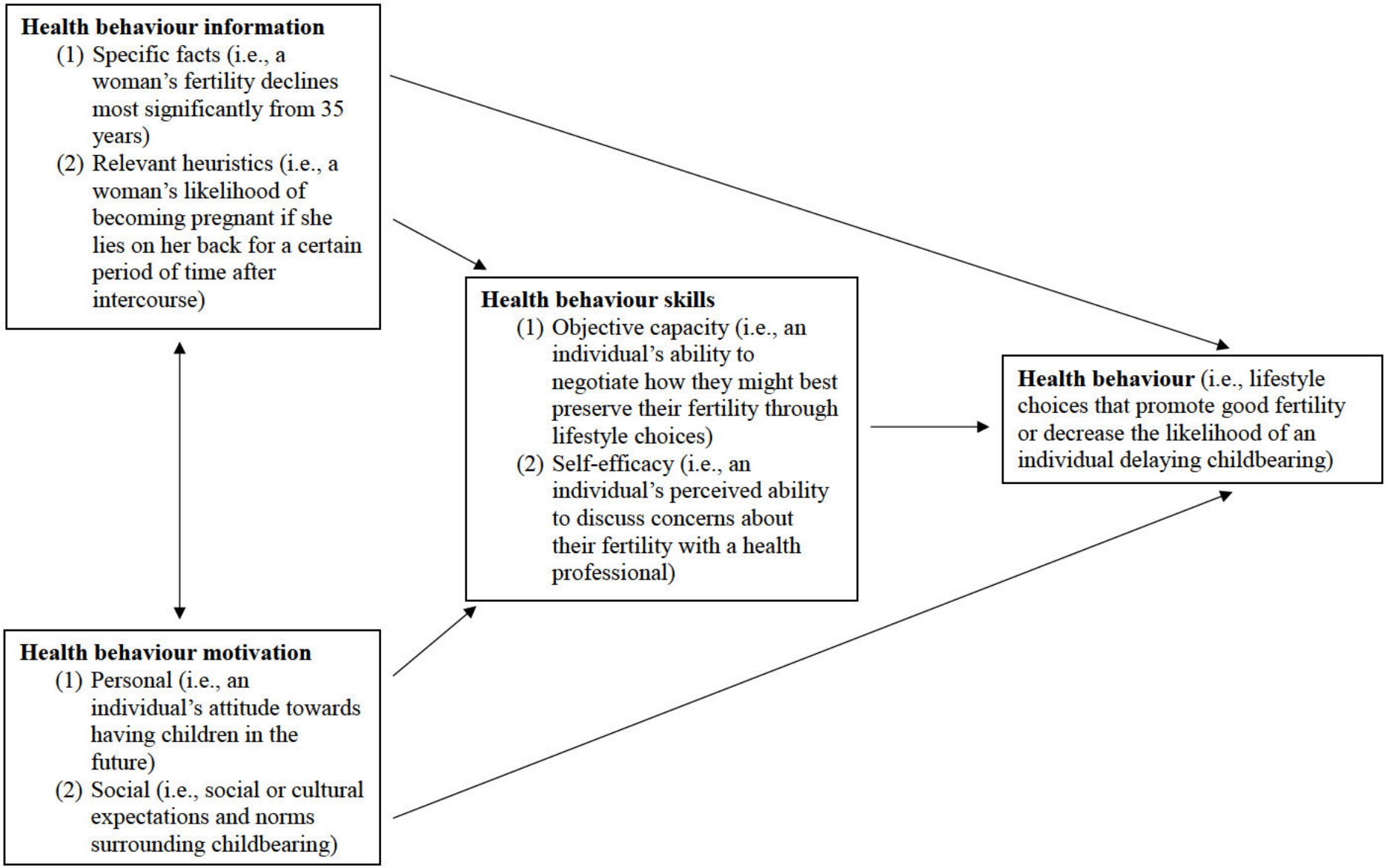

Figure 2. The Information-Motivation-Behavioural Skills Model, exploring information, motivation and behavioural skills specific to involuntary childlessness and infertility.

1.4 Psychological Scale Development

Scale development is conceptualised through two leading paradigms in psychology: Classical Test Theory (CTT) and Item Response Theory (IRT). Empirical studies have found comparable performance in scales developed using either paradigmatic approach (Courville, 2004; Fan, 1998), and adoption of either paradigm dictates the item and scale analyses that are used to determine final scale structure.

Exclusive to the paradigmatic approach, several authors agree that scale development is a complex and iterative process requiring methodological rigor that can be undertaken in three steps following construct operationalisation: (1) item generation, (2) theoretical analysis and (3) psychometric analysis (De Vellis, 2012; Nunnally, 1967).

1.4.1 Construct operationalisation.

At the very least, precise operationalisation should consist of a definition of the latent variable and should extend to a description of how the new construct relates to existing phenomena and their operationalisation (De Vellis, 2012). With regards to scale development, the specificity of a scale should also be defined, whether its intention be to measure a specific or global construct (De Vellis, 2012).

There are two constructs that are used to measure people's understanding of fertility in the literature: fertility awareness and fertility knowledge. The constructs are often used interchangeably, creating issues for scale use, interpretation and determination of the significance of research findings.

1.4.1.1 Fertility awareness

Fertility awareness is defined as a woman's understanding of the fertile period of the menstrual cycle (Hampton & Mazza, 2015). Educating couples about this period provides a relatively inexpensive and simple way to increase the chance of conception (Bunting & Boivin,

2008; Hampton & Mazza, 2015). However, the primary focus of fertility awareness education has been to provide females with information related to their menstrual cycle, but fails to provide further education to males seeking information about their own fertility or a couple's overall fertility potential.

1.4.1.2 Fertility knowledge

Previous literature has failed to formally define fertility knowledge, despite increasing usage of the term. There are few studies that have investigated components of fertility knowledge informed by a theoretical framework, exposing difficulties in precise and informed construct operationalisation. Bunting, Tsibulsky, and Boivin (2013) identify three areas of fertility knowledge that are most likely to affect fertility decision-making: (1) knowledge about indicators for reduced fertility (e.g., smoking and weight), (2) misconceptions about fertility, and (3) basic facts about infertility. In light of these known factors, and reflecting the IMB model conceptualisation of information as both specific facts and relevant heuristics, fertility knowledge is hereby defined as one's level of understanding about both male and female fertility decline with age, risk factors for infertility, misconceptions about fertility and a basic awareness of infertility treatment.

1.4.2 Item generation.

Development of an initial item pool can be achieved using inductive methods, through literature review and pre-existing scale content, deductive methods, through qualitative information obtained from the target population, or a combined approach (Hinkin, 1995). Parameters relevant to the entire scale include length, format and instructions, while item parameters include consideration to simple, clear, specific and unbiased structure (Morgado, Meireles, Neves, Amaral, & Ferreira, 2018).

1.4.3 Theoretical analysis.

Theoretical analysis must be undertaken to assess content validity of the new scale; the extent to which content material relevant to the desired construct is sampled in the item pool (Morgado et al., 2018). To ensure content validity, expert judges or members of the intended respondent population evaluate proposed items for construct representativeness (Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003). Content validity may be qualitative, that is, feedback provided for each item or the entire scale, or quantitative, that is, mathematically quantified as a Content Validity Index (CVI) addressing item relevance and clarity (Polit & Beck, 2006).

1.4.4 Psychometric analysis.

Validity and reliability testing are used to refine the item pool until a scale that best measures the intended construct is devised. Preliminary item analyses are undertaken to determine parameters of each item in a validation sample, including tests of item difficulty, discrimination and item-to-total correlation (De Vellis, 2012). Further, entire scale analyses are conducted, comprising testing of construct validity through exploratory factor analysis (EFA), complemented by other forms of validity testing which may include concurrent, convergent, divergent and predictive validity (De Vellis, 2012). Psychometric testing also comprises reliability testing, including internal consistency, test-retest and split-half reliability. While more rigorous testing can lead to a higher quality scale, psychometric testing is not an isolated process where every test must be administered to fulfil validity and reliability. Instead, psychometric testing should be an iterative process, where further psychometric testing ensures a valid and reliable scale continues to be reflective of its intended population (Chan, 2014). Nevertheless, scale development should focus on item and scale evaluation to provide reasonable evidence of initial psychometric strength.

1.5 Current Use of Scales to Assess People's Understanding of Fertility

Numerous scales are employed to measure people's understanding of fertility in diverse adult populations of, or approaching, reproductive age. Existing scales assess knowledge of age-related fertility decline, risk factors for infertility, misconceptions about fertility and infertility treatments. Some have been evaluated for their psychometric properties and have revealed differences in knowledge according to gender, age and previous experience of fertility issues. A literature review was conducted based on the combination of search terms provided in Table 1 (see Appendix B for specific logic grids) to identify previous scale development methods. A summary of findings is provided in Table 2.

Table 1

Search terms and Boolean (Logical) Operators used in the database searches

AND ⇨

Understandings of fertility	Measurement
Fertility knowledge	Scale
Fertility awareness	Inventory
	Questionnaire
OR ⇩	Measure
	Survey
	Instrument
	Checklist
	Schedule

Notes. Search terms included stated terms in both singular and plural forms.

Table 2

Summary of measures used to assess understanding of fertility in studies published since 2000 in populations of people of or approaching reproductive age in the general population

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Abiodun et al. (2016)	Nigeria Cross-sectional, 389 participants (231 female, 158 male)	SFAQ (9) Fertility awareness (F)			
Almeida-Santos, Melo, Macedo, and Moura-Ramos (2017)	Portugal Cross-sectional, 2404 participants (1596 female, 808 male)	Study specific (24) Fertility knowledge (detail not provided)			
Bodin et al. (2017)	Sweden Cross-sectional, 796 male participants	Study specific (5) Fertility knowledge (M & F)	Inductive (pre-existing scale content)	Qualitative (experienced clinicians)	
Boivin et al. (2018)	Wales	Modified CFKS (15) Fertility knowledge (M & F)			

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
	Intervention, 208 participants (122 female, 86 male)				
Bunting et al. (2013)	79 countries Cross-sectional, 10,045 participants (8,355 female, 1,690 male)	CFKS (13) Fertility knowledge (M & F)	Inductive (pre-existing scale content, literature review)		Exploratory factor analysis (1 factor structure, 30% explained variance) Internal consistency ($\alpha = .79$)
Chan, Chan, Peterson, Lampic, and Tam (2015)	Hong Kong Cross-sectional, 367 participants (275 female, 92 male)	SFAQ (9) Fertility Awareness (F)			
Conceicao, Pedro, and Martins (2017)	Portugal Intervention, 173 participants (140 female, 33 male)	Study specific (37) Fertility knowledge (M & F)	Inductive (pre-existing scale content)		

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Daniluk and Koert (2013)	Canada Cross-sectional, 599 male participants	FAS-M (modified FAS) (20) Fertility knowledge (M & F)			Factor analysis (failed to converge) Internal consistency ($\alpha = .74$)
Daniluk and Koert (2015)	Canada Intervention, 199 participants (151 female, 48 male)	Fertility Awareness Survey (FAS) (16) Fertility knowledge (M & F)			
Daumler et al. (2016)	Canada Cross-sectional, 701 male participants	Study specific (4) Fertility knowledge (M)	Inductive (systematic review) Deductive (two male infertility specialists)		
Fulford, Bunting, Tsibulsky, and Boivin (2013)	38 countries (including Japan, Russia, India, China)	CFKS (13) Fertility knowledge (M & F)			Internal consistency ($\alpha = .74$)

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
	Cross-sectional, 1345 female participants				
Garcia, Vassena, Prat, and Vernaeve (2016)	Spain Intervention, 201 female participants	Study specific (10) Fertility knowledge and awareness (F)	Inductive (pre-existing scale content)		
Hampton, Mazza, and Newton (2013)	Australia Cross-sectional, 204 female participants	Study specific (3) Fertility awareness (F)	Inductive (pre-existing scale content)	Pilot study (6 female participants)	Inter-rater reliability (Cohen's Kappa = .82)
Hampton and Mazza (2015)	Australia Cross-sectional, 328 female participants	Modified Hampton et al. (2013) (3) Fertility awareness (F)		Pilot study (30 female participants)	Inter-rater reliability (Cohen's Kappa = .93)
Heywood, Pitts, Patrick, and Mitchell (2016)	Australia Cross-sectional, 1780 secondary school participants (1,125 female, 655 male)	Study specific (13) Fertility knowledge (detail not provided)			

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Holton et al. (2016)	Australia Cross-sectional, 1,104 male participants	Study specific (3) Fertility knowledge (M & F)	Inductive (pre-existing scale content)		
Kudesia, Chernyak, and McAvey (2017)	United States of America Cross-sectional, 1,245 participants	Fertility & Infertility Treatment and Knowledge Score (FIT-KS) (29) Fertility knowledge (F)	Inductive (pre-existing scale content, literature review) Deductive (research and clinical experience)	Expert review (15 reproductive endocrinologists) Pilot study (10 laypeople)	Item difficulty (.56) Item discrimination (.20) Internal consistency Item consistency (.05) Divergent, convergent, discriminative validity
Lampic et al. (2006)	Sweden	SFAQ (9) Fertility awareness (F)	Deductive (research and clinical experience)	Pilot study (50 student participants)	Test-retest reliability

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
	Cross-sectional, 401 participants (222 female, 179 male)				
Lucas, Rosario, and Shelling (2015)	New Zealand Cross-sectional, 683 participants (453 female, 226 male, 4 other)	Study specific (3) Fertility awareness (F)	Inductive (pre-existing scale content)		
Maeda, Nakamura, Boivin, et al. (2016)	Japan Cross-sectional, 640 participants (344 female, 296 male)	CFKS-J (13) Fertility knowledge (M & F)			Factor analysis (1 factor structure) Internal consistency ($\alpha = .72$) Moderate point biserial correlation (Item 1 = .53)
Maeda, Nakamura,	Japan	CFKS-J (13) Fertility knowledge (M & F)			

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Kobayashi, et al. (2016)	Intervention, 1,455 participants (729 female, 726 male)				
Maeda et al. (2015)	Japan Intervention, 1455 participants (729 female, 726 male)	CFKS-J (13) Fertility knowledge (M & F)	Forward and back-translation		Internal consistency $\alpha = .74, .72)$ Factor analysis (1 factor structure) Biserial correlations (.36 to .55)
Meissner, Schippert, and von Versen-Hoynck (2016)	Germany Cross-sectional, 1,144 (881 female, 263 male)	SFAQ (9) Fertility awareness (F)	Inductive (pre-existing scale content, systematic review)		
Mortensen, Hegaard, Andersen, and Bentzen (2012)	Denmark Cross-sectional, 863 female participants	SFAQ (9) Fertility knowledge (F)			

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Mu (2017)	United States of America Cross sectional, 342 female participants	Study specific (MU-fertility knowledge assessment scale) (26) Fertility knowledge (F)			Internal consistency (Kuder Richardson coefficient = .74) Known groups validity Exploratory factor analysis
Na Nakhon, Limvorapitux, and Vichinsartvichai (2018)	Thailand Cross-sectional, 401 participants (233 female, 168 male)	Study specific (8) Fertility knowledge (M & F)	Inductive (pre-existing scale content)	Quantitative (Item-Objective Congruence score 0.5) Pilot study (20 laypeople)	Internal consistency ($\alpha = .70$)
Nouri et al. (2014)	Austria Cross-sectional, 340 participants (170 female, 170 male)	Study specific (21) Fertility awareness (M & F)	Inductive (pre-existing scale content)	Pilot study (n = 30)	

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Peterson, Pirritano, Tucker, and Lampic (2012)	United States of America Cross-sectional, 246 participants (138 female, 108 male)	SFAQ (9) Fertility awareness (F)			
Prior, Lew, Hammarberg, and Johnson (2018)	Australia Cross-sectional, 1,215 participants (930 female, 285 male)	Study specific (length not provided) Fertility knowledge (M & F)	Inductive (published literature, pre-existing scale content) Deductive (research and clinical experience)		
Righarts, Dickson, Parkin, and Gillett (2017)	New Zealand Cross-sectional, 1,034 female participants	Study specific (3) Fertility knowledge (F)			
Swift and Liu (2014)	Canada Cross-sectional, 140 female participants	Study specific (22) Fertility awareness (F)			

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
Sorensen et al. (2016)	Denmark Cross-sectional, 517 participants (438 female, 79 male)	SFAQ (9) Fertility awareness (F)			
Ter Keurst, Boivin, and Gameiro (2016)	UK Cross-sectional, 257 female participants	Study specific (6) Fertility knowledge (F)	Inductive (pre-existing scale content)		
Vassard, Lallemant, Nyboe Andersen, Macklon, and Schmidt (2016)	UK & Denmark Cross-sectional, 1,237 participants (1,000 female, 237 male)	Modified SFAQ (4) Fertility awareness (F)	Format modified		
Vujcic, Radicevic, Dubljanin, Maksimovic, and Grujicic (2017)	Serbia Cross-sectional, 665 participants (271 female, 147 male)	SFAQ (9) Fertility awareness (F)			
Williamson et al. (2014)	Canada	Study specific (4)			

Author, year	Country Type of study, sample size	Scale (n = items) Construct operationalisation (male/female[a])	Item generation[b]	Theoretical analysis[c]	Psychometric analysis
	Intervention, 69 female participants	Fertility knowledge (F)			
Wojcieszek and Thompson (2013)	Australia Intervention, 137 participants	Study specific (5) Fertility and infertility knowledge (F)	Inductive (systematic review)		

Notes. [a] Whether the scale assessed knowledge about male (M) and/or female (F) fertility; [b] Whether the scale used inductive or deductive item generation; [c] Whether the scale used quantitative or qualitative theoretical analysis.
CFKS = Cardiff Fertility Knowledge Scale; CFKS-J = Cardiff Fertility Knowledge Scale (Japanese translation); FAS = Fertility Awareness Survey; FAS-M = Fertility Awareness Survey (for men); SFAQ = Swedish Fertility Awareness Questionnaire.

The review identified three instruments designed to assess understanding of fertility across 37 studies: nine used the Swedish Fertility Awareness Questionnaire (SFAQ), six used the Cardiff Fertility Knowledge Scale (CFKS) or its Japanese translation (CFKS-J), and three used the Fertility Awareness Survey (FAS) or its modified male version (FAS-M). All other studies used study-specific scales (19). The research aimed to elicit people's understanding of fertility using cross-sectional approaches, with the exception of eight intervention studies.

However, current literature is limited in the poor adherence to scale development paradigms and protocol. For example, the most frequently used scale, the SFAQ, provided no detail of item generation or evaluation in its original validation study, and subsequent studies failed to test the scale's psychometric properties to ensure enduring validity and reliability. Additionally, 14 scales measured understanding of both male and female fertility, 20 measured female fertility and only one measured male fertility.

1.6 Rationale for the Present Study

As infertility and involuntary childlessness remain global public health issues, improving people's understanding of their fertility provides a means to address preventable, or at least modifiable, infertility risks through health promotion interventions using the IMB Model. It is essential to measure this construct accurately, to benefit future development of educational programs and interventions that are designed to increase understanding of fertility. However, existing scales that are used most frequently in the media do not suitably address relevant content or achieve adequate psychometric standards. Study-specific measures, while perhaps designed to overcome shortcomings these, do not comprehensively address the limitations affecting existing scales and therefore are not suitable alternatives. While several study-specific scales show some evidence of scale development, all fail to provide comprehensive evidence of initial item generation and evaluation. The greatest limitation in the literature, however, is the absence of

comparable scales that measure factors specific to male and female fertility separately, without due consideration for specific factors that might affect one gender more significantly than the other; for example, the greater effects of age on female fertility.

To address these shortcomings, the research aims and hypotheses of this thesis are proposed to guide development of two scales that assess fertility knowledge, one for male fertility and one for female fertility, hereby referred to as the Male Fertility Knowledge Inventory (MFKI) and the Female Fertility Knowledge Inventory (FFKI). Additionally, this thesis aims to address limitations of previous scales in relation to item generation, theoretical and psychometric analysis, to produce two psychometrically sound scales. While understandings of fertility are measured by fertility knowledge or fertility awareness, for increased focus on male fertility, fertility knowledge will be the operationalised construct according to which the scales are developed.

1.6.1 Research Aims.

(1) To develop two separate item pools (one for male and one for female fertility knowledge) containing approximately twice the number of items of the intended scales;
(2) To evaluate the items for content validity and amend or remove items accordingly in each pool;
(3) To evaluate each item for its difficulty, discrimination and item-to-total correlation;
(4) To conduct EFA to determine the underlying structure of the MFKI and FFKI and to determine items suitable for inclusion in the two final scales;
(5) To evaluate the complete scales and their underlying structures for internal consistency.

1.6.2 Hypotheses.

Eight hypotheses will be tested to assess scale validity:

(1) There will be a positive correlation between the MFKI and the SFAQ;
(2) There will be a positive correlation between the MFKI and the CFKS;

(3) There will be a positive correlation between the MFKI and the Health Literacy Skills Instrument Short Form (HLSISF);

(4) There will be no correlation between the MFKI and the General Nutrition Knowledge Questionnaire (Revised) (GNKQR);

(5) There will be a positive correlation between the FFKI and the SFAQ;

(6) There will be a positive correlation between the FFKI and the CFKS;

(7) There will be a positive correlation between the FFKI and the HLSISF;

(8) There will be no correlation between the FFKI and the GNKQR.

Chapter 2 Method

2.1 Participants

Participants were divided into three experimental groups: (1) infertility health professionals, (2) laypeople and (3) people of reproductive age. Infertility health professionals were eligible to participate if they were 18 years or older, had been employed in a specialist infertility service for a minimum of one year and spoke fluent English. Laypeople and people of reproductive age formed the pilot and validation study groups respectively, and were eligible if they were of reproductive age (18 to 51 years) and fluent in English.

2.1.1 Expert evaluation.

Eight female infertility health professionals participated (five embryologists, one Associate Professor, one Medical Doctor and one Laboratory Manager) aged 30 to 52 years (M = 41.9, SD = 8.9), with an average of 13.3 years of professional experience. Six cases were removed due to incomplete responses.

2.1.2 Pilot study.

Thirteen laypeople participated (eight female and five male), aged 18 to 29 years (M = 21.2, SD = 3.1). Data from one participant was excluded due to incomplete responses. Demographic characteristics and information regarding reproductive intentions can be found in Tables 3 and 4, respectively.

2.1.3 Validation study.

The sample consisted of 226 participants aged 18 to 51 years (M = 26.2, SD = 8.0). The response rate was 71%, with 92 incomplete responses excluded from analysis. Participants in the validation study who selected “gender not listed” were excluded from demographic analyses due to the small sample size (n = 2), however, were included for item and scale analyses. Demographic and reproductive characteristics can be found in Tables 3 and 4, respectively.

Table 3

Demographic characteristics of pilot and validation study populations

Characteristics[a]	Pilot study		Validation study[b]	
	Male (*n*=5)	Female (*n*=8)	Male (*n*=56)	Female (*n*=168)
Age, *M* (*SD*)	20.4 (2.1)	21.8 (3.6)	25.3 (7.2)	26.5 (8.3)
Country of birth				
Australia	3 (60)	8 (100)	46 (82)	133 (79)
China	1 (20)		2 (4)	4 (2)
India	1 (20)			2 (1)
UK			3 (5)	6 (4)
Other			4 (7)	21 (13)
Ethnic heritage				
African			1 (2)	
American			1 (2)	2 (1)
Asian	3 (60)	2 (25)	3 (5)	10 (6)
Australian	2 (40)	4 (50)	39 (70)	118 (70)
European		2 (25)	10 (18)	29 (17)
Indian			1 (2)	3 (2)
Indigenous Australian				2 (1)
Middle Eastern				2 (1)
Other				3 (2)
Relationship status				
Married/de facto/engaged		1 (13)	11 (20)	54 (32)
Separated/divorced				2 (1)
In a relationship	5 (100)	4 (50)	17 (30)	55 (33)
Single		3 (38)	27 (48)	57 (34)
Education				
High school	1 (20)	1 (13)	9 (16)	12 (7)
Apprenticeship/Certificate			3 (5)	10 (6)
Bachelor	3 (60)	6 (75)	26 (46)	88 (52)

Characteristics[a]	Pilot study		Validation study[b]	
	Male	Female	Male	Female
	(*n*=5)	(*n*=8)	(*n*=56)	(*n*=168)
Honours	1 (20)	1 (13)	10 (18)	17 (10)
Masters/PhD			5 (9)	36 (21)
Employment				
Full-time	1 (20)	2 (25)	18 (32)	48 (29)
Part-time	2 (40)	6 (75)	19 (34)	85 (51)
Unemployed	2 (40)		19 (34)	32 (19)

Notes. [a] Data presented as *n* (%), unless otherwise indicated; percentage values may add to greater than 100% due to rounding protocol; [b] Variations in sample size due to missing data.

Table 4

Reproductive characteristics of pilot and validation study populations

Characteristics[a]	Pilot Study[b]		Validation Study[b]	
	Male (*n*=5)	Female (*n*=8)	Male (*n*=56)	Female (*n*=168)
Plans to have children				
Yes	5 (100)	7 (88)	32 (57)	132 (79)
No		1 (13)	24 (43)	31 (18)
Children desired, *M* (*SD*)	2.0 (0.7)	2.9 (1.0)	2.26 (0.7)	2.3 (0.7)
Desired age at first child, *M* (*SD*)	29.0 (1.7)	29.0 (2.4)	29.6 (2.9)	28.7 (3.3)
Desired age at last child, *M* (*SD*)	33.0 (2.6)	35.5 (1.9)	34.0 (2.9)	32.9 (3.6)
Importance of having children				
Very important	1 (20)	2 (25)	16 (29)	61 (36)
Important	3 (60)	2 (25)	7 (13)	44 (26)
Moderately important		3 (38)	11 (20)	23 (14)
Slightly important	1 (20)	1 (13)	2 (4)	12 (7)
Not important			19 (34)	21 (13)
Confidence in having children				
Very confident	1 (20)		14 (25)	31 (18)
Confident		2 (25)	16 (29)	33 (20)
Moderately confident	3 (60)	3 (38)	11 (20)	57 (34)
Slightly confident	1 (20)	2 (25)	5 (9)	21 (13)
Not confident			5 (9)	18 (11)
Action if unable to conceive naturally				
Fertility treatment	3 (60)	6 (75)	27 (48)	97 (58)
Foster a child			2 (4)	6 (4)
Adopt a child	1 (20)	2 (25)	11 (20)	32 (19)
Choose not to have a child			9 (16)	22 (13)
Other	1 (20)			
Information sources[c]				
Books	2	1	23	60

Characteristics[a]	Pilot Study[b]		Validation Study[b]	
	Male (*n*=5)	Female (*n*=8)	Male (*n*=56)	Female (*n*=168)
Magazines		2	5	25
Brochures		1	6	26
Newspapers			10	12
Internet	4	5	42	123
Radio			4	9
Videos	1		10	21
Television programs	1	3	24	49
Public health centres		1	12	39
Doctor	1	3	25	86
Family members	3	2	24	80
Friends	2	5	22	74
Other			13	33
Fertility knowledge self-rating				
Extremely educated				2 (1)
Very educated		1 (13)	2 (4)	14 (8)
Educated		3 (38)	9 (16)	41 (24)
Somewhat educated	4 (80)	3 (38)	32 (57)	95 (57)
Not educated at all	1 (20)	1 (13)	12 (21)	16 (10)
Previously sought fertility consultation		1 (13)	2 (4)	18 (11)
Currently trying to conceive			1 (2)	5 (3)
Currently pregnant				4 (2)

Notes. [a] Data presented as n (%), unless otherwise indicated; percentage values may add to greater than 100% due to rounding protocol; [b] Variations in sample size due to missing data; [c] No percentage value as participants could select more than one option.

2.2 Materials

All surveys were hosted online on SurveyMonkey™, and consisted of demographic and reproductive information, refined versions of the MFKI and FFKI, and scales specific to each participant group (Appendices C, D, E, F and G).

2.2.1 Demographic items.

Infertility health professionals were asked to answer four items which included age, gender, period employed within specialist infertility services and employment title. They could also indicate whether they wished to be contacted if the initial items were significantly amended. Pilot and validation study participants were asked seven demographic items about age, gender, country of birth, ethnic heritage, relationship status, level of education and employment status.

2.2.2 Reproductive intentions.

Pilot and validation study participants responded to four items on the intention to have children subscale, one item on the importance of having children subscale and one item on the behavioural intention in case of infertility subscale of the SFAQ (Lampic et al., 2006). Participants provided information regarding their sources of fertility information, previous infertility consultation, confidence achieving reproductive intentions and a self-rating of their fertility knowledge.

2.2.3 Male and Female Fertility Knowledge Inventories (MFKI and FFKI).

Participants in all groups completed revised versions of the MFKI and FFKI. The inventories addressed four areas that assessed fertility knowledge according to the operationalised definition of fertility knowledge in the current study and informed by previous literature (Bunting et al., 2013; Fisher et al., 2003): (1) age-related fertility decline, (2) risk factors for infertility, (3) common misconceptions, and (4) basic knowledge about infertility treatment. Items were created according to scale development conventions with consideration to wording, item format and response format (De Vellis, 2012). Participants in the validation study indicated their knowledge

about each item by responding “true”, “false” or “I don’t know”, to avoid forced and unreliable answers, where one point was awarded for a correct answer, and zero points for an incorrect or “I don’t know” answer (Converse & Presser, 1986). As the development and validation of these instruments is the subject of this thesis, psychometric detail will be provided in the Results section.

2.2.4 Swedish Fertility Awareness Questionnaire (SFAQ).

Participants in the validation study completed the SFAQ, developed by Lampic et al. (2006), a 56-item self-report measure that assesses six areas of importance regarding fertility beliefs and behaviours. Participants provided responses to the nine-item awareness of fertility issues subscale. A correct answer is assigned one point, and an incorrect answer assigned zero points; higher scores reflect greater fertility awareness. Internal consistency of this subscale has not been tested. Test-retest reliability has been conducted, however, results are unpublished (Lampic et al., 2006). The scale has previously been used in male and female populations of reproductive age. In the current sample, the internal consistency was questionable (a = .19).

2.2.5 Cardiff Fertility Knowledge Scale (CFKS).

Participants in the validation study completed the CFKS, created by Bunting et al. (2013), a 13-item measure of fertility knowledge. Participants responded “true”, “false” or “don’t know”, where a correct answer is assigned one point, and an incorrect or “don’t know” answer is assigned zero points. The total score was converted into a percentage where a higher score indicated greater fertility knowledge. The original study included translation of the scale into 12 languages; with moderate (a = .79) and satisfactory internal consistency for most countries (n = 79), except Italy (a = .59) and Turkey (a = .41) (Bunting et al., 2013). All items load on one general factor that account for 30% of between-item variance (Bunting et al., 2013). The scale has been used in male and female adult populations of reproductive age. In the current sample, there was questionable internal consistency (a = .60).

2.2.6 Health Literacy Skills Instrument Short Form (HLSISF).

The HLSISF was completed by participants in the validation study and is a short-form measure of functional health literacy adapted from the original 25-item measure (McCormack et al., 2010). The HLSISF consists of 10 items designed to capture five components of health literacy (print-prose, print-document, print-quantitative, oral and Internet). One point is awarded for correct answers; higher scores indicate greater health literacy. The HLSISF correlates strongly with the original 25-item HLSI (.90, significance not reported), has acceptable internal consistency (*a* = .70) and suitable known-groups and divergent validity (Bann, McCormack, Berkman, & Squiers, 2012). In the current sample, there was acceptable internal consistency (*a* = .72).

2.2.7 General Nutrition Knowledge Questionnaire (Revised) (GNKQR).

The GNKQR is an 88-item, revised version of the GNKQ, developed by Parmenter and Wardle (1999) and adapted for use in Australian adult populations (Hendrie, Cox, & Coveney, 2008). Participants in the validation study responded to the items on three- and four-point Likert scales, and by multiple choice. One point is awarded for each correct response, and subscale scores are summed, where higher scores indicate greater nutrition knowledge. All four subscales demonstrate high internal consistency; knowledge of expert advice (*a* = .70), awareness of food groups (*a* = .86), food choices (*a* = .72) and health issues related to diet and weight management (*a* = .77) (Hendrie et al., 2008). The overall scale also demonstrates high internal consistency (*a* = .93), test-retest reliability and strong concurrent validity (Hendrie et al., 2008). In the current sample, there was good internal consistency (*a* = .88), while results on the four subscales revealed poor to good internal consistency (knowledge of expert advice *a* = .55, awareness of food groups *a* = .81, food choices *a* = .73, health issues related to diet and weight management *a* = .70).

2.3 Procedure

The study was approved by the University of Adelaide School of Psychology Research Ethics Committee on 7 May 2018, approval number 18/52. Participation was voluntary and all participants were provided with an information sheet and consent form (Appendices H, I and J) prior to commencement. Participants were provided with written instructions and scales specific to each experimental group. The procedure was conducted over a four-month period.

2.3.1 Expert evaluation.

Infertility health professionals were recruited from Australian fertility clinics and were contacted indirectly through an email addressed to their clinic informing them of the aims of the research and their role should they choose to participate. Each participant completed an online questionnaire, which took approximately 30 minutes and consisted of demographic questions and preliminary versions of the MFKI and FFKI comprising 36 items each. Participants rated each item on a four-point Likert scale for relevance (1 = *Not relevant* to 4 = *Highly relevant*) and clarity (1 = *Item is not clear* to 4 = *Item is clear*), based on Content Validity Index (CVI) calculation techniques (Rubio et al., 2003), indicated its medical accuracy (*Yes/No*), and rated the entire inventories for comprehensiveness (*open response*). One participant reviewed all revised items following significant amendments based on the suggestions of this group.

2.3.2 Pilot study.

Participants were recruited from the University of Adelaide's School of Psychology Research Participation System and received course credit. Each questionnaire took approximately 30 minutes to complete, consisting of the revised 31-item MFKI and FFKI. Participants rated each item for clarity on a four-point Likert scale (1 = *Item is not clear* to 4 = *Item is clear*) based on CVI calculation techniques (Rubio et al., 2003), and acceptability (*Yes/No* response) with the option of providing further comment. Participants also rated each of the overall inventories for their representativeness (Y*es/No*), and comprehensiveness (*open response*).

2.3.3 Validation study.

The validation study was a cross-sectional survey. Participants were recruited from the University of Adelaide's School of Psychology Research Participation System and received course credit, a post on the author's (XX), supervisor's (XX) and University of Adelaide Faculty of Health and Medical Sciences' Facebook pages, the Australian Psychological Society's website (Appendix K), and snowball sampling.

Each questionnaire took approximately 45 minutes to complete. The questionnaire consisted of the revised MFKI and FFKI comprising 31 items each, the GNKQR, HLSISF, CFKS and the SFAQ, and demographic questions for a total of 201 items. The item order of the MFKI and FFKI was randomised to control for order effects and inflated reliability (Goodhue & Loiacono, 2002; Wilson & Lankton, 2012). The MFKI and FFKI were placed at the start of the survey and separated from the SFAQ and the CFKS to ensure that participants would not answer fertility knowledge scales in succession.

2.4 Power Analysis

For exploratory factor analysis (EFA), attempts were made to undertake *a priori* power analysis. However, it has been argued that strict rules about sample size for EFA have mostly disappeared, and therefore many recommendations are based on rules of thumb (Costello & Osborne, 2005). Recommendations have included minimum sample sizes (between 200 and 500 participants) dependent on communalities and factor loadings, and participant-to-item ratios between 3 and 10 participants per item (Cattell, 1978; Everitt, 1975; Gorsuch, 1983). When Costello and Osborne (2005) reviewed EFA sample sizes published in a two-year period they found that most studies utilised participant-to-item ratios between 5:1 and 10:1, while many used participant-to-item ratios of only 2:1 or less. Further, Howard (2016) recommends accepting whichever is greater: a minimum sample size of 200 or a 5:1 ratio. The current study therefore required a minimum of 200 participants, as the 24-item MFKI required at least 120 participants to

be subject to EFA according to this ratio. This suggested that the current study had sufficient statistical power, as 226 participants were included in EFA.

2.5 Analytical Approach

Data was analysed using Excel Microsoft Office Professional Plus 2016 with the Real Statistics Resource Pack and SPSS Statistics Version 25. Analysis of the MFKI and FFKI occurred separately and sequentially, with item amendments from the expert evaluation (Stage 1) being presented to the pilot study (Stage 2) and so forth. Analyses were also organised into two stages for the validation study. Stage 3 involved refinement of the item pool, while Stage 4 involved validity and reliability analyses of each scale (Figure 3). Each stage was intended to select and refine items that most effectively measured fertility knowledge.

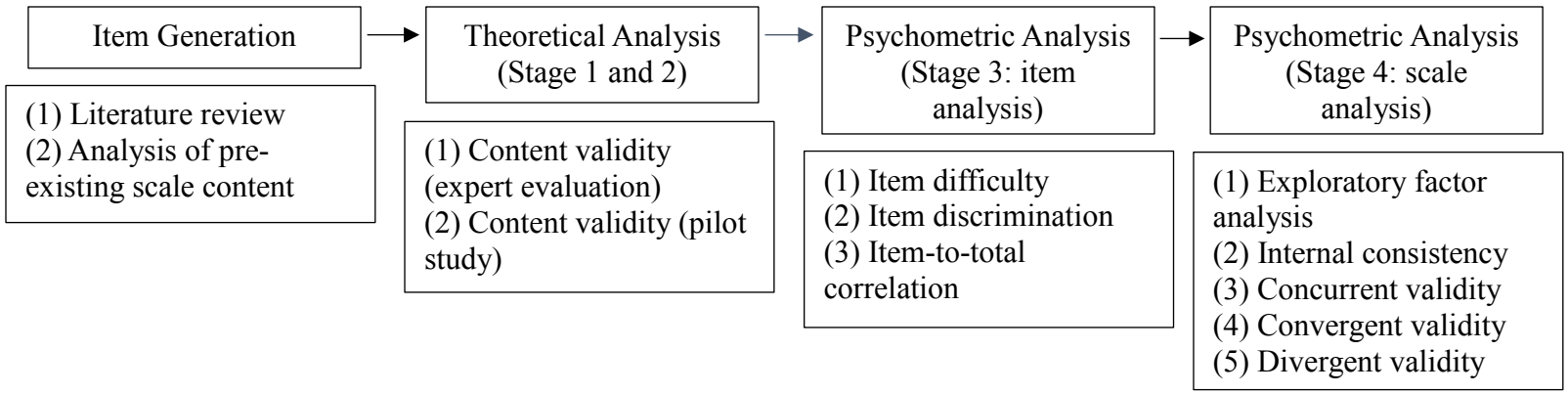

Figure 3. Male and Female Fertility Knowledge Inventories scale development stages.

2.5.1 Stage 1 (expert evaluation) and stage 2 (pilot study).

Content validity can be established through expert and layperson item evaluation (Grant & Davis, 1997). In the current study, item content validity was determined in two phases, the first being *a priori* domain analysis preceding item generation. Expert and layperson evaluation was then undertaken *a posteriori*, using CVIs to evaluate item relevance and clarity (Polit & Beck, 2006). Item CVIs (I-CVI) were calculated by dichotomising ratings on a four-point Likert scale. Rating criteria depends on the number of judges; .78 or greater represented good content validity in the current study (Polit & Beck, 2006). Scale CVIs (S-CVI) are calculated using two different methods, however the CVI (average) method is regarded as the best indicator of validity and was calculated in the current study, as alternative methods often underestimate scale validity (Polit & Beck, 2006).

Face validity is the extent to which a measure reflects what it is intended to measure, and is necessary, but not sufficient for ensuring construct validity (Nunnally & Bernstein, 1994). In the current study, face validity was measured using I-CVI for relevance and by the responses to item comprehensiveness for overall scale validity (Hardesty & Bearden, 2004).

2.5.2 Stage 3 (validation study).

Item difficulty (*p*) refers to the proportion of individuals who respond correctly to an individual item, denoted by the average respondent score. Items that scored between .4 and .6 were deemed acceptable, however scores outside this criterion may provide valuable information and thus could be considered for inclusion in the current study (Kline, 2005).

The index of discrimination (*D*) refers to an item's ability to discriminate between participants who are likely to obtain particularly high and low total scores on a scale. Higher indexes indicated greater discrimination and were calculated using the extreme groups method (Cureton, 1957). Items that scored between .4 and .6 were considered good, and within .1 of the

upper and lower bounds, reasonably good (Ebel & Frisbie, 1991). Items outside this range were subject to improvement if selected (Ebel & Frisbie, 1991).

Item-to-total correlations determine the relationship between an individual's response to an item and their corrected total score (Kline, 2005). Correlations less than .5 were considered moderate to strong and suitable for scale inclusion (Kline, 2005). As the 31-item MFKI and FFKI data represented a false dichotomy with an underlying continuous distribution, biserial correlations that do not assume a true dichotomy (unlike Pearson's biserial correlations) were required. The scales were examined for normality, including examination of the histogram, skewness, kurtosis and Shapiro-Wilk test. As the assumption of normality was violated, the required transformation was undertaken (Appendix L).

2.5.3 Stage 4 (validation study).

Prior to EFA, the Kaiser-Meyer Olsen (KMO) coefficient and Bartlett's Test of Sphericity were examined to determine suitability for analysis.

To determine scale validity, correlation coefficients were calculated. As Pearson's correlation coefficient assumes normality of data, all scales in the validation study and the 14-item MFKI and 15-item FFKI were examined for normality as described previously. All variables were non-normally distributed and therefore the appropriate transformations were attempted. Even with transformation none achieved normality except the GNKQR, and therefore a non-parametric Spearman's correlation coefficient was calculated.

To demonstrate concurrent validity, the SFAQ and CFKS were selected, based on the relative frequency of use as existing scales (Table 2) and previous validity testing (Kudesia et al., 2017). To demonstrate convergent validity, a measure of health literacy was selected based on previous research that suggests that fertility knowledge is primarily linked to education, and by extension, health literacy (Bunting et al., 2013; Maeda et al., 2015). General nutrition knowledge

was selected to demonstrate divergent validity, based on its successful use in previous research (Kudesia et al., 2017).

Chapter 3 Results

3.1 Generation of Item Pool

To address the first research aim, two item pools of 36 items were developed following the review of fertility knowledge scales (Table 2), review of the fertility literature and scale development protocol (De Vellis, 2012).

3.2 Content Validity Indexes (CVIs)

To address the second research aim, each item in the 36-item MFKI and FFKI was evaluated according to its I-CVI for relevance and clarity from the expert evaluation, and clarity from the pilot study. Items were flagged (i.e., marked for possible revision or elimination) if: (1) the I-CVI was less than .78 for relevance or clarity, and/or (2) responses to open-ended questions regarding clarity, comprehensibility and acceptability contained suggestion of amendment. Researchers (XX and XX) reviewed flagged items. Following this stage of analysis, 31 revised items were included in both the MFKI and FFKI. Tables 5 and 6 show the proposed MFKI and FFKI items respectively, CVI ratings from the expert and layperson evaluations, and item revisions, additions and removals.

Table 5

Expert evaluation and pilot study Content Validity Indexes for each item in the Male Fertility Knowledge Inventory

Item	Expert Evaluation			Pilot Study	
	I-CVI (Relevance)	I-CVI (Clarity)	Item revision	I-CVI (Clarity)	Item revision
Age-related fertility decline					
Men do not experience a natural decline in their fertility^	.88	1		.92	
After 45 years old, a man's fertility declines, making it significantly more difficult for him and his partner to conceive	.88	1	Over 40 years of age, a man's fertility declines, making it significantly more difficult for him and his partner to conceive^	1	
The age of his female partner can affect a male's chances of getting his partner pregnant*	1	.75	The age of his female partner also plays a role in their chances of conceiving^	1	
Children born to older fathers are more likely to develop health issues such as autism and schizophrenia^	.88	.88		.92	
Risk factors for infertility					

Item		Expert Evaluation			Pilot Study
Sexually transmitted infections, including chlamydia, gonorrhoea and HPV (Human Papillomavirus), can affect a man's fertility^	1	1		1	
Following cancer treatment (i.e., chemotherapy, radiotherapy), a man and his partner are more likely to have difficulties conceiving^	1	1		1	
An occlusion (blockage) in the male reproductive system can affect a man's fertility^	.88	1		1	
Changes in a man's hormone levels can affect his and his partner's chance of conceiving*	.88	1		1	Changes in a man's hormone levels can affect his chances of conceiving with a partner^
A man's weight can affect his fertility*	1	1	A man's weight/BMI (Body Mass Index) can affect his fertility^	1	

Item	Expert Evaluation			Pilot Study
Smoking cigarettes can affect a man's fertility^	1	1		1
Male shift workers can experience fertility problems due to changes in their Circadian Rhythm (normal sleeping pattern)*	.63	1	Item removed	
High levels of alcohol consumption can affect male fertility*	.88	1	Chronic consumption of alcohol can affect sperm quality^	1
Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a man's fertility^	.88	1		1
High levels of caffeine consumption can affect a man's fertility*	.86	1	Item removed	
Men who have had a mumps infection are more likely to have fertility problems*	.75	.88	Men who have had mumps before puberty may experience fertility problems if left untreated^	1

Item	Expert Evaluation		Pilot Study	
Sperm quality can be improved by eating more fruit and vegetables*	.75	.88	A man's diet does not affect his fertility^	1
Male fertility can be negatively affected by high consumption of processed meat*	.63	.88	Item removed	
Taking certain vitamins can increase the quality of a man’s sperm*	.88	1	Taking vitamin supplements can increase the quality of a man’s sperm^	1
A man’s sperm are adversely affected by temperature changes*	1	.88	A man's sperm can be negatively affected by increased heat^	1
			Use of anabolic steroids once a week can negatively affect a man’s fertility (steroids contain Testosterone and are performance enhancing drugs used to increase muscular strength and body weight)^	1

Item	Expert Evaluation			Pilot Study
			Chromosomal changes can affect the production and transportation of sperm^	1
Misconceptions				
Men continue to produce new sperm throughout their lifetime*	.63	1	Men continue to produce and mature new sperm every 72 days^	1
A man who produces sperm is fertile^	1	1		1
If a couple is attempting to conceive, they should have intercourse only when the female is most fertile during her menstrual cycle, to conserve the amount of sperm available for conception*	.75	.88	If a couple is attempting to conceive, they should abstain from having sex until the female is most fertile during her menstrual cycle, to conserve the amount of sperm available for conception^	.92
If a man already has one biological child, he will not have trouble conceiving again^	.88	1		.92
If a man and his partner are struggling to become	.63	.63	Item removed	

Item	Expert Evaluation		Pilot Study	
pregnant, he should just relax, as the stress of trying to conceive affects his fertility*				
Males are more fertile if they lead a healthy lifestyle*	.63	.75	Item removed	
To improve his fertility, a man should exercise more intensively*	.38	.63	Moderate, sustained exercise can improve a man's sperm quality (i.e., 3-4 times a week)^	1
			Intense, sustained exercise can improve a man's sperm quality (i.e., 4-5 times a week for 2 hours)^	.92
Reversal of a vasectomy procedure will guarantee the return of a man's fertility^	.88	1		1
Lubricants make it easier for a man and his partner to conceive*	.50	.88	Some lubricants negatively affect sperm^	1
Infertility treatment				

Item	Expert Evaluation			Pilot Study	
Most fertility problems are caused by the male partner*	.75	.88	Most fertility problems are caused by the male partner alone*	.92	Most fertility problems are caused by issues with the male partner's reproductive health alone^
A man and his partner who are trying to conceive should seek medical advice if they cannot get pregnant following 2 years of regular and unprotected sexual intercourse*	1	.88	A man and his partner who are trying to conceive should seek medical advice if they cannot get pregnant following 1 year of regular and unprotected sexual intercourse^	1	
It is normal for a man and his partner to get pregnant on the first round of IVF (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)*	.88	.75	More than half of men and their partners get pregnant on the first round of IVF (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)*	1	More than half of men and their partners conceive on the first round of IVF (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)^

Item	Expert Evaluation		Pilot Study	
The primary role of a fertility specialist is to provide IVF (In Vitro Fertilisation) to a man and his partner (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)^	.88	1		1
In fertility testing, a conclusive indicator of a man's fertility is his sperm count (the number of sperm in a semen sample)*	.88	1	Sperm count (the number of sperm in a semen sample) is the most important indicator of male fertility^	1
A man and his partner who undergo treatment with IVF (In Vitro Fertilisation) have a 50% chance of having a child (In Vitro Fertilisation: a medical procedure where	.63	.75	Item removed	

Item	Expert Evaluation			Pilot Study
fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)*				
In most countries, there is no limit on how long sperm can be frozen for*	.13	1	Item removed	
There is no age limit for a man if he would like to donate his sperm*	.38	1	Item removed	
S-CVI	.79	.92		.92

Notes. I-CVI = Item Content Validity Index; S-CVI = Scale Content Validity Index.
*Item flagged for review, ^Final version of item.

Table 6

Expert evaluation and pilot study Content Validity Indexes for each item in the Female Fertility Knowledge Inventory

Item	Expert Evaluation			Pilot Study	
	I-CVI (Relevance)	I-CVI (Clarity)	Item revision	I-CVI (Clarity)	Item revision
Age-related fertility decline					
A woman is most fertile before the age of 35 years^	1	1		1	
After 45 years old, a woman's fertility declines, making it significantly more difficult for her to get pregnant*	.88	.75	A woman in her 40s is unlikely to conceive naturally using her own eggs even with fertility treatment, due to the natural decline in fertility^	1	
The age of her male partner can affect a woman's chances of conceiving^	.88	1		1	
The risk of miscarriage for fit and healthy women is the same, whether they are in their 30s or their 40s^	1	1		1	
Risk factors for infertility					

Item		Expert Evaluation		Pilot Study
Sexually transmitted infections, including chlamydia, gonorrhoea and HPV (Human Papillomavirus), can affect a woman's fertility^	1	1		1
Following cancer treatment (i.e., chemotherapy, radiotherapy), a female is more likely to have difficulties conceiving^	1	1		.92
A fallopian tube occlusion (blockage) in the female reproductive system can affect her fertility^	1	1		1
A history of endometriosis can affect a woman's fertility^	1	1		.92
A woman's weight can affect her fertility*	1	1	A woman's weight/BMI (Body Mass Index) can affect her fertility^	1

Item	Expert Evaluation			Pilot Study
Smoking cigarettes can affect a woman's fertility^	1	1		.92
Female shift workers can experience fertility problems due to changes in their Circadian Rhythm (normal sleeping pattern)*	.75	.88	Item removed	
High levels of alcohol consumption can affect female fertility*	.75	.75	Consumption of one standard drink of alcohol per day is enough to reduce a woman's fertility^	.92
Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a woman's fertility^	.88	1		1
High levels of caffeine consumption can affect a woman's fertility*	.75	.88	Item removed	
A woman who has amenorrhoea (she is of reproductive age, but does not have a menstrual period), is	.75	.88		1

Item	Expert Evaluation			Pilot Study
more likely to have fertility problems^				
Female fertility can be improved by eating more fruit*	.63	.75	A woman's diet does not affect her fertility^	.92
Female fertility can be negatively affected by high consumption of fast food*	.63	1	Item removed	
Misconceptions				
A woman's body temperature gives an accurate indication of the day on which she ovulates during her menstrual cycle*	.50	.88	Item removed	
Women continue to produce new eggs until they reach menopause^	.88	1		1
A woman who has a regular menstrual cycle is fertile^	1	1		1
If a woman's menstrual cycle lasts longer than 28 days, it is considered abnormal*	.88	1	If a woman's menstrual cycle is longer than 35 days, it is considered abnormal^	.92

Item		Expert Evaluation		Pilot Study	
If a woman already has one biological child, she will not have trouble conceiving again*	.88	1		.92	
If a woman is struggling to become pregnant she should just relax, as the stress of trying to conceive significantly affects her fertility*	.75	.88	If a woman is struggling to become pregnant she should just relax, as the stress of trying to conceive directly affects her fertility*	.92	If a woman is struggling to become pregnant she should try to relax, as the stress of trying to conceive directly affects her fertility^
Females are more fertile if they lead a healthy lifestyle*	.63	.63	Item removed		
To improve her fertility, a woman should exercise more intensively*	.50	.63	Moderate, sustained exercise can improve a woman's fertility (i.e., up to 4 hours of brisk walking a week)^	1	
			Intense, sustained exercise can improve a woman's fertility (i.e., 1 hour of high intensity exercise a day)^	1	
Taking certain vitamins can increase a woman's ovarian	.88	1	Taking vitamin supplements can increase a woman's	1	

Item	Expert Evaluation		Pilot Study		
reserve (the number of eggs available to her, and the number of fertile years she has remaining)*			ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining)^		
Taking birth control pills for a long period of time can affect a woman's fertility*	.88	.75	Taking birth control pills for a long period of time can affect a woman's chances of becoming pregnant in the future^	1	
If a woman lays on her back for 15 minutes after intercourse, she has a greater chance of becoming pregnant*	.63	1		1	
Infertility treatment					
Most fertility problems are caused by the female partner*	.88	1	Most fertility problems are caused by the female partner alone*	.92	Most fertility problems are caused by issues with the female partner's reproductive health alone^
A woman trying to conceive should seek medical advice if she cannot get pregnant	.88	.88	A woman trying to conceive should seek medical advice if she cannot get pregnant	1	

Item	Expert Evaluation		Pilot Study		
following 2 years of regular and unprotected sexual intercourse*			following 1 year of regular and unprotected sexual intercourse^		
It is normal for a woman to get pregnant on the first round of IVF (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)*	.63	.75	More than half of women and their partners get pregnant on the first round of IVF (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)*	.92	More than half of women and their partners conceive on the first round of IVF (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)^
The primary role of a fertility specialist is to provide IVF (In Vitro Fertilisation) to a woman (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is	.63	.88		1	

Item	Expert Evaluation			Pilot Study
transferred to a woman's uterus a few days later)*^				
The Anti-Mullerian Hormone test measures a woman's ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining)*	.88	.88	A woman can be tested to determine her ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining)^	1
A woman who undergoes multiple rounds of IVF (In Vitro Fertilisation) treatment has a 50% chance of having a child (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)*	.50	.63	Item removed	
Freezing her eggs guarantees a woman will be able to	1	1		1

Item	Expert Evaluation		Pilot Study	
become pregnant in the future^				
There is an age limit for a woman to donate her eggs to a fertility clinic to assist a woman she does not know*	.50	.75	Item removed	
			A woman in her 40s is equally as likely to become pregnant through IVF as a woman in her 30s (In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later)^	.92
S-CVI	.81	.90		.81

Notes. I-CVI = Item Content Validity Index; S-CVI = Scale Content Validity Index.
*Item flagged for review, ^Final version of item.

3.3 Item Analysis

To fulfil the third research aim, items on the 31-item MFKI and FFKI were analysed using responses from the validation study (Tables 7 and 8). Individual cases without a response were excluded in a pairwise fashion, resulting in eight excluded from the MFKI and five excluded from the FFKI. Items were removed if they failed to meet all statistical criteria, that is, item difficulty, index of discrimination and item-to-total correlation (*see section 2.5.2*) and were evaluated for inclusion if they met one or two criteria. Items were immediately accepted if they fulfilled all three criteria. Researcher disagreement was resolved with consideration to the item's CVI rating. There was 87.1% agreement between researchers (XX and XX) on both scales, with a Cohen's kappa of .65. Following this stage of analysis, 24 items were included in the MFKI, and 21 in the FFKI.

Table 7

Item analysis of the Male Fertility Knowledge Inventory

Item	*p*	*D*	Item-to-Total Correlation[a]
Men do not experience a natural decline in their fertility	.60	.44	-.53
Over 40 years of age, a man's fertility declines, making it significantly more difficult for him and his partner to conceive*^	.44	.13	-.22
The age of his female partner also plays a role in their chances of conceiving*	.98	.05	-.71
Children born to older fathers are more likely to develop health issues such as autism and schizophrenia*	.30	.20	-.29
Sexually transmitted infections, including chlamydia, gonorrhoea and HPV (Human Papillomavirus), can affect a man's fertility	.78	.34	-.51
Following cancer treatment (i.e., chemotherapy, radiotherapy), a man and his partner are more likely to have difficulties conceiving^	.80	.44	-.67
An occlusion (blockage) in the male reproductive system can affect a man's fertility	.80	.48	-.75
Changes in a man's hormone levels can affect his chances of conceiving with a partner	.78	.53	-.75
A man's weight/BMI (Body Mass Index) can affect his fertility^	.82	.41	-.66
Smoking cigarettes can affect a man's fertility	.78	.46	-.69
Chronic consumption of alcohol can affect sperm quality	.88	.33	-.75
Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a man's fertility	.80	.49	-.79
Men who have had mumps before puberty may experience fertility problems if left untreated	.36	.57	-.57
A man's diet does not affect his fertility	.81	.49	-.76
Taking vitamin supplements can increase the quality of a man's sperm	.30	.43	-.53

Item	*p*	*D*	Item-to-Total Correlation[a]
A man's sperm can be negatively affected by increased heat	.67	.56	-.58
Use of anabolic steroids once a week can negatively affect a man's fertility (steroids contain Testosterone and are performance enhancing drugs used to increase muscular strength and body weight)^	.75	.56	-.70
Chromosomal changes can affect the production and transportation of sperm	.50	.69	-.68
Men continue to produce and mature new sperm every 72 days^	.29	.39	-.48
A man who produces sperm is fertile	.72	.30	-.47
If a couple is attempting to conceive, they should abstain from having sex until the female is most fertile during her menstrual cycle, to conserve the amount of sperm available for conception*	.67	.34	-.39
If a man already has one biological child, he will not have trouble conceiving again^	.80	.39	-.60
Moderate, sustained exercise can improve a man's sperm quality (i.e., 3-4 times a week)^	.63	.64	-.69
Intense, sustained exercise can improve a man's sperm quality (i.e., 4-5 times a week for 2 hours)	.19	.39	-.53
Reversal of a vasectomy procedure will guarantee the return of a man's fertility	.79	.41	-.54
Some lubricants negatively affect sperm	.48	.71	-.65
Most fertility problems are caused by issues with the male partner's reproductive health alone*	.75	.34	-.43
A man and his partner who are trying to conceive should seek medical advice if they cannot get pregnant following 1 year of regular and unprotected sexual intercourse*	.93	.15	-.51
More than half of men and their partners conceive on the first round of IVF*	.38	.38	-.31

Item	*p*	*D*	Item-to-Total Correlation[a]
The primary role of a fertility specialist is to provide IVF (In Vitro Fertilisation) to a man and his partner	.65	.43	-.51
Sperm count (the number of sperm in a semen sample) is the most important indicator of male fertility^	.40	.49	-.58

Notes. [a] Item-to-total correlation = Biserial correlation, using transformed data.
p = Item difficulty, *D* = Item discrimination.
^n = 225, *Item removed.

Table 8

Item analysis of the Female Fertility Knowledge Inventory

Item	*p*	*D*	Item-to-Total Correlation[a]
A woman is most fertile before the age of 35 years	.96	.12	-.70
A woman in her 40s is unlikely to conceive using her own eggs even with fertility treatment, due to the natural decline in fertility*	.40	.26	-.28
The age of her male partner can affect a woman's chances of conceiving*	.60	.16	-.25
The risk of miscarriage for fit and healthy women is the same, whether they are in their 30s or their 40s	.67	.66	-.63
Sexually transmitted infections, including chlamydia, gonorrhoea and HPV (Human Papillomavirus), can affect a woman's fertility	.91	.25	-.72
Following cancer treatment (i.e., chemotherapy, radiotherapy), a female is more likely to have difficulties conceiving*	.86	.28	-.68
A fallopian tube occlusion (blockage) in the female reproductive system can affect her fertility*	.88	.30	-.75
A history of endometriosis can affect a woman's fertility	.81	.46	-.69
A woman's weight/BMI (Body Mass Index) can affect her fertility	.87	.30	-.70
Smoking cigarettes can affect a woman's fertility	.80	.46	-.67
Consumption of one standard drink of alcohol per day is enough to reduce a woman's fertility*	.29	.16	-.21
Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a woman's fertility	.82	.46	-.77
A woman who has amenorrhoea (she is of reproductive age, but does not have a menstrual period), is more likely to have fertility problems*	.74	.31	-.46
A woman's diet does not affect her fertility^	.83	.46	-.77

Item	*p*	*D*	Item-to-Total Correlation[a]
Women continue to produce new eggs until they reach menopause	.47	.56	-.55
A woman who has a regular menstrual cycle is fertile	.68	.54	-.65
If a woman's menstrual cycle is longer than 35 days, it is considered abnormal*	.63	.21	-.30
If a woman already has one biological child, she will not have trouble conceiving again	.87	.36	-.76
If a woman is struggling to become pregnant she should try to relax, as the stress of trying to conceive directly affects her fertility*	.15	.16	-.34
Moderate, sustained exercise can improve a woman's fertility (i.e., up to 4 hours of brisk walking a week)	.65	.54	-.57
Intense, sustained exercise can improve a woman's fertility (i.e., 1 hour of high intensity exercise a day)^	.24	.41	-.52
Taking vitamin supplements can increase a woman's ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining)	.54	.69	-.60
Taking birth control pills for a long period of time can affect a woman's chances of becoming pregnant in the future	.42	.46	-.51
If a woman lays on her back for 15 minutes after intercourse, she has a greater chance of becoming pregnant	.49	.39	-.40
Most fertility problems are caused by issues with the female partner's reproductive health alone*^	.75	.26	-.43
A woman trying to conceive should seek medical advice if she cannot get pregnant following 1 year of regular and unprotected sexual intercourse*	.94	.13	-.56
More than half of women and their partners conceive on the first round of IVF	.46	.62	-.59
The primary role of a fertility specialist is to provide IVF (In Vitro Fertilisation) to a woman	.60	.59	-.62

Item	*p*	*D*	Item-to-Total Correlation[a]
A woman can be tested to determine her ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining)	.65	.48	-.54
Freezing her eggs guarantees a woman will be able to become pregnant in the future^	.84	.39	-.67
A woman in her 40s is equally as likely to become pregnant through IVF as a woman in her 30s^	.63	.64	-.59

Notes. [a] Item-to-total correlation = Biserial correlation, using transformed data.
p = Item difficulty, *D* = Item discrimination.
^n = 225, *Item removed.

3.4 Exploratory Factor Analysis (EFA)

To fulfil the fourth research aim, EFA was conducted to explore the underlying structure of the 24-item MFKI and the 21-item FFKI and to refine the inventories. Recommendations were used to guide the analysis as follows: (1) items with factor loadings greater than or equal to .32 were retained and deemed representative of a factor, (2) items that were representative of no factors were removed preferentially, followed by items that loaded on multiple factors, (3) three items were required to constitute a factor (Hair, Black, Babin, Anderson, & Tatham, 2006; Hinkin, 1998; Tabachnick & Fidell, 2001). As the Kaiser-Guttman Criterion is considered the least accurate method for determining the number of factors to retain, Osborne (2014) recommends use of this criterion combined with the scree plot in determining the number of factors. As the current study was exploratory, solutions extracting the number of factors one to two factors above and below the elbow of the scree plot were examined (Osborne, 2014).

On analysis of the MFKI, the KMO indicated sampling adequacy for the analysis (.847), and Bartlett's Test of Sphericity (X^2 (276) = 1135.2, p = .000) indicated suitability of the correlation matrix for factor analysis (Howard, 2016). Principal Axis Factoring (PAF) with oblique rotation (direct oblimin $\delta = 0$) was performed to allow correlation of the resultant factors (Howard, 2016). The initial analysis yielded seven factors with eigenvalues greater than 1.0, accounting for 54.08% of the total variance. However, the scree plot suggested a one-factor solution (Figure 4). Therefore, factor analysis was conducted using PAF with oblique rotation, specifying that one, two and three factors should be identified. When tested against the one-, and two-factor solutions, the three-factor solution accounted for the greatest degree of explained variance (46.23%) and was the most interpretable solution. There were no multiple loading items, and items did not load greater than .236 on a secondary factor. Five communalities were greater than 0.3. The items cluster together to suggest that Factor 1 represents environment and

reproductive health, Factor 2 represents lifestyle factors, and Factor 3 represents sperm quality (Table 9).

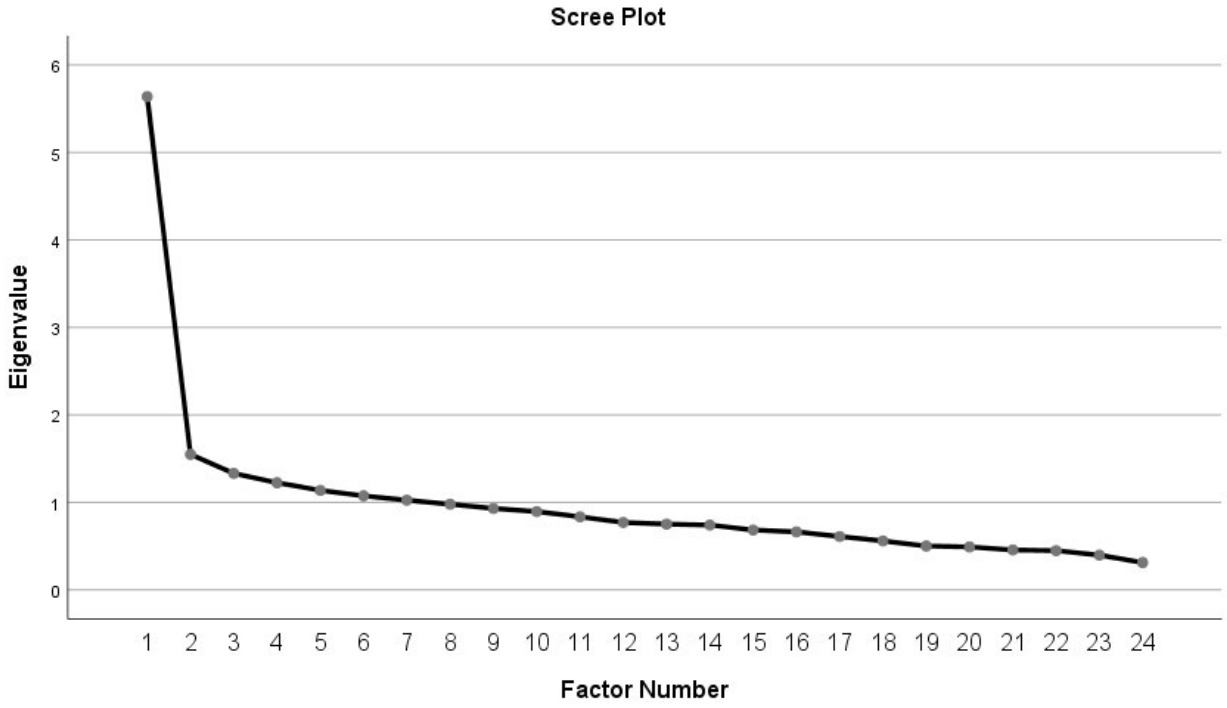

Figure 4. Scree plot of the Male Fertility Knowledge Inventory by Principal Axis Factoring.

Table 9

Summary of exploratory factor analysis results for the Male Fertility Knowledge Inventory in a sample of people of reproductive age

Item & number	Factor Loadings		
	1	2	3
Factor 1: Environment and reproductive health			
1. An occlusion (blockage) in the male reproductive system can affect a man's fertility	**.813**	-.012	-.09
2. Men do not experience a natural decline in their fertility	**.488**	-.001	.005
3. Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a man's fertility	**.427**	-.217	.038
4. If a man already has one biological child, he will not have trouble conceiving again	**.329**	.103	.235
5. Use of anabolic steroids once a week can negatively affect a man's fertility (steroids contain Testosterone and are performance enhancing drugs used to increase muscular strength and body weight)	**.439**	-.069	.125
Factor 2: Lifestyle factors			
6. A man's weight/BMI (Body Mass Index) can affect his fertility	.236	**-.387**	-.054
7. A man's diet does not affect his fertility	.031	**-.721**	.004
8. Chronic consumption of alcohol can affect sperm quality	.025	**-.570**	.065
9. Smoking cigarettes can affect a man's fertility	-.073	**-.726**	.067
Factor 3: Sperm quality			
10. Men continue to produce and mature new sperm every 72 days	.031	.044	**.452**
11. Intense, sustained exercise can improve a man's sperm quality (i.e., 4-5 times a week for 2 hours)	-.039	.048	**.505**
12. Men who have had mumps before puberty may experience fertility problems if left untreated	-.01	-.102	**.372**
13. Some lubricants negatively affect sperm	.107	-.111	**.397**

14. Chromosomal changes can affect the production and transportation of sperm	.054	-.186	**.421**
Initial eigenvalues for each factor	3.82	1.44	1.22
Percentage of variance accounted for after extraction	27.26	10.26	8.71

Notes. Factor loadings > .32 are in bold type.
Rotation converged in 8 iterations.

On analysis of the FFKI, the KMO indicated sampling adequacy for the analysis (.805) and Bartlett's Test of Sphericity (X^2 (210) = 988.2, p = .000) indicated suitability of the correlation matrix for factor analysis. PAF with oblique rotation (direct oblimin $\delta = 0$) was performed. The initial analysis yielded six factors with eigenvalues greater than 1.0, accounting for 53.75% of the total variance. However, the scree plot suggested a one or two factor solution (Figure 5). Therefore, factor analysis was conducted using PAF with oblique rotation, specifying that one-, two-, three- and four-factor solutions should be tested. When tested against these solutions, the four-factor solutions accounted for the greatest degree of explained variance (53.74%) and resulted in the most interpretable solution. There were no multiple loadings, and eleven of the items had communalities greater than .3. The items cluster together to suggest that Factor 1 represents reproductive health, Factor 2 represents lifestyle factors, Factor 3 represents chance of conception and Factor 4 represents ovarian reserve and preservation (Table 10).

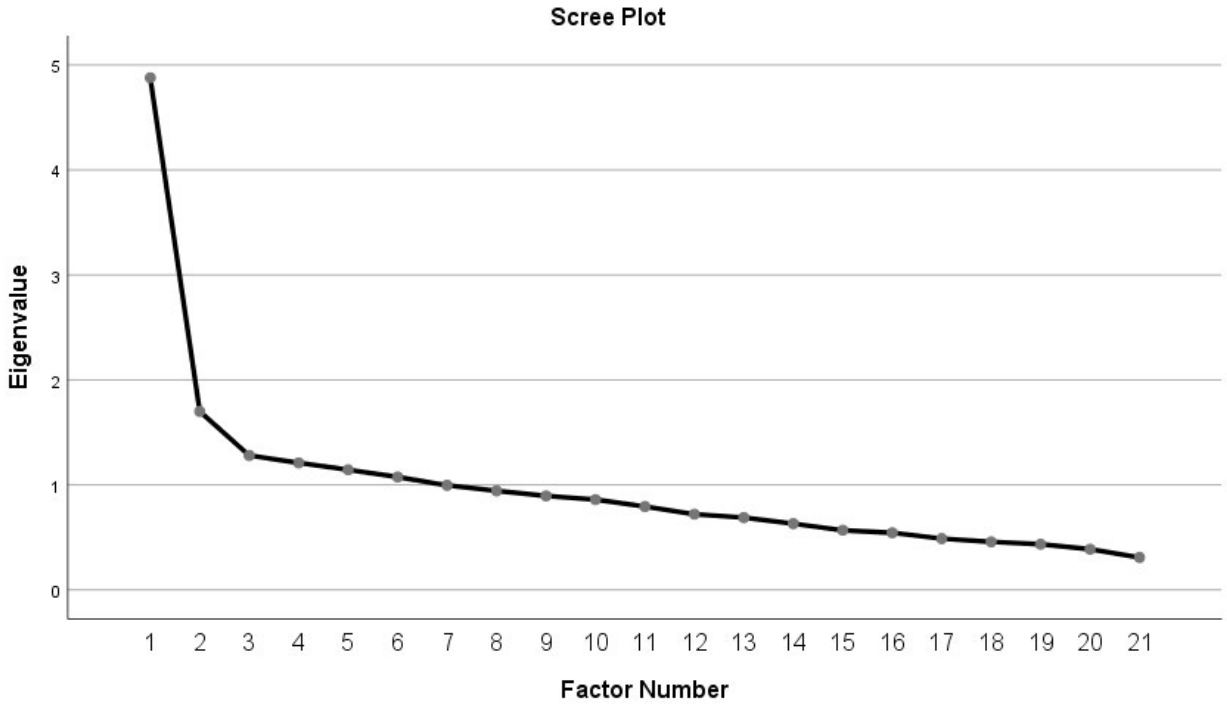

Figure 5. Scree plot of the Female Fertility Knowledge Inventory by Principal Axis Factoring.

Table 10

Summary of exploratory factor analysis results for the Female Fertility Knowledge Inventory in a sample of people of reproductive age

Item	Factor Loading			
	1	2	3	4
Factor 1: Reproductive health				
1. Sexually transmitted infections, including chlamydia, gonorrhoea and HPV (Human Papillomavirus), can affect a woman's fertility	**.415**	-.186	-.032	.068
2. A history of endometriosis can affect a woman's fertility	**.671**	.090	.162	-.047
3. A woman's weight/BMI (Body Mass Index) can affect her fertility	**.615**	-.156	-.096	.085
Factor 2: Lifestyle factors				
4. A woman's diet does not affect her fertility	.153	**-.513**	.138	.072
5. Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a woman's fertility	.058	**-.624**	-.070	.176
6. Smoking cigarettes can affect a woman's fertility	-.113	**-.731**	.107	-.034
7. Moderate, sustained exercise can improve a woman's fertility (i.e., up to 4 hours of brisk walking a week)	.164	**-.395**	.054	-.089
Factor 3: Chance of conception				
8. The risk of miscarriage for fit and healthy women is the same, whether they are in their 30s or their 40s	-.021	-.053	**.597**	.023
9. A woman in her 40s is equally as likely to become pregnant through IVF as a woman in her 30s	.036	-.111	**.553**	-.073
10. More than half of women and their partners conceive on the first round of IVF	.066	.014	**.419**	.112
Factor 4: Ovarian reserve and preservation				
11. Women continue to produce new eggs until they reach menopause	.008	-.112	-.101	**.563**
12. The primary role of a fertility specialist is to provide IVF (In Vitro Fertilisation) to a woman	-.085	-.038	.306	**.446**

13. A woman who has a regular menstrual cycle is fertile	.237	.076	.131	**.388**
14. Taking vitamin supplements can increase a woman's ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining)	0	.045	.019	**.673**
15. Freezing her eggs guarantees a woman will be able to become pregnant in the future	.158	.006	.208	**.327**
Initial eigenvalues for each factor	4.068	1.609	1.259	1.126
Percentage of variance accounted for after extraction	27.12	10.73	8.39	7.50

Notes. Factor loadings > .32 are in bold type.
Rotation converged in 11 iterations.

3.5 Descriptive statistics

Table 11 summarises the descriptive statistics and reliability of all scales, presented within an acceptable range of .60 to .88, excepting the SFAQ (.19).

Table 11

Means, standard deviations and reliability for all criterion measures

Scale	N[a]	*M* (*SD*)	Reliability[b]
MFKI	222	8.86 (3.05)	.78
FFKI	224	10.35 (3.19)	.77
SFAQ	189	1.74 (1.20)	.19
CFKS	221	7.97 (2.44)	.60
HLSISF	212	6.68 (4.87)	.72
GNKQR	199	63.84 (10.13)	.88

Notes. [a] = Variations in sample size due to missing data, [b] = Cronbach's Alpha.
MFKI = 14-item Male Fertility Knowledge Inventory; FFKI = 15-item Female Fertility Knowledge Inventory; SFAQ = Swedish Fertility Awareness Questionnaire; CFKS = Cardiff Fertility Knowledge Scale; HLSISF = Health Literacy Skills Instrument Short Form, GNKQR = General Nutrition Knowledge Questionnaire (Revised).

3.6 Internal consistency

To fulfil the fifth research aim, the internal consistency of the MFKI, FFKI and their factors was calculated. The MFKI revealed acceptable reliability (α = .78), while its factors revealed minimally acceptable to acceptable internal consistency, excepting the sperm quality factor (α = .58) (De Vellis, 2012) (Table 12).

The complete FFKI revealed acceptable internal consistency (α = .77), as did all its factors excepting the chance of conception factor (α = .57) (De Vellis, 2012) (Table 13).

Table 12

Internal consistency for the Male Fertility Knowledge Inventory and factors

MFKI	Reliability[a]
Entire scale	.78
Environment and reproductive health	.67
Lifestyle factors	.73
Sperm quality	.58

Notes. [a] = Cronbach's Alpha.

Table 13

Internal consistency for the Female Fertility Knowledge Inventory and factors

FFKI	Reliability[a]
Entire scale	.77
Reproductive health	.64
Lifestyle factors	.70
Chance of conception	.57
Ovarian reserve and preservation	.68

Notes. [a] = Cronbach's Alpha.

3.7 Validity testing

To test the eight hypotheses, Spearman's correlation analyses were conducted (Tables 14 and 15).

Table 14

Summary of correlations between the Male Fertility Knowledge Inventory, its factors and scales used for validity testing

	MFKI	EnvRep	Life	SpQual	SFAQ	CFKS	HLSISF	GNKQR
MFKI	1.00							
EnvRep	.747**	1.00						
Life	.621**	.340**	1.00					
SpQual	.836**	.411**	.388**	1.00				
SFAQ	.092	.027	.144*	.077	1.00			
CFKS	.566**	.368**	.295**	.535**	.264**	1.00		
HLSISF	.056	.183**	.007	-.048	.167*	.149*	1.00	
GNKQR	.453**	.388**	.309**	.335**	.268**	.522**	.318**	1.00

Notes. *$p < .05$, **$p < .01$, two-tailed test.
MFKI = 14-item Male Fertility Knowledge Inventory; EnvRep = Environment and reproductive health; Life = Lifestyle factors; SpQual = Sperm quality; SFAQ = Swedish Fertility Awareness Questionnaire, concurrent validity; CFKS = Cardiff Fertility Knowledge Scale, concurrent validity; HLSISF = Health Literacy Skills Instrument Short Form, convergent validity; GNKQR = General Nutrition Knowledge Questionnaire (Revised), divergent validity.

Table 15

Summary of correlations between the Female Fertility Knowledge Inventory, its factors and scales used for validity testing

	FFKI	RepHe	Life	Concep	OvRes	SFAQ	CFKS	HLSISF	GNKQR
FFKI	1.00								
RepHe	.580**	1.00							
Life	.624**	.339**	1.00						
Concep	.699**	.306**	.327**	1.00					
OvRes	.786**	.344**	.253**	.358**	1.00				
SFAQ	.271**	.186**	.123	.173**	.247**	1.00			
CFKS	.590**	.379**	.369**	.352**	.495**	.264**	1.00		
HLSISF	.143*	.095	.017	.048	.226**	.167*	.149*	1.00	
GNKQR	.603**	.452**	.320**	.372**	.522**	.268**	.522**	.318**	1.00

Notes. *$p < .05$, **$p < .01$, two-tailed test.
FFKI = 15-item Female Fertility Knowledge Inventory; RepHe = Reproductive health; Life = Lifestyle factors; Concep = chance of conception; OvRes = Ovarian reserve and preservation; SFAQ = Swedish Fertility Awareness Questionnaire, concurrent validity; CFKS = Cardiff Fertility Knowledge Scale, concurrent validity; HLSISF = Health Literacy Skills Instrument Short Form, convergent validity; GNKQR = General Nutrition Knowledge Questionnaire (Revised), divergent validity.

3.7.1 Hypotheses 1 and 2: there will be a positive correlation between the MFKI and both the SFAQ and CFKS.

As in Table 14, there was no significant correlation between the entire MFKI or its factors with the SFAQ, excepting the negligible positive correlation between the lifestyle factors factor and SFAQ (.144, $p<.05$) (Hinkle, Wiersma, & Jurs, 2003). Therefore, hypothesis one was not supported. There was a moderate positive correlation between both the entire MFKI and the sperm quality factor, with the CFKS (.566 and .535, respectively, $p<.01$), and negligible to low correlations of its other factors (Hinkle et al., 2003), supporting hypothesis two. Overall, partial support for concurrent validity was achieved.

3.7.2 Hypotheses 5 and 6: there will be a positive correlation between the FFKI and both the SFAQ and CFKS.

There were negligible positive correlations between the entire FFKI and three of its factors with the SFAQ ranging from .173 to .271 ($p<.01$) (Hinkle et al., 2003) (Table 15). Therefore, hypothesis five was not supported. There was a moderate positive correlation between the entire FFKI and the CFKS (.590), and low positive correlations of all factors with the CFKS ($p<.01$) (Hinkle et al., 2003), supporting hypothesis six. Overall, partial support for concurrent validity was achieved.

3.7.3 Hypotheses 3 and 7: there will be a positive correlation between the MFKI and FFKI respectively, and the HLSISF.

To establish convergent validity, the hypotheses that there would be a positive correlation between the MFKI and FFKI, and HLSISF were not supported. As in Table 14, there were no significant correlations between the MFKI and its factors and the HLSISF, excepting a negligible positive correlation of the environment and reproductive health factor (.183, $p< .01$) (Hinkle et al., 2003). As in Table 15, there was a negligible positive correlation between both the FFKI and

the ovarian reserve and preservation factor, and the HLSISF (.143, $p<.05$ and .226, $p<.01$, respectively). Therefore, both hypotheses were not supported and did not provide evidence of convergent validity.

Positive correlations between existing measures of fertility knowledge (SFAQ and CFKS) and the HLSISF were negligible (.167 and .149, respectively) ($p< .05$) (Table 14).

3.7.4 Hypotheses 4 & 8: There will be no correlation between the MFKI and FFKI respectively, and the GNKQR.

To establish divergent validity, the hypotheses that there would be no correlation between the MFKI and FFKI, and the GNKQR was not supported (Tables 14 and 15). There was a moderate positive correlation between the MFKI and all of its factors, and the GNKQR, with correlations ranging from .309 to .453 ($p<.01$) (Hinkle et al., 2003). Similarly, the FFKI and the ovarian reserve and preservation factor correlated moderately with the GNKQR (.603 and .522, respectively, $p<.01$), and there were negligible to moderate positive correlations between all other factors and the GNKQR, ranging from .320 to .452 ($p<.01$). Therefore, the hypotheses were not supported and did not provide evidence for divergent validity.

Positive correlations between existing measures of fertility knowledge varied; there was a negligible correlation with the SFAQ (.268, $p< .01$), while the CFKS revealed a moderate correlation (.522) ($p< .01$) (Table 14).

Chapter 4 Discussion

The aim of the current study was to develop and validate two scales that measure knowledge specific to, and representative of, male and female fertility in a population of reproductive age. Scale development adopted the Classical Test Theory paradigm and followed protocol for construct operationalisation, item generation, and theoretical and psychometric analysis (De Vellis, 2012; Morgado et al., 2018). Extensive development of individual items saw 36 initial items in each pool refined through expert and layperson CVI evaluation, item difficulty, item discrimination and item-to-total analyses. Findings supported a three-factor structure for the final 14-item MFKI and a four-factor structure for the final 15-item FFKI (see Appendix M for copies of the final inventories with participant instructions), demonstrating acceptable reliability. Support for concurrent validity was partially confirmed for both scales, with greater evidence provided by the CFKS than the SFAQ, inconsistent with validity testing in previous scale development (Kudesia et al., 2017). Additionally, convergent and divergent validity were not confirmed and were inconsistent with previous literature (Bunting et al., 2013; Kudesia et al., 2017). Both scales contain content pertinent to fertility decision-making (Bunting et al., 2013), and types of information important to enable behaviour change stipulated by the IMB Model (Fisher et al., 2003), useful in future research and intervention design.

4.1 Initial Item Generation and Analysis

While several scales in the literature review attempt to demonstrate item generation (Daumler et al., 2016; Kudesia et al., 2017; Prior et al., 2018), there is little evidence for the evaluation of multiple iterations of proposed items in an initial item pool. Additionally, scales that do undergo theoretical analysis most commonly use qualitative methods (n = 5), while one employed quantitative and qualitative methods, as in the current study (Table 2). Furthermore, theoretical analysis of fertility knowledge is currently limited to the conceptualisation of

generalised fertility knowledge, indiscriminate of the severity of lifestyle and reproductive factors that impact male and female fertility differently. While numerous scales seek to measure aspects of both male and female fertility in a single scale (Daniluk & Koert, 2016; Holton et al., 2016; Kudesia et al., 2017), there are none that offer two separate, but comparable, scales measuring aspects of fertility specific to each gender. Therefore, the current study is the first to date that offers two separate scales following established item generation and theoretical analysis techniques to address the aforementioned shortcomings.

4.2 Psychometric Analysis

4.2.1 Internal structure.

Findings revealed a three-factor structure for the final 14-item MFKI (environment and reproductive health, lifestyle factors and sperm quality), explaining 46.23% of the total variance, while a four-factor solution on the final 15-item FFKI (reproductive health, lifestyle factors, chance of conception and ovarian reserve and preservation) explained 53.74% of the total variance. In comparison to previous research, the current scales explain greater variance in comparison to the CFKS (30% explained variance) (Bunting et al., 2013), and the Fertility Awareness Scale (FAS), which failed to converge altogether (Daniluk & Koert, 2013).

The internal structure and item content is similar between the current scales; for example, the MFKI environment and reproductive health factor is analogous to the FFKI reproductive health factor, explaining similar variance (27.26% and 27.12%, respectively). Additionally, the lifestyle factors factor in the MFKI and FFKI explain similar variance, and share two items in common regarding diet and smoking (10.26% and 10.73%, respectively). While to some extent similar, factors also vary in content. The MFKI sperm quality and FFKI ovarian reserve and preservation factors reveal the importance of knowledge of biological functions specific to each gender (explaining 8.71% and 7.50%, respectively), aspects of which have not been separately

addressed in fertility knowledge measurement. There are, however, further items in this FFKI factor related to fertility preservation that reflect the feminised conceptualisation of fertility and typically greater involvement of females in infertility treatment (Arya & Dibb, 2016). Finally, given the favourable portrayal of success stories of births to women over 40 years old in the media (Hewlett, 2004), the additional chance of conception factor in the FFKI addresses these strongly held misconceptions regarding age-related female fertility decline in a population of reproductive age. A significant strength of the current scales is the inclusion of items that encompass specific facts and heuristics, important information areas as identified by the IMB Model (Fisher et al., 2003).

Correlations between factors in the MFKI and FFKI ranged from low to moderate, indicating that although they share variance, they also explain different aspects of fertility knowledge. As this is the first study to examine a multifactorial structure of fertility knowledge, it is possible that the construct is integrated differently to that proposed by previous research (Bunting et al., 2013).

Widaman (1993) suggests that accurate analysis of data in EFA occurs when items have uniformly high communalities without cross loadings and several variables that load strongly on each factor. In practice, these conditions can be rare (Widaman, 1993). Communalities on the current scales are relatively low, with five items on the MFKI and eleven items on the FFKI having communalities greater than .3. However, all items are without cross loadings and factors are comprised of at least three items that have relatively strong loadings. Thus, as results fulfil two of these three criteria, and as the current study has adequate power, future research should continue to explore the multifactorial structure of the current scales using confirmatory factor analysis.

4.2.2 Internal consistency.

The MFKI and FFKI revealed internal consistency within the acceptable range ($\alpha = .78, \alpha = .77$, respectively). It is recommended that the scales be used in their entirety to optimise their reliability, as minimal acceptability of the sperm quality ($\alpha = .58$) and chance of conception factors ($\alpha = .57$) on respective scales limits the reliability of their use as independent measures of fertility knowledge.

The reliability of the complete MFKI and FFKI are comparable to existing measures of fertility knowledge, with greater reliability than both the SFAQ and CFKS in the current study (α = .19, α = .60, respectively). Previous use of the CFKS and the CFKS-J reveals acceptable internal consistency, ranging from $\alpha = .72$ (Maeda, Nakamura, Boivin, et al., 2016) to $\alpha = .79$ (Bunting et al., 2013). The current scales also reveal a slight improvement on less commonly used scales in the literature, including the FAS and the MU-Fertility Knowledge Assessment Scale ($\alpha = .74$) (Daniluk & Koert, 2012; Mu, 2017).

The MFKI and FFKI are the first multifactorial fertility knowledge scales in the literature. As acknowledged by Giles (2008), multifactorial scales are likely to have lower internal consistency than unifactorial scales. Therefore, the comparable internal consistency as previously discussed is a strength of the current study.

With regards to optimal scale length, reliability can be inflated due to a large number of scale items; De Vellis (2012) suggests that extremely high internal consistency (α > .9) indicates the need for further scale length refinement. Internal consistency of the MFKI and FFKI, however, does not indicate that this is required.

4.2.3 Concurrent validity.

The hypotheses that there would be a positive association between the MFKI and FFKI, and the SFAQ were not supported, with no and negligible positive correlations respectively.

Evidence for concurrent validity did not replicate previous findings that established a moderate positive correlation between the SFAQ and the Fertility and Infertility Treatment and Knowledge Score (FIT-KS) (p = .45, p< .0001) (Kudesia et al., 2017). There are several possible explanations for this finding. Firstly, the SFAQ revealed minimal internal consistency (α = .19), limiting conclusions drawn from such results. Secondly, the content of the FIT-KS and the SFAQ share focus on female fertility and fecundability at advancing ages, aligning closely to fertility awareness (Hampton & Mazza, 2015). The FFKI also contains several items pertinent to this content (5, 6, 7, 8 & 15) that may explain the negligible correlations detected, in contrast to the MFKI, which does not contain items specific to female fertility and did not reveal this association.

The hypotheses that there will be a positive association between the MFKI and FFKI, and the CFKS were supported by moderate correlations between the scales. There is no previous research with which to compare this result, however, there are several possible explanations for these findings. Firstly, the CFKS and current scales employ the same answer format, unlike the open response format of the SFAQ which required increased cognitive effort and may have contributed to respondent burden, decreasing response quality (Lavrakas, 2008). Secondly, unlike the SFAQ, understandings of fertility on the CFKS are operationalised as fertility knowledge and hence measure the same construct as current scales.

4.2.4 Convergent validity.

The hypotheses that the MFKI and FFKI would correlate positively with health literacy were not supported, with no or negligible correlations respectively. These results were not in accordance with previous research (Maeda et al., 2015), and findings in other health contexts that suggest a positive association between health literacy and cancer, diabetes and HIV knowledge (De Walt, Berkman, Sheridan, & Pignone, 2004). Differences in health literacy measurement may

have contributed to the findings in the current study. Maeda et al. (2015) used the 14-item Health Literacy Scale, which is a self-report measure of health literacy, while the HLSISF in the current study purports to measure the same construct, however, tests the ability to read, locate and understand health information in written and oral mediums. Additionally, the current sample was highly educated, with 90% of females and 76% of males currently enrolled in or having completed university studies; the population most likely to delay childbearing (Fulford et al., 2013). Intuitively, this implies that participants can more easily apply complex critical thinking skills to understand health-related materials in contrast to less educated populations. Thus, this scale may have been less sensitive in determining an association between fertility knowledge and health literacy in contrast to the previous sample where only 45% of participants were university educated (Maeda et al., 2015). Furthermore, as participants responded to content in videos and audio recordings, increased respondent burden may have played a role in response quality (Lavrakas, 2008).

4.2.5 Divergent validity.

The hypotheses that there would be no association between the MFKI and FFKI, respectively, and nutrition knowledge was not supported, with moderate associations between scales. These results were not in accordance with a previous study using the FIT-KS that found a weak association between nutrition and fertility knowledge, suggesting that nutrition knowledge evidenced divergent validity (Kudesia et al., 2017). It was argued that a moderate or strong correlation, as in the current study, would suggest that a fertility knowledge scale served as a proxy measurement for general health knowledge. However, a similar correlation between these scales and health literacy would also be expected if the current scales were a proxy measure for general health knowledge, which, as previously discussed did not occur. Additionally, the CFKS also had a moderate association with nutrition knowledge in the current study, indicating a greater

association between fertility and nutrition knowledge than previously identified. This result is somewhat unexpected given that the FIT-KS, CFKS and the current scales measure the same operationalised construct of fertility knowledge. However, it is possible that nutrition knowledge is a suitable test of divergent validity for fertility awareness, as the construct measures understanding of a woman's fertile period of the menstrual cycle (Hampton & Mazza, 2015) and is unlikely to correlate with nutrition knowledge, given the lack of focus on nutritional factors related to fertility. This was demonstrated in the relatively weak association between the SFAQ and GNKQR; this outcome, however, is limited by the low reliability of the SFAQ. As divergent validity has only been tested in the current study and for the FIT-KS (Kudesia et al., 2017), further research should be undertaken to explore these conflicting results.

4.3 Demographic and Reproductive Characteristics

Participation in fertility research has previously been dominated by female populations, as involvement in fertility preservation and treatment is systematically presumed to be of female interest and responsibility (Arya & Dibb, 2016). Therefore, the low proportion of male participants in the validation study (24%), while not uncommon, partially limits the external validity of the scales and suggests further validation be undertaken in male populations.

Additionally, previous research indicates that women younger than 35 years are more likely to intend to take measures to improve their chance of conceiving when they are knowledgeable about fertility and feel susceptible to infertility, while there is no association in older women (Fulford et al., 2013). In the current validation study, the average age of men and women was significantly younger than this critical age (25.3 and 26.5 years, respectively), and the median age of first-time mothers and fathers in Australia, being 33.1 and 28.9 years, respectively (ABS, 2016; AIHW, 2017). Thus, the current study contains participants that are representative of a population most likely to delay childbearing given their highly educated

characteristics, but still younger than the critical age of fertility decision-making and childbearing, which is relevant to future research implications.

4.4 Limitations

This study was the first to develop and validate two scales that measure knowledge specific to male and female fertility. However, several limitations of the current study should be noted. Fertility knowledge research is still in its early stages and thus psychometric testing was largely exploratory, so the current study selected the most suitable constructs to test validity given the limited literature. However, existing measures of fertility knowledge did not reveal associations with health literacy and nutrition knowledge that would be expected if such constructs were truly suitable for psychometric testing in fertility knowledge scale development, with only the association between the SFAQ and nutrition knowledge providing support as hypothesised for divergent validity. However, it is not advisable to evaluate suitability of divergent validity, based on the low reliability of this scale in the current study. Future research should therefore identify additional means of validity testing for fertility knowledge.

Additionally, caution should be exercised when considering the use of the MFKI and FFKI factors as individual measures of aspects of fertility knowledge, as psychometric properties do not reveal acceptable reliability and validity. Thus, there is greater need to explore individual aspects of fertility knowledge to contribute to a greater understanding of the construct.

4.5 Clinical Implications and Further Research

The current study offers several peripheral contributions to the literature, including a review of the limitations of existing measures of fertility knowledge measurement, and a working definition of fertility knowledge informed by fertility research and the IMB Model (Bunting et al., 2013; Fisher et al., 2003).

The contribution of these two new scales, the MFKI and FFKI, is significant as researchers will now be able to assess knowledge of male and female fertility separately. The creation of interventions designed to improve fertility knowledge using the IMB model requires delivery of specific information that is most relevant to the selected population's health behaviour practices (Fisher et al., 2003), and by extension requires scales specific to this information to evaluate outcomes. Hence, the MFKI and FFKI allow researchers to apply greater specificity in their approach and measurement. This will also permit researchers to identify areas of fertility knowledge that are poorly understood in the general population and within specific, diverse groups upon further validity testing, such as adolescents, members of the LGBTIQA+ community and those from culturally and linguistically diverse backgrounds. Ultimately, researchers will be able to explore how such knowledge, together with motivation and behavioural skills, may be able to minimise the risk of involuntary childlessness due to modifiable male and female fertility risk factors in cross sectional and longitudinal research.

As the current sample revealed that a high proportion of people receive fertility information from the internet, their doctor and public health centres, future use of the scales in clinical practice should reflect such information sources. Clinical interventions can be developed using the current scales to deliver information online or in person to educate people about male and female fertility, as has recently been proposed by several Australian fertility researchers (Hammarberg et al., 2017; Prior et al., 2018). Additionally, the development of criterion estimates will allow use of these scales as screening tools in primary healthcare and will identify individuals at greatest risk of infertility and involuntary childlessness due to lack of knowledge.

4.6 Conclusion

The present study developed two measures of fertility knowledge and examined their psychometric properties in a population of reproductive age. The 14-item MFKI and 15-item

FFKI were created using established test protocol with high internal consistency and partial evidence for concurrent validity. The present research suggests that determination of appropriate validity testing will be useful in future research to allow further refinement of the scales, as findings did not necessarily support previous research (Kudesia et al., 2017; Maeda et al., 2015). Furthermore, it is challenging to compare the psychometric properties of the MFKI and FFKI to existing measures, as there is little published literature exploring such tests and a lack of overarching theoretical framework exploring the internal structure of fertility knowledge. Overall, the findings provide initial support for the validity and reliability of the MFKI and FFKI as measures of fertility knowledge in populations of reproductive age, offering a useful tool for clinical and research purposes.

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Appendices

Appendix A

Abstract submitted and accepted to the Undergraduate Research Conference (July 2018)

Rationale: involuntary childlessness and infertility remain global public health issues, with couples experiencing complicated grief and loss, and feelings of depression, anxiety and disempowerment. Previous research reveals poor understanding of natural age-related fertility decline and risk factors for infertility in male and female populations, resulting in preventable, or at least modifiable, fertility issues. According to the Information-Motivation-Behavioural Skills Model, knowledge is an initial prerequisite for enacting a health behaviour.

Research question/focus: to date, two measures are commonly used to assess people's fertility knowledge, both of which have not been suitably tested for validity and reliability. Both fail to measure a broad range of knowledge related to lifestyle factors affecting fertility, common misconceptions about infertility and basic knowledge of infertility treatments. Furthermore, they do not differentiate between male and female infertility risks, despite a substantial body of evidence indicating the influence of both male and female health in conception. The focus of this research is to develop two psychometrically sound measures specific to knowledge about male and female fertility.

Research methodology: people of reproductive age participated in a quantitative cross-sectional research study. The new measures will be assessed using item and scale content validity indexes, item difficulty and discrimination analyses and biserial correlation. The dimensional characteristics of the measures will be determined using Exploratory Factor Analysis. Subsequently analysis of internal consistency and tests of convergent, divergent and concurrent validity will be undertaken. Preliminary findings will be presented.

Significant and originality of findings: this project develops two measures that future researchers can use to reliably quantify what people know about fertility. Psychometrically strong measures will enable researchers to accurately assess fertility knowledge and to explore how such knowledge, together with motivation and behavioural skills, may be able to minimise the risk of involuntary childlessness due to modifiable fertility issues.

Appendix B

Search terms used to identify existing measures of fertility understandings

PubMed Logic Grid

AND ⇨

Understanding of fertility	Measurement
fertility knowledge [tiab] OR fertility awareness [tiab]	scale* [tiab] OR inventor* [tiab] OR question* [tiab] OR measure* [tiab] OR survey* [tiab] OR instrument* [tiab] OR checklist* [tiab] or schedule* [tiab]

PsychINFO Logic Grid

AND ⇨

Understanding of fertility	Measurement
fertility knowledge.ti,ab OR fertility awareness.ti,ab	scale*.ti,ab OR inventor*.ti,ab OR question*.ti,ab OR measure*.ti,ab OR survey*.ti,ab OR instrument*: ti,ab OR checklist*:ti,ab OR schedule*:ti,ab

CINAHL Logic Grid

AND ⇨

Understanding of fertility	Measurement
TI fertility knowledge OR TI fertility awareness OR AB fertility knowledge OR AB fertility awareness	TI scale* OR TI inventor* OR TI question* OR TI measure* OR TI survey* OR TI instrument* OR TI checklist* OR TI schedule* OR AB scale* OR AB inventor** OR AB question* OR AB measure* OR AB survey* OR AB instrument* OR AB checklist* OR AB schedule*

Appendix C

Expert evaluation: instructions for item evaluation (of items in Tables 5 and 6) and demographic items

We are developing measures to assess a person's fertility knowledge, defined as one's level of understanding regarding male and female fertility decline, risk factors for poor fertility, and a basic awareness of infertility treatment.

Involuntary childlessness and infertility remain global public health issues. As more people delay childbearing and/or experience infertility difficulties, the need for reliable and valid measures of fertility knowledge has greater significance as previous research reveals poor understanding of these concepts in study populations resulting in preventable, or at the very least, modifiable, fertility issues.

You are being asked to serve as a content expert because of your knowledge and skills in the area of infertility. Your participation in the review process of the measures is valuable as a preliminary step to future studies that investigate fertility-related knowledge in a range of populations and to enable the development and evaluation of fertility-related health promotions programs.

The measures consist of questions related to the dimensions of (1) age-related fertility decline, (2) biological, reproductive and lifestyle risks, (3) misconceptions about fertility, and (4) infertility assessment and treatment for both males and females. In the final measure, fertility knowledge will be assessed with three response options for each item, True, False, or Don't Know.

Please take the time to evaluate each question for:

1. Medical accuracy – In judging medical accuracy please indicate, Yes/No, as to whether each question is accurate according to the medical literature, with regards to your understanding and the clinical recommendations you would give to a client in your practice.
2. Relevance – In judging relevance please indicate how relevant, not relevant/somewhat relevant/quite relevant/highly relevant, the information in each question is for people to know in relation to fertility and conception.
3. Clarity – In judging clarity please indicate how clearly each question is worded, not clear/needs major revision to be clear/needs minor revision to be clear/item is clear. For questions considered to lack clarity please advise of any jargon that should be avoided, or if there are any terms for which a definition should be provided. If so, please specify which terms would benefit from including a definition.

Providing information about medical accuracy, relevance and clarity will be useful in refining the measures. Finally, please respond to the questions relating to comprehensiveness of the measures with suggestions for the addition or deletion of any questions. We thank you in advance for your assistance.

Demographic items

1. Are you: male/female/other (please specify)
2. What is your age (in years)? (open response)
3. How long have you been employed in specialist infertility services? (open response)
4. In what role are you employed? (open response)
5. I consent to the researchers contacting me in the event they would like to clarify my response to an item in this survey.

6. I consent to the researchers contacting me in the event they would like to request I briefly review the measures if substantial revisions, deletions or additions have been made based on the feedback from the first survey of health professionals.

Appendix D

Pilot study: instructions for item evaluation (of items in Tables 5 and 6)

We are developing measures to assess a person's fertility knowledge, defined as one's level of understanding regarding male and female fertility decline, risk factors for poor fertility, and a basic awareness of infertility treatment. Involuntary childlessness and infertility remain global public health issues. As more people delay childbearing and/or experience infertility difficulties, the need for reliable and valid measures of fertility knowledge has greater significance as previous research reveals poor understanding of these concepts in study populations resulting in preventable, or at the very least, modifiable, fertility issues.

To ensure the questions can be easily understood by people who might complete them in the future, you are being asked to provide feedback about the clarity and acceptability of the proposed questions. Your participation in the review process of the measures is valuable as a preliminary step to future studies that will be able to investigate fertility-related knowledge in a range of populations and to enable the development and evaluation of fertility-related health promotions programs.

The measures of fertility knowledge consist of questions related to both male and female fertility. In the final measure, fertility knowledge will be assessed with 3 response options for each item: True, False, or Don't Know.

Please take the time to evaluate each question for:

1. Clarity: in judging clarity, please indicate how clearly each question is worded, not clear/needs major revision to be clear/needs minor revision to be clear/item is clear. For questions considered to lack clarity, please advise of any jargon that should be avoided, or if there are any terms for which a definition should be provided. If so, please specify which terms would benefit from including a definition.
2. Acceptability: in judging acceptability, please indicate "acceptable" if the question is acceptable and is not offensive, and "not acceptable" if the question is not acceptable and there are any terms in the question by which you may be offended. For questions considered unacceptable, please specify which terms would benefit from being amended.

   Providing information about clarity and acceptability will be useful in refining the measures.

Finally, please respond to the questions relating to comprehensiveness of the measures with suggestions for the addition or deletion of any questions. At the end of the questionnaire, we will ask several questions relating to your own reproductive intentions. The researchers acknowledge that asking about trying to conceive and pregnancy status is very personal, but the questions are asked as they may influence a person's fertility knowledge. We thank you in advance for your assistance.

Appendix E

Validation study: instructions and scales (correct responses as indicated or marked in bold type

Below are some statements concerning fertility. Please indicate whether you believe they are "true" or "false" by ticking the appropriate box. If you do not know the answer, please tick "I don't know". As this is a test of your knowledge, please do not feel inclined to look up the answer for any question as we would like to have an accurate measure of your knowledge.

Attachment: 31-item Male and Female Fertility Knowledge Inventories (items as indicated in Table 5 and 6).

GENERAL NUTRITION KNOWLEDGE QUESTIONNAIRE

This is a survey, not a test. Your answers will help identify which dietary advice people find confusing. It is important that you complete it by yourself. Your answers will remain anonymous. If you don't know the answer, mark "not sure" rather than guess. Thank you for your time.

Section 1: The first few items are about what advice you think experts are giving us.

1. Do health experts recommend that people should be eating more, the same amount, or less of the following foods? (tick one box per food)

	More	Same	Less	Not Sure
Fruit	✓	☐	☐	☐
Food and drinks with added sugar	☐	☐	✓	☐
Vegetables	✓	☐	☐	☐
Fatty foods	☐	☐	✓	☐
Processed red meat	☐	☐	✓	☐
Wholegrains	✓	☐	☐	☐
Salty foods	☐	☐	✓	☐
Water	✓	☐	☐	☐

2. How many servings of fruit and vegetables per day do experts advise people to eat as a minimum? (One serving could be, for example, an apple or a handful of chopped carrots) (tick one)

2	☐
3	☐
4	☐
5 or more	✓
Not sure	☐

3. Which of these types of fats do experts recommend that people should eat less of? (tick one box per food)

	Eat less	Not eat less	Not sure
Unsaturated fats	☐	✓	☐

Trans fats	✓	☐	☐
Saturated fats	✓	☐	☐

4. Which type of dairy foods do experts say people should drink? (tick one)

Full fat (e.g. full fat milk)	☐
Reduced fat (e.g. skimmed and semi-skimmed milk)	✓
Mixture of full fat and reduced fat	☐
Neither, dairy foods should be avoided	☐
Not sure	☐

5. How many times per week do experts recommend that people eat oily fish (e.g. salmon and mackerel)? (tick one)

1-2 times per week	✓
3-4 times per week	☐
Every day	☐
Not sure	☐

6. Approximately how many alcoholic drinks is the maximum recommended per day (The exact number depends on the size and strength of the drink)? (tick one)

1 drink each for men and women	✓
2 drinks each for men and women	☐
2 drinks for men and 1 drink for women	☐
3 drinks for men and 2 drinks for women	☐
Not sure	☐

7. How many times per week do experts recommend that people eat breakfast? (tick one)

3 times per week	☐
4 times per week	☐
Every day	✓
Not sure	☐

8. If a person has two glasses of fruit juice in a day, how many of their daily fruit and vegetable servings would this count as? (tick one)

None	☐
One serving	✓
Two servings	☐
Three servings	☐
Not sure	☐

9. According to the 'eatwell guide' (a guideline showing the proportions of food types people should eat to have a balanced and healthy diet), how much of a person's diet should be made up of starchy foods? (tick one)

Quarter	☐
Third	✓
Half	☐
Not sure	☐

Section 2: Experts classify foods into groups. We are interested to see whether people are aware of food groups and the nutrients they contain.

1. Do you think these foods and drinks are typically high or low in added sugar? (tick one box per food)

	High in added sugar	Low in added sugar	Not sure
Diet cola drinks	☐	✓	☐
Natural yoghurt	☐	✓	☐
Ice cream	✓	☐	☐
Tomato ketchup	✓	☐	☐
Melon	☐	✓	☐

2. Do you think these foods are typically high or low in salt? (tick one box per food)

	High in salt	Low in salt	Not Sure
Breakfast cereals	✓	☐	☐
Frozen vegetables	☐	✓	☐
Bread	✓	☐	☐
Baked beans	✓	☐	☐
Red meat	☐	✓	☐
Canned soup	✓	☐	☐

3. Do you think these foods are typically high or low in fibre? (tick one box per food)

	High in fibre	Low in fibre	Not Sure
Oats	✓	☐	☐
Bananas	✓	☐	☐
White rice	☐	✓	☐
Eggs	☐	✓	☐
Potatoes with skin	✓	☐	☐
Pasta	☐	✓	☐

4. Do you think these foods are a good source of protein? (tick one box per food)

	Good source of protein	Not a good source of protein	Not sure
Poultry	✓	☐	☐
Cheese	✓	☐	☐
Fruit	☐	✓	☐
Baked beans	✓	☐	☐
Butter	☐	✓	☐
Nuts	✓	☐	☐

5. Which of the following foods do experts count as starchy foods? (tick one box per food)

	Starchy food	Not a starchy food	Not sure
Cheese	☐	✓	☐
Pasta	✓	☐	☐

Potatoes	✓	☐	☐	
Nuts	☐	✓	☐	
Plantains	✓	☐	☐	

6. Which is the main type of fat present in each of these foods? (tick one box per food)

	Polyunsaturated fat	Monounsa t-urated fat	Saturated fat	Cholester ol	Not sure
Olive oil	☐	✓	☐	☐	☐
Butter	☐	☐	✓	☐	☐
Sunflower oil	✓	☐	☐	☐	☐
Eggs	☐	☐	☐	✓	☐

7. Which of these foods has the most trans-fat? (tick one)

Biscuits, cakes and pastries	✓
Fish	☐
Rapeseed oil	☐
Eggs	☐
Not sure	☐

8. The amount of calcium in a glass of whole milk compared to a glass of skimmed milk is: (tick one)

About the same	✓
Much higher	☐
Much lower	☐
Not sure	☐

9. Which one of the following nutrients has the most calories for the same weight of food? (tick one)

Sugar	☐
Starchy	☐
Fibre/roughage	☐
Fat	✓
Not sure	☐

10. Compared to minimally processed foods, processed foods are: (tick one)

Higher in calories	✓
Higher in fibre	☐
Lower in salt	☐
Not sure	☐

Section 3: The next few items are about choosing foods

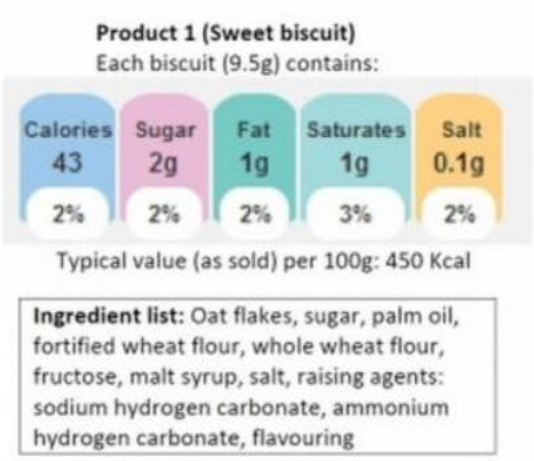
1. If a person wanted to buy a yogurt at the supermarket, which would have the least sugar/sweetener? (tick one)

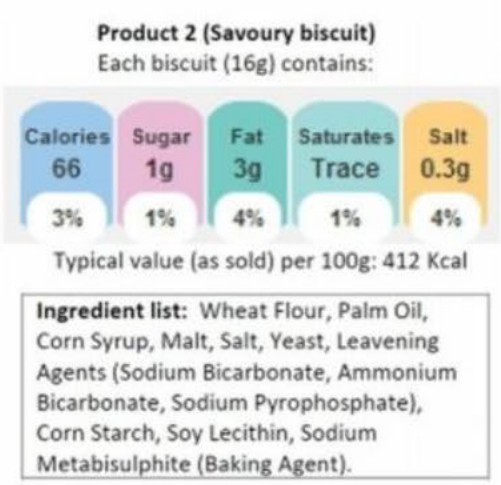
0% fat cherry yogurt	☐
Natural yogurt	✓
Creamy fruit yogurt	☐
Not sure	☐

2. If a person wanted soup in a restaurant or cafe, which one would be the lowest fat option? (tick one)	
Mushroom risotto soup (field mushrooms, porcini mushrooms, arborio rice, butter, cream, parsley and cracked black pepper)	☐
Carrot butternut and spice soup (carrot , butternut squash, sweet potato, cumin, red chillies, coriander seeds and lemon)	✓
Cream of chicken soup (British chicken, onions, carrots, celery, potatoes, garlic, sage, wheat flour, double cream)	☐
Not sure	☐
3. Which would be the healthiest and most balanced choice for a main meal in a restaurant? (tick one)	
Roast turkey, mashed potatoes and vegetables	✓
Beef, Yorkshire pudding and roast potatoes	☐
Fish and chips served with peas and tartar sauce	☐
Not sure	☐
4. Which would be the healthiest and most balanced sandwich lunch? (tick one)	
Ham sandwich + fruit + blueberry muffin + fruit juice	☐
Tuna salad sandwich + fruit + low fat yogurt + water	✓
Egg salad sandwich + crisps + low fat yogurt + water	☐
Not sure	☐
5. Which of these foods would be the healthiest choice for a pudding? (tick one)	
Berry sorbet	✓
Apple and blackberry pie	☐
Lemon cheesecake	☐
Carrot cake with cream cheese topping	☐
Not sure	☐
6. Which of these combinations of vegetables in a salad would give the greatest variety of vitamins and antioxidants? (tick one)	
Lettuce, green peppers and cabbage	☐
Broccoli, carrot and tomatoes	✓
Red peppers, tomatoes and lettuce	☐
Not sure	☐
7. If a person wanted to reduce the amount of fat in their diet, but didn't want to give up chips, which of the following foods would be the best choice? (tick one)	
Thick cut chips	✓
Thin cut chips	☐
Crinkle cut chips	☐
Not sure	☐
8. One healthy way to add flavour to food without adding extra fat or salt is to add: (tick one)	
Coconut milk	☐
Herbs	✓
Soya sauce	☐

Not sure	☐
9. Which of the following cooking methods requires fat to be added? (tick one)	
Grilling	☐
Steaming	☐
Baking	☐
Sautéing	✓
Not sure	☐
10. Traffic lights are often used on nutrition labelling, what would amber mean for the fat content of a food? (tick one)	
Low fat	☐
Medium fat	✓
High in fat	☐
Not sure	☐
11. "Light" foods (or Diet foods) are always good options because they are low in calories. (tick one)	
Agree	☐
Disagree	✓
Not sure	☐

The following questions are related to food labels:





12. Looking at products 1 and 2, which one has the most calories (kcal) per 100 grams (tick one)	
Product 1	✓
Product 2	☐
Both have the same quantity	☐
Not sure	☐
13. Looking at product 1, what are the sources of sugar in the ingredient list? (tick one)	
Sugar and malt syrup	☐

Sugar, fructose and lecithin	☐
Sugar, fructose and malt syrup	✓
Not sure	☐
Section 4: This section is about health problems or diseases related to diet and weight management	
1. Which of these diseases is related to a low intake of fibre? (tick one)	
Bowel disorders	✓
Anaemia	☐
Tooth decay	☐
Not sure	☐
2. Which of these diseases is related to how much sugar people eat? (tick one)	
High blood pressure	☐
Tooth decay	✓
Anaemia	☐
Not sure	☐
3. Which of these diseases is related to how much salt (or sodium) people eat? (tick one)	
Hypothyroidism	☐
Diabetes	☐
High blood pressure	✓
Not sure	☐
4. Which of these options do experts recommend to reduce the chances of getting cancer? (tick one)	
Drinking alcohol regularly	☐
Eating less red meat	✓
Avoiding additives in food	☐
Not sure	☐
5. Which of these options do experts recommend to prevent heart disease? (tick one)	
Taking nutritional supplements	☐
Eating less oily fish	☐
Eating less trans-fats	✓
Not sure	☐
6. Which of these options do experts recommend to prevent diabetes? (tick one)	
Eating less refined foods	✓
Drinking more fruit juice	☐
Eating more processed meat	☐
Not sure	☐
7. Which one of these foods is more likely to raise people's blood cholesterol? (tick one)	
Eggs	☐
Vegetable oils	☐
Animal fat	✓
Not sure	☐

8. Which one of these foods is classified as having a high Glycaemic Index (Glycaemic Index is a measure of the impact of a food on blood sugar levels, thus a high Glycaemic Index means a greater rise in blood sugar after eating)? (tick one)	
Wholegrain cereals	☐
white bread	✓
Fruit and vegetables	☐
Not sure	☐
9. To maintain a healthy weight people should cut fat out completely. (tick one)	
Agree	☐
Disagree	✓
Not sure	☐
10. To maintain a healthy weight people should eat a high protein diet. (tick one)	
Agree	☐
Disagree	✓
Not sure	☐
11. Eating bread always causes weight gain. (tick one)	
Agree	☐
Disagree	✓
Not Sure	☐
12. Fibre can decrease the chances of gaining weight. (tick one)	
Agree	✓
Disagree	☐
Not sure	☐

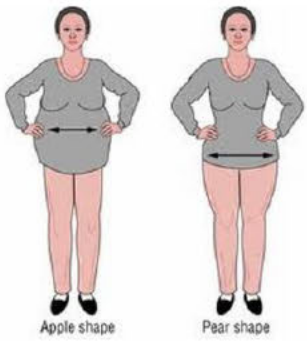
13. Which of these options can help people to maintain a healthy weight? (answer each one)

	Yes	No	Not sure
Not eating while watching TV	✓	☐	☐
Reading food labels	✓	☐	☐
Taking nutritional supplements	☐	✓	☐
Monitoring their eating	✓	☐	☐
Monitoring their weight	✓	☐	☐
Grazing throughout the day	☐	✓	☐

14. If someone has a Body Mass Index (BMI) of 23kg/m^2, what would their weight status be? (tick one)	
Underweight	☐
Normal weight	✓
Overweight	☐
Obese	☐
Not sure	☐
15. If someone has a Body Mass Index (BMI) of 31kg/m^2, what would their weight status be? (tick one)	

Underweight	☐
Normal weight	☐
Overweight	☐
Obese	✓
Not sure	☐

Look at the body shapes below:



16. Which of these body shapes increases the risk of cardiovascular disease (Cardiovascular disease is a general term that describes a disease of the heart of blood vessels, for example, angina, heart attack, heart failure, congenital heart disease and stroke)? (tick one)

Apple shape	✓
Pear shape	☐
Not sure	☐

Health Literacy Skills Instrument

Please answer the following questions based on information in the text provided. There are also several external links to websites that you will need to access in order to complete the following questions. Please ensure you open these links in a new tab on your web browser, and return to the survey once you have gathered the necessary information.

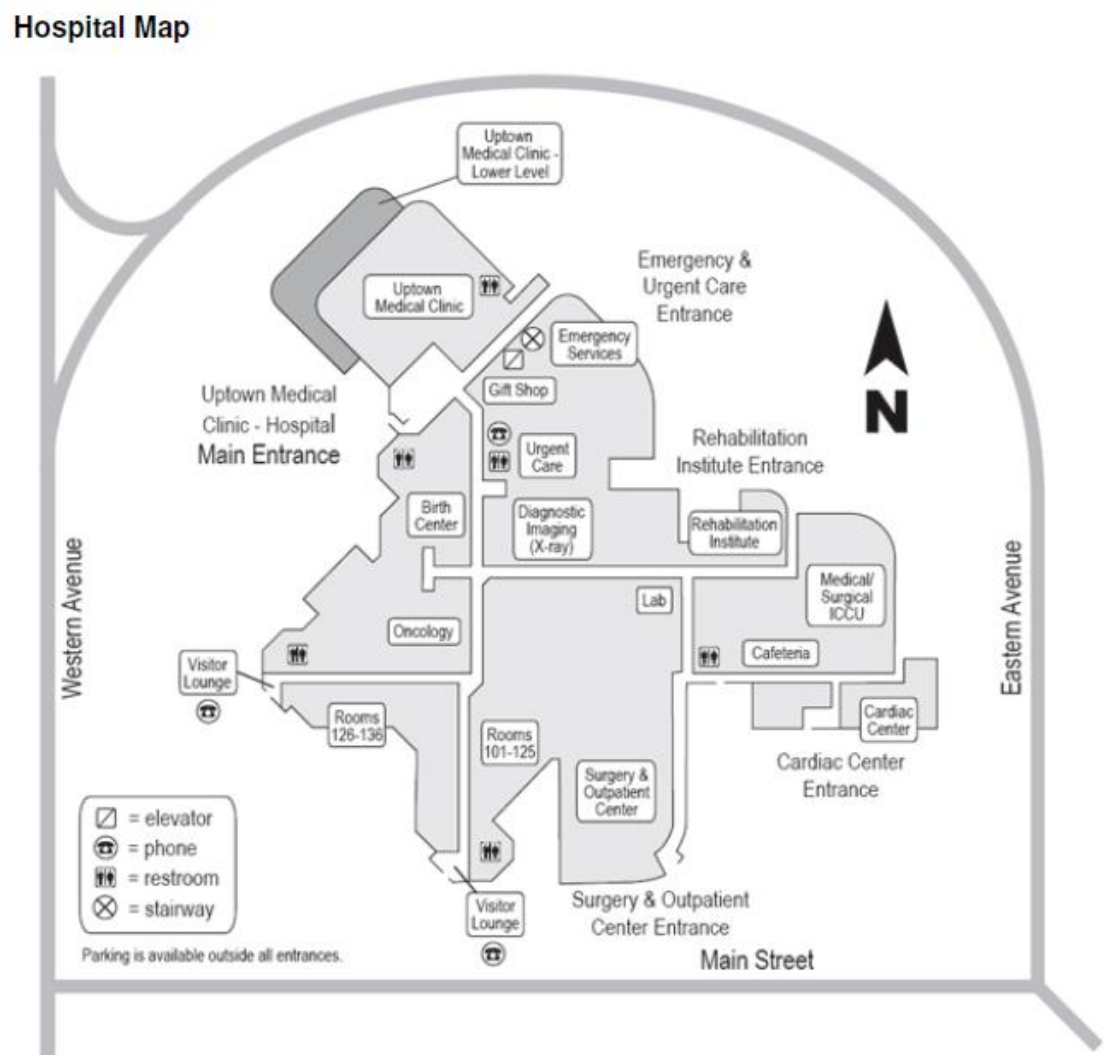
Cholesterol: What Your Level Means	**Total cholesterol level**
What is cholesterol? Cholesterol is a waxy substance the body uses to protect nerves, make cell tissues and produce certain hormones.	• Less than 200 is best. • 200 to 239 is borderline high. • 240 or more means a person is at increased risk for heart disease.

Are there different types of cholesterol?	**LDL cholesterol levels**
Yes. Cholesterol travels through the blood in different types of packages, called lipoproteins. Low-density lipoproteins (LDL) deliver cholesterol to the body. High-density lipoproteins (HDL) remove cholesterol from the bloodstream.	• Below 100 is ideal for people who have a higher risk of heart disease. • 100 to 129 is near optimal. • 130 to 159 is borderline high. • 160 or more means a person is at a higher risk for heart disease. **HDL cholesterol levels** • Less than 40 means a person is at higher risk for heart disease. • 60 or higher greatly reduces

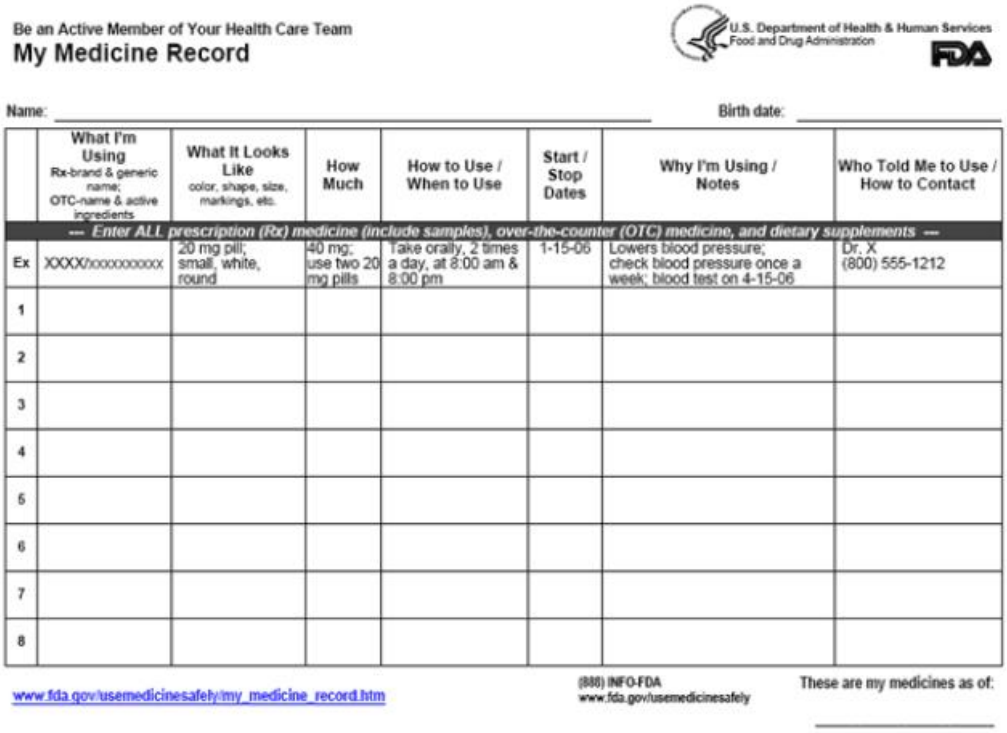
1. Which set of low density lipoprotein (LDL) and high density lipoprotein (HDL) levels is best? (LDL of 134 and HDL of 61/**LDL of 98 and HDL of 82**/LDL of 140 and HDL of 50/LDL of 165 and HDL of 80/Not sure)

Please listen to the recording below before proceeding to the next screen.

2. If a person was worried about his cough, what number should he press? (1/2/**4**/Call 000/Not sure)



3. Which of the following entrances is closest to the elevator? (There is no elevator/Surgery & Outpatient Centre Entrance/Rehabilitation Institute Entrance/**Main Entrance**/Don't know)



Be an Active Member of Your Health Care Team

My Medicine Record

U.S. Department of Health & Human Services
Food and Drug Administration
FDA

Name: _____ Birth date: _____

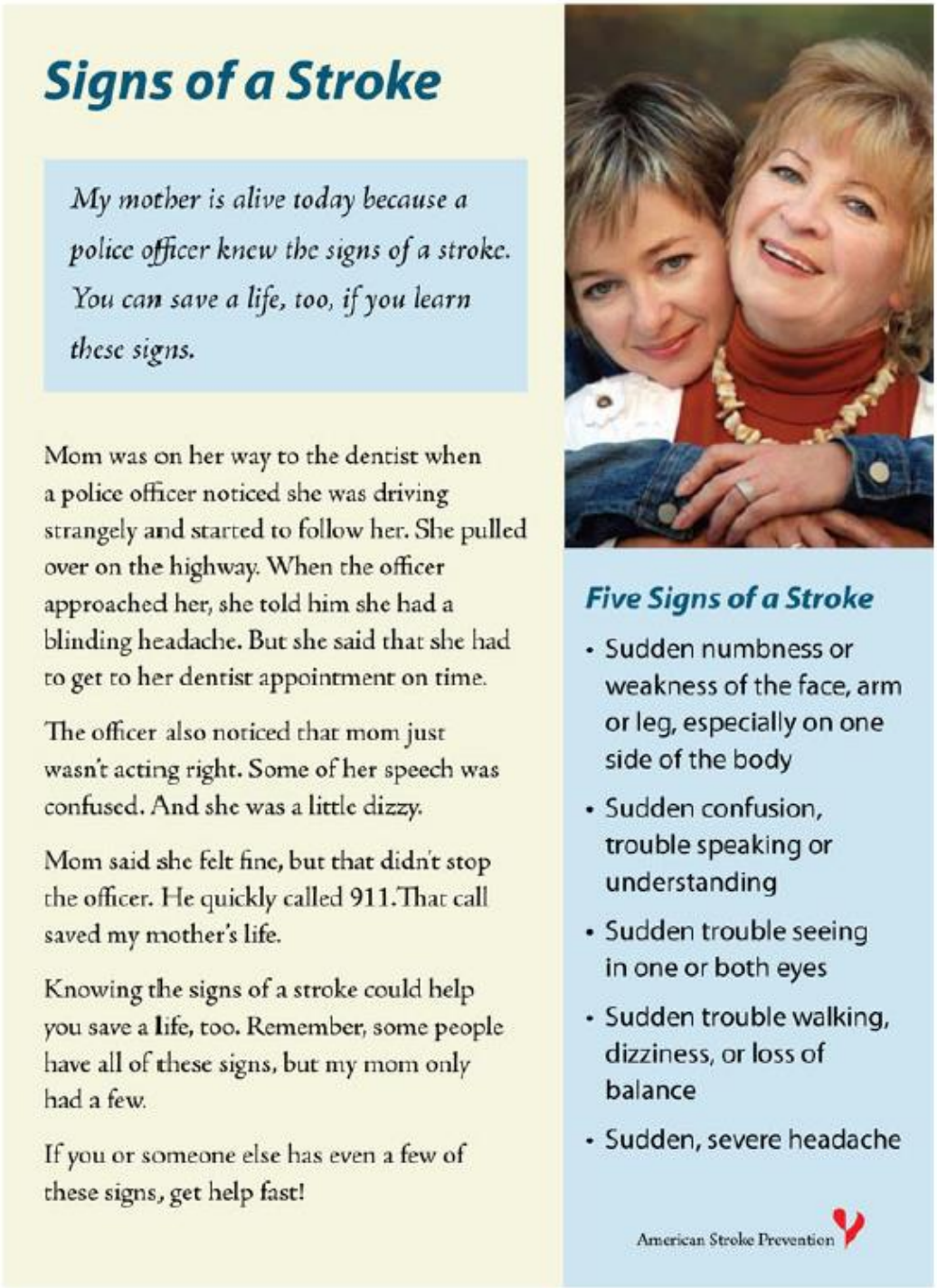
	What I'm Using Rx-brand & generic name; OTC-name & active ingredients	What It Looks Like color, shape, size, markings, etc.	How Much	How to Use / When to Use	Start / Stop Dates	Why I'm Using / Notes	Who Told Me to Use / How to Contact
	--- Enter ALL prescription (Rx) medicine (include samples), over-the-counter (OTC) medicine, and dietary supplements ---						
Ex	XXXX/xxxxxxxxxx	20 mg pill; small, white, round	40 mg; use two 20 mg pills	Take orally, 2 times a day, at 8:00 am & 8:00 pm	1-15-06	Lowers blood pressure; check blood pressure once a week; blood test on 4-15-06	Dr. X (800) 555-1212
1							
2							
3							
4							
5							
6							
7							
8							

www.fda.gov/usemedicinesafely/my_medicine_record.htm (888) INFO-FDA www.fda.gov/usemedicinesafely These are my medicines as of: _____

4. In the example listed in the first row of the table, when should the medicine be taken? (Two times a day anytime between 8 a.m. and 8 p.m./At 8 a.m. or 8 p.m. each day/**At 8 a.m. and 8 p.m. each day**/Don't know)

Please read the questions below, then visit the following website to answer the question. Answer the questions based on the information in the website (https://www.cardiosmart.org/healthwise/tx43/94/tx4394).

5. Kate weighs 150 pounds. Which activity would burn the most calories? (Walking at a medium pace for 30 minutes/**Raking the lawn for 30 minutes**/Bowling for 30 minutes/Don't know)



Signs of a Stroke

My mother is alive today because a police officer knew the signs of a stroke. You can save a life, too, if you learn these signs.

Mom was on her way to the dentist when a police officer noticed she was driving strangely and started to follow her. She pulled over on the highway. When the officer approached her, she told him she had a blinding headache. But she said that she had to get to her dentist appointment on time.

The officer also noticed that mom just wasn't acting right. Some of her speech was confused. And she was a little dizzy.

Mom said she felt fine, but that didn't stop the officer. He quickly called 911. That call saved my mother's life.

Knowing the signs of a stroke could help you save a life, too. Remember, some people have all of these signs, but my mom only had a few.

If you or someone else has even a few of these signs, get help fast!

Five Signs of a Stroke

- Sudden numbness or weakness of the face, arm or leg, especially on one side of the body
- Sudden confusion, trouble speaking or understanding
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, or loss of balance
- Sudden, severe headache

American Stroke Prevention

6. Which of the following is NOT a sign of a stroke? (**Shaking chills**/Blurred vision/Bad headache/Numbness on one side/Don't know)

Expanding portions

Are you eating a variety of healthy foods, exercising and still struggling with your weight? Some people may need to pay closer attention to portion control — managing the amount of food that they eat — as their total calorie intake determines their weight.

A serving isn't what they happen to put on their plate. It's a specific amount of food defined by common measurements, such as cups, ounces or pieces. The serving sizes represented here are part of the Mayo Clinic Healthy Weight Pyramid — a food pyramid designed to promote weight loss and long-term health. Use these serving sizes in conjunction with a diet based on a variety of healthy foods. Add the right amount of regular physical activity, and a person will be well on their way to enjoying good nutrition and controlling their weight.

Vegetables

Until they're comfortable judging serving sizes, you may need to use measuring cups and spoons. A half a cup of cooked carrots, for example, equals one serving. Here are the recommended serving sizes for other vegetables:

Food	Serving size
Raw leafy vegetables	= 2 cups
Raw vegetables, chopped	= 1 cup
Chopped, cooked or canned vegetables	= 1/2 cup

Meat and beans

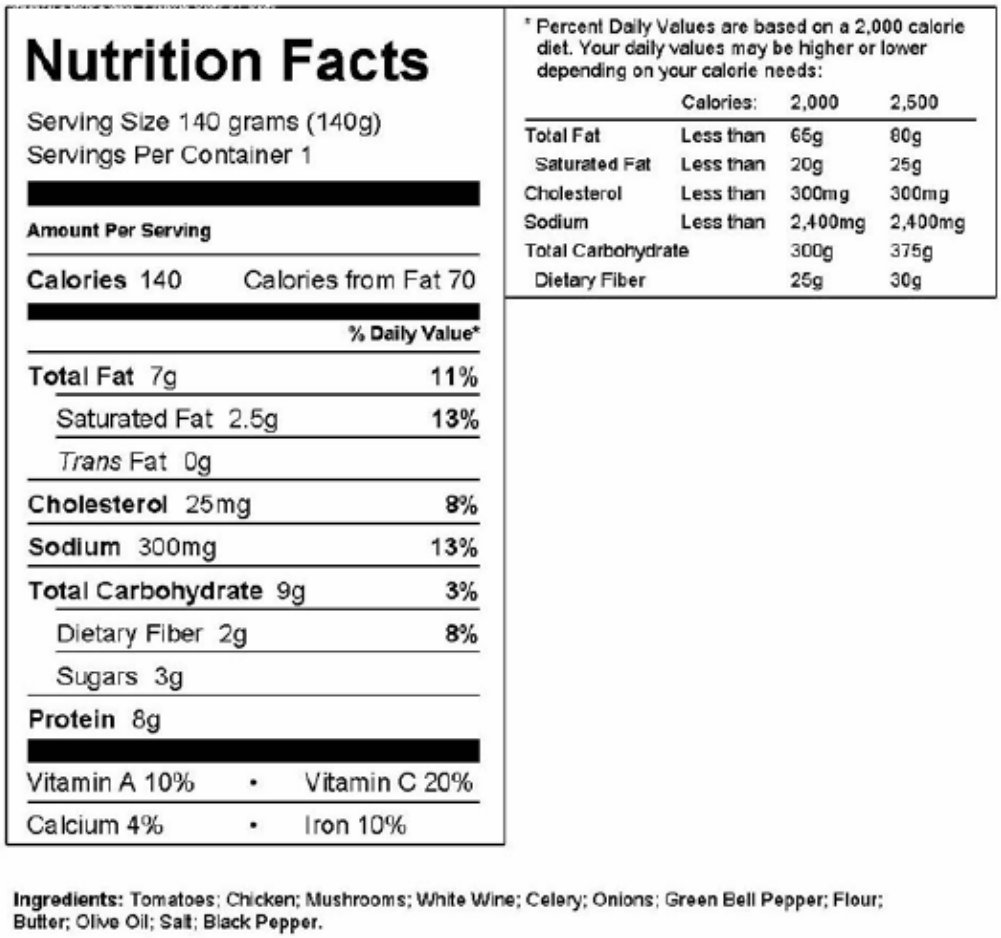
Familiar objects can help a person picture proper portions for meat, poultry, fish and beans. For example, a 3-ounce serving of fish is about the size of a deck of cards. Here are the serving sizes for meat and meat substitutes:

Food	Serving size
Cooked skinless poultry or fish	= 3 ounces
Cooked lean meat	= 1 1/2 ounces
Cooked legumes or dried beans	= 1/2 cup or about the size of an ice cream scoop
Egg	= 1 medium

7. A person is cooking dinner for himself and he wants to include one serving from the meat and beans group. What should he choose? (**1 ½ ounces of cooked lean beef**/1 ½ ounces of cooked fish/3 boiled eggs/1 cup cooked kidney beans/Don't know)

Please watch the video below before proceeding to the next screen.

8. What parts of the body do lunge exercises work? (Arms and shoulders/Back and abdomen/**Legs and buttock**/Don't know)



Nutrition Facts

Serving Size 140 grams (140g)
Servings Per Container 1

Amount Per Serving

Calories 140 Calories from Fat 70

	% Daily Value*
Total Fat 7g	**11%**
Saturated Fat 2.5g	**13%**
Trans Fat 0g	
Cholesterol 25mg	**8%**
Sodium 300mg	**13%**
Total Carbohydrate 9g	**3%**
Dietary Fiber 2g	**8%**
Sugars 3g	
Protein 8g	

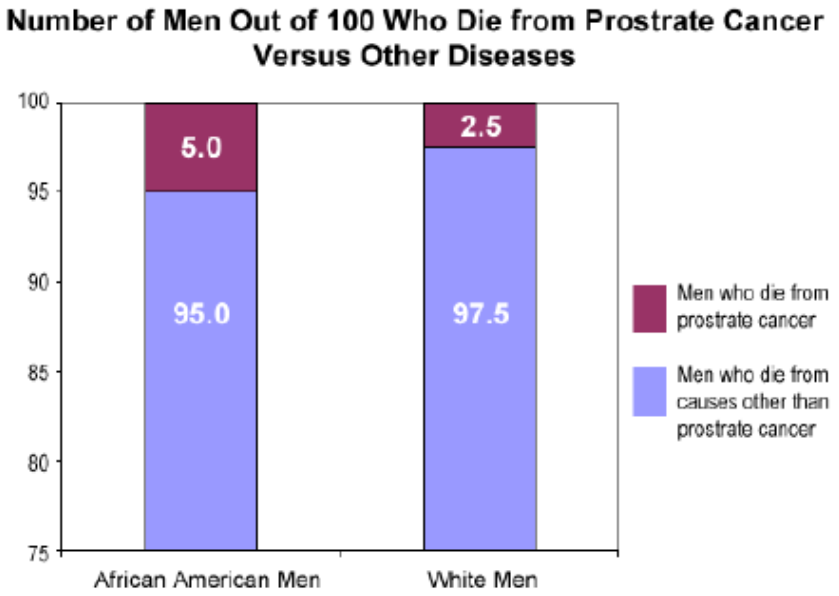
Vitamin A 10% • Vitamin C 20%
Calcium 4% • Iron 10%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Ingredients: Tomatoes; Chicken; Mushrooms; White Wine; Celery; Onions; Green Bell Pepper; Flour; Butter; Olive Oil; Salt; Black Pepper.

9. If a person is on a 2,500 calorie diet, what percent of the daily value of saturated fat would he get from one serving? (**10 percent**/11 percent/12 percent/13 percent/Not sure)



10. More men die from prostate cancer than from other causes. Based on the chart above, would you say this is true, false, or are you not sure? (True/**False**/Not sure)

Swedish Fertility Awareness Questionnaire

This is not a knowledge test – we want to know what you believe.

1. At what age are women the most fertile? (open response) (Ans: 20-24 years)
2. At what age is there a slight decrease in women's ability to become pregnant? (open response) (Ans: 27-28 years)
3. At what age is there a marked decrease in women's ability to become pregnant? (open response) (Ans: 37-38 years)
4. A young woman (<25 years) and a man have unprotected intercourse at the time of ovulation—how large is the chance that she will then become pregnant? (open response) (Ans: 30-35%)
5. A woman and a man who regularly have unprotected intercourse during a period of 1 year: How large is the chance that the woman will become pregnant

   a. If she is 25-30 years old? (open response) (Ans: 78%)
   b. If she is 35-40 years old? (open response) (Ans: 53%)

6. How many couples in Australia are involuntarily childless? (open response) (Ans: 10-19%)
7. Couples that undergo treatment with IVF – what is their chance, on average, of getting a child after one treatment? (open response) (Ans: 25%)
8. What can have a negative impact on men's fertility?

Cardiff Fertility Knowledge Scale

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 DON'T KNOW.

1. A woman is less fertile after the age of 36 years. **TRUE**/FALSE/DON'T KNOW
2. When a couple cannot conceive it is usually due to a fertility problem in the woman. TRUE/**FALSE**/DON'T KNOW
3. A couple would be classified as infertile if they did not achieve a pregnancy after 1 year of regular sexual intercourse (without using contraception). **TRUE**/FALSE/DON'T KNOW
4. Smoking decreases female fertility but not male fertility. TRUE/**FALSE**/DON'T KNOW
5. About 1 in 10 couples are infertile. **TRUE**/FALSE/DON'TKNOW
6. If a man produces sperm he is fertile. TRUE/**FALSE**/DON'T KNOW
7. These days a woman in her 40s has a similar chance of getting pregnant as a woman in her 30s. TRUE/**FALSE**/DON'T KNOW
8. Having a healthy lifestyle makes you fertile. TRUE/**FALSE**/DON'T KNOW

9. If a man has had mumps after puberty he is more likely to later have a fertility problem.

   TRUE/FALSE/DON'T KNOW

10. A woman who never menstruates is still fertile. TRUE/**FALSE**/DON'T KNOW

11. If a woman is overweight by more than 13 kg (28 pounds) then she may not be able to get pregnant. **TRUE**/FALSE/DON'T KNOW

12. If a man can achieve an erection then it is an indication that he is fertile.

    TRUE/**FALSE**/DON'T KNOW

13. People who have had a sexually transmitted disease are likely to have reduced fertility.

    TRUE/FALSE/DON'T KNOW

Appendix F

Pilot and validation study: demographic and reproductive items

Reproductive information

Intention to have children

1. Do you have any children? YES/NO
2. How many children do you want? (open response)
3. At what age would you like to/did you have your first child? (open response)
4. At what age would you like to/did you have, your last child? (open response)

Importance of having children

5. How important is/was it for you to have children? (very important, important, moderately important, slightly important, not important)

Behavioural intention in case of infertility

6. What would you most likely do if you and your partner could not get pregnant? (undergo fertility treatment, foster a child, adopt a child, choose not to have a child)
7. How confident are you that you will have your desired number of children? (very confident, confident, moderately confident, slightly confident, not confident)
8. What have been your primary sources of information on fertility and reproduction? (books, magazines, brochures, newspapers, internet, videos, radio, television programs, public health centres, doctor, family members, friends, other)
9. How would you rate your knowledge of fertility and infertility issues? (not educated at all, somewhat educated, educated, very educated, extremely educated)
10. Have you previously sought a medical consultation and/or treatment for your fertility? (this includes seeking advice from a doctor, undergoing fertility diagnostic testing,

ovulation induction, insemination, surgery and treatment with Assisted Reproductive Technologies)

11. Are you currently trying to conceive? YES/NO
12. Are you currently pregnant? YES/NO

Demographic information

1. What is your age (in years)? (open response)
2. Are you: male/female/gender not listed
3. What country were you born in? (open response)
4. Which of the following best represents your ethnic heritage? (peoples' ethnicity describes their feeling of belonging and attachment to a distinct group of a larger population that shares their ancestry, colour, language or religion) (African, American (including Canadian, Mexican, Brazilian etc), Asian, Australian, European, Indigenous Australian, Maori or Pacific Islander, Middle Eastern, Middle Eastern, Other (please specify)).
5. What is your current relationship status? (Married/de facto/engaged, separated/divorced, in a relationship, single)
6. What is the highest level of education you have completed, or are currently completing? Open response, please answer this question with the type of degree (i.e., Apprenticeship, Bachelor, Honours, Masters), the area of study (i.e., medicine, health science, engineering), and year you are currently in (i.e., 1, 2, 3, completed).
7. Are you currently: employed full-time/employed part-time/unemployed/retired

Appendix G

Permission for use of the SFAQ, CFKS and HLSISF in the current study (NB. all scales are in the public domain excepting the HLSISF, no response received for enquiry to use the GNKQ)

From: Claudia Lampic [Claudia.Lampic@ki.se]

Sent: Monday, 16 April 2018 5:40:35 PM

To: XXXX

Subject: SV: Swedish Fertility Awareness Questionnaire

Dear XXXX

You are very welcome to use our measure in your research. Please find enclosed the English versions of the full questionnaires for women and men.

Best regards, Claudia

From: Jacky Boivin [boivin@cardiff.ac.uk]

Sent: Tuesday, 17 April 2018 9:31 PM

To: XXXX

Subject: Re: Cardiff Fertility Knowledge Scale

Dear XXXX,

Yes XXXX can use the CFKS. The scale is in the appendix to the original paper (Bunting). We have also amended it with two extra items (see Fertility Education VFKS) which was evaluated in the attached in press study (see Boivin Hum Reprod, attached). Please would you cite as indicated, if you use in your work. Your student might want to know that there is a very active group on Adelaide working on fertility education — with this fantastic website: https://yourfertility.org.au

Thanks for your interest, Jacky

From: hlsi@rti.org

Sent: Monday, 16 April 2018 at 20:57 PM

To: XXXX

Subject: RE: Attn: Dr Lauren McCormack, HLSI-SF permission

Dear XXXX,

Thank you kindly for your interest in the Health Literacy Skills Instrument. Dr. McCormack has received your message. We are more than happy to share a copy with you. We are asking all who request the instrument to please complete the attached User Registration form. Pleases return to me via email. Once I have your signed form, I will email you a copy of the instrument (with full 25 items and 10-items indicated) along with a User Guide. Please note that I will be out of the office today. Thank you again for your interest in the HLSI.

Best, Rebecca

Appendix H

Expert evaluation: participant information sheet and consent form

PARTICIPANT INFORMATION SHEET

Project Title: Development and validation of a male-specific and female-specific measure of fertility knowledge
School of Psychology Research Ethics Committee: 18/52
Principal Investigator: XXXX
Student Researcher: XXXX
Student's Degree: Bachelor of Psychology (Honours)

Dear Participant,
You are invited to participate in the research project described below.

What is the project about?
This project aims to develop and validate one male-specific and one female-specific measure of fertility knowledge that may be used in future research and in the assessment of interventions designed to improve such knowledge.

Who is undertaking the project?
This project is being conducted by XXXX, forming the basis of her Honours degree in Psychology, under the supervision of XXXX.

Why am I being invited to participate?
This research will examine existing fertility knowledge measures and use this as a basis for the development of two new measures, designed to measure male and female-specific fertility knowledge. We are seeking infertility health professionals (medical specialists, scientists, nurses or counsellors) who have provided specialist infertility services for a minimum of 1 year, and who are fluent in English.

What am I being invited to do?
If you consent to participate, you will be invited to review the preliminary set of questions for both the male and female-specific fertility measures in an online survey. You will be asked to assess each preliminary question for its (1) medical accuracy, (2) relevance, and (3) clarity. Furthermore, to assess comprehensiveness you will be asked if there are any areas of fertility knowledge you feel have not been addressed in the survey which should be considered for inclusion. If you consent, the researchers may contact you to clarify your responses to particular items in the survey or to ask you to briefly review the measures again if substantial revisions, deletions or additions have been made based on the feedback from the first survey of health professionals.

How much time will my involvement in the project take?
The survey is anticipated to take approximately 40 minutes of your time.

Are there any risks associated with participating in this project?
It is not anticipated that you will experience any emotional distress as a result of participating in this study. However, you do have the option not to answer specific questions. Contact details for

support and helpline numbers are provided at the bottom of this information sheet.

What are the potential benefits of the research project?
This research will help to improve ways to measure fertility knowledge that is specific to both male and female aspects of fertility and is likely to improve the way in which we can accurately quantify fertility knowledge. Although you will not receive any financial compensation for your involvement in the study, your input will provide valuable insights which will help to develop validated measures of fertility knowledge that can be used in future research and in the evaluation of health promotion programs that aim to improve fertility knowledge.

Can I withdraw from the project?
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time until the data analysis phase.

What will happen to my information?
Your responses will be entirely confidential and will not be linked with any identifying information. All data will be stored securely for a period of five years. The resulting fertility knowledge measures form the research for an Honours thesis, the results of which will be written up for publication in a peer-reviewed journal.
Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Who do I contact if I have questions about the project?
Should you wish to ask any further questions about the project, please contact XXXX.

What if I have a complaint or any concerns?
The study has been approved by the School of Psychology Research Ethics Committee at the University of Adelaide (approval number 18/52). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (2007). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Convenor, Human Research Ethics Sub-Committee (School of Psychology) on:

Phone: +61 8 8313 4936
Email: paul.delfabbro@adelaide.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?
Please contact XXXX. You will then receive a link to the consent form and the online survey.

Yours sincerely,
XXXX

Support Resources

- Lifeline (available 24/7, phone: 13 11 14)

- Beyond Blue (available 24/7, phone: 1300 224 636)

CONSENT FORM

1. I have read the attached Information Sheet and agree to take part in the following research project:

Title:	Development and validation of a male and female-specific measure of fertility knowledge.
Ethics Approval	[redacted]

2. I have had the project, so far as it affects me, and the potential risks and burdens fully explained to my satisfaction by the research worker. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.

3. Although I understand the purpose of the research project is to improve the quality of health/medical care, it has also been explained that my involvement may not be of any benefit to me.

4. I agree to participate in the activities as outlined in the participant information sheet.

5. I understand that as my participation is anonymous, I can withdraw any time up until submission of the survey.

6. I have been informed that the information gained in the project may be published in a journal article and/or thesis.

7. I have been informed that in the published materials I will not be identified and my personal results will not be divulged.

8. My information will only be used for the purpose of this research project and it will only be disclosed according to the consent provided, except where disclosure is required by law.

9. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Appendix I

Pilot study: participant information sheet and consent form

PARTICIPANT INFORMATION SHEET

Project Title: Development and validation of a male-specific and female-specific measure of fertility knowledge
School of Psychology Research Ethics Committee: [redacted]
Principal Investigator: XXXX
Student Researcher: XXXX
Student's Degree: Bachelor of Psychology (Honours)

Dear Participant,
You are invited to participate in the research project described below.

What is the project about?
This project aims to develop and validate one male-specific and one female-specific measure of fertility knowledge that may be used in future research and in the assessment of interventions designed to improve such knowledge.

Who is undertaking the project?
This project is being conducted by XXXX, forming the basis of her Honours degree in Psychology, under the supervision of XXXX.

Why am I being invited to participate?
This research will examine existing fertility knowledge measures and use this as a basis for the development of two new measures, designed to measure male and female-specific fertility knowledge. We seeking are people aged 18 to 52 years, who speak English fluently.

What am I being invited to do?
If you consent to participate, you will be invited to complete an evaluation of the questions proposed to be included in the final measures. You will be asked to provide feedback about each question in terms of its clarity and acceptability. Furthermore, you will be asked if there are any areas of fertility you feel have not been addressed in the survey and should be considered for inclusion and if you feel the measures appear to measure fertility knowledge. Additionally, you will be asked some questions regarding your own reproductive intentions and demographics.

How much time will my involvement in the project take?
The questionnaire is anticipated to take approximately 30 minutes of your time.

Are there any risks associated with participating in this project?
It is not anticipated that you will experience any emotional distress as a result of participating in this study. However, you do have the option not to answer specific questions if you feel uncomfortable in doing so. Contact details for support and helpline numbers are provided at the bottom of this information sheet.

What are the potential benefits of the research project?

This research will help to improve ways to measure fertility knowledge that is specific to both male and female aspects of fertility and is likely to improve the way in which we can accurately quantify fertility knowledge. Although you will not receive any financial compensation for your involvement in the study, your input will provide valuable insights which will help to develop validated measures of fertility knowledge that can be used in future research and in the evaluation of health promotion programs that aim to improve fertility knowledge.

Can I withdraw from the project?
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time until the data analysis phase.

What will happen to my information?
Your responses will be entirely confidential and will not be linked with any identifying information. All data will be stored securely for a period of five years. The resulting fertility knowledge measures form the research for an Honours thesis, the results of which will be written up for publication in a peer-reviewed journal. Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Who do I contact if I have questions about the project?
Should you wish to ask any further questions about the project, please contact XXXX.

What if I have a complaint or any concerns?
The study has been approved by the School of Psychology Research Ethics Committee at the University of Adelaide (approval number 18/52). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (2007). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Convenor, Human Research Ethics Sub-Committee (School of Psychology) on:

Phone: +61 8 8313 4936
Email: paul.delfabbro@adelaide.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?
On the following webpages, please complete the consent form. After you have given your consent, you will continue to the questionnaire.

Yours sincerely,
XXXX

Support Resources

- Lifeline (available 24/7, phone: 13 11 14)
- Beyond Blue (available 24/7, phone: 1300 224 636)

CONSENT FORM

1. I have read the attached Information Sheet and agree to take part in the following research project:

Title:	Development and validation of a male and female-specific measure of fertility knowledge.
Ethics Approval	[redacted]

2. I have had the project, so far as it affects me, and the potential risks and burdens fully explained to my satisfaction by the research worker. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.

3. I have been given the opportunity to have a member of my family or a friend present while the project was explained to me.

4. Although I understand the purpose of the research project, it has also been explained that my involvement may not be of any benefit to me.

5. I agree to participate in the activities outlined in the participant information sheet.

6. I understand that as my participation is anonymous, I can withdraw any time up until submission of the survey/completion of the focus group. I understand that I am free to withdraw from the project at any time and that this will not affect my study at the University, now or in the future.

7. I have been informed that the information gained in the project may be published in a journal article and/or thesis.

8. I have been informed that in the published materials I will not be identified and my personal results will not be divulged.

9. My information will only be used for the purpose of this research project and it will only be disclosed according to the consent provided, except where disclosure is required by law.

10. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Appendix J

Validation study: participant information sheet and consent form

PARTICIPANT INFORMATION SHEET

Project Title: Development and validation of a male-specific and female-specific measure of fertility knowledge
School of Psychology Research Ethics Committee: [redacted]
Principal Investigator: XXXX
Student Researcher: XXXX
Student's Degree: Bachelor of Psychology (Honours)

Dear Participant,
You are invited to participate in the research project described below.

What is the project about?
This project aims to develop and validate one male-specific and one female-specific measure of fertility knowledge that may be used in future research and in the assessment of interventions designed to improve such knowledge.

Who is undertaking the project?
This project is being conducted by XXXX, forming the basis of her Honours degree in Psychology, under the supervision of XXXX.

Why am I being invited to participate?
This research will examine existing fertility knowledge measures and use this as a basis for the development of two new measures, designed to measure male and female-specific fertility knowledge. We seeking are people 18 years and older, who speak English fluently and have not previously participated in the preliminary validation of these measures (i.e., those people who have not previously provided expert medical opinion in an initial evaluation survey of the new measures, or those people who have not attended a group pilot session about these measures in 2018).

What am I being invited to do?
If you consent to participate, you will be invited to complete an online survey that comprises of the male-specific and female-specific fertility knowledge measures. In addition, you will be invited to complete several other measures, which are designed to test for validity and reliability.

How much time will my involvement in the project take?
The survey is anticipated to take approximately 45 minutes of your time.

Are there any risks associated with participating in this project?
It is possible that in disclosing some information about your reproductive intentions, you may experience distress. However, you do have the option not to answer specific questions. Contact details for support and helpline numbers are provided at the bottom of this information sheet.

What are the potential benefits of the research project?
This research will help to improve ways to measure fertility knowledge that is specific to both male

and female aspects of fertility and is likely to improve the way in which we can accurately quantify fertility knowledge. Although you will not receive any financial compensation for your involvement in the study, your input will provide valuable insights which will help to develop validated measures of fertility knowledge that can be used in future research and in the evaluation of health promotion programs that aim to improve fertility knowledge.

Can I withdraw from the project?

Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time until the data analysis phase.

What will happen to my information?
Your responses will be entirely confidential and will not be linked with any identifying information. All data will be stored securely for a period of five years. The resulting fertility knowledge measures form the research for an Honours thesis, the results of which will be written up for publication in a peer-reviewed journal.

Your non-identifiable responses to one of the measures in the survey, a measure of health literacy, will be provided to the original author of the measure for use in its further validation.

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Who do I contact if I have questions about the project?
Should you wish to ask any further questions about the project, please contact XXXX.

What if I have a complaint or any concerns?

The study has been approved by the School of Psychology Research Ethics Committee at the University of Adelaide (approval number 18/52). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (2007). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Convenor, Human Research Ethics Sub-Committee (School of Psychology) on:

Phone: +61 8 8313 4936

Email: paul.delfabbro@adelaide.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?
Please continue to the following page, where you will be directed to a consent form. After you have given your consent, you will be directed through to the online survey.

Yours sincerely,
XXXX

Support Resources

- Lifeline (available 24/7, phone: 13 11 14)
- Beyond Blue (available 24/7, phone: 1300 224 636)

CONSENT FORM

1. I have read the Participant Information and agree to take part in the following research project:

Title:	Development and validation of a male and female-specific measure of fertility knowledge.
Ethics Approval Number:	[redacted]

2. I have had the project, so far as it affects me, and the potential risks and burdens fully explained to my satisfaction by the research worker. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.

3. I have been given the opportunity to have a member of my family or a friend present while the project was explained to me.

4. Although I understand the purpose of the research project, it has also been explained that my involvement may not be of any benefit to me.

5. I agree to participate in the activities outlined in the participant information sheet.

6. I understand that as my participation is anonymous, I can withdraw any time up until submission of the survey/completion of the survey. I understand that I am free to withdraw from the project at any time and that this will not affect my study at the University, now or in the future.

7. I have been informed that the information gained in the project may be published in a journal article and/or thesis.

8. I have been informed that in the published materials I will not be identified and my personal results will not be divulged.

9. I agree to my non-identifiable information (responses to one of the measures included in this survey, Health Literacy) being shared to the original author of the measure for use in its further validation.

   Yes ☐ No ☐

10. My information will only be used for the purpose of this research project and it will only be disclosed according to the consent provided, except where disclosure is required by law.

11. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Appendix K

Submission of online advertisement to the Australian Psychological Society for website promotion

Background to research: involuntary childlessness and infertility remain global public health issues, with affected couples experiencing a cyclical pattern of complicated grief and loss, and feelings of depression, anxiety and disempowerment. However, previous research reveals poor understanding of the age-related fertility decline and risk factors for infertility, resulting in preventable, or at least, modifiable, fertility issues. To date, the measures that are most widely used in the literature to measure people's knowledge about fertility have not been adequately tested for validity and reliability. Furthermore, they fail to measure a broad range of knowledge related to both male and female fertility.

Research focus: to develop two psychometrically sound measures that will allow researchers to design and evaluate the efficacy of targeted educational interventions that aim to minimise the risk of involuntary childlessness due to modifiable factors in male and female populations most likely to delay childbearing.

How can I participate? Males and females aged 18-51 years inclusive are eligible to participate in this survey, anticipated to take approximately 40 minutes. There is no requirement regarding your level of understanding about fertility or infertility treatments.

Appendix L

Table L1

Skewness and kurtosis of the 31-item Male and Female Fertility Knowledge Inventories and transformation

	Pre-transformation			Post-transformation[b]		
	Skewness	Kurtosis	Shapiro-Wilk[a]	Skewness	Kurtosis	Shapiro-Wilk[a]
MFKI	-0.884	0.663	.949 (.000)	0.254	.026	.988 (.064)
FFKI	-1.033	1.419	.936 (.000)	0.351	0.027	.986 (.022)

Notes. [a] = Statistic (significance); [b] = Reflect and square root transformation performed.

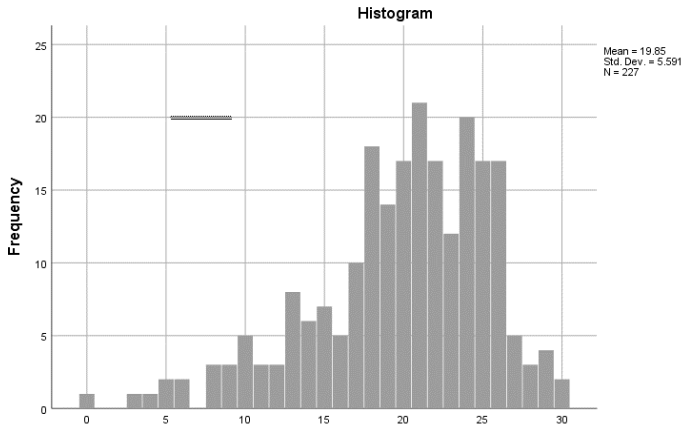


Figure L1. Histogram of 31-item Male Fertility Knowledge Inventory, data not transformed.

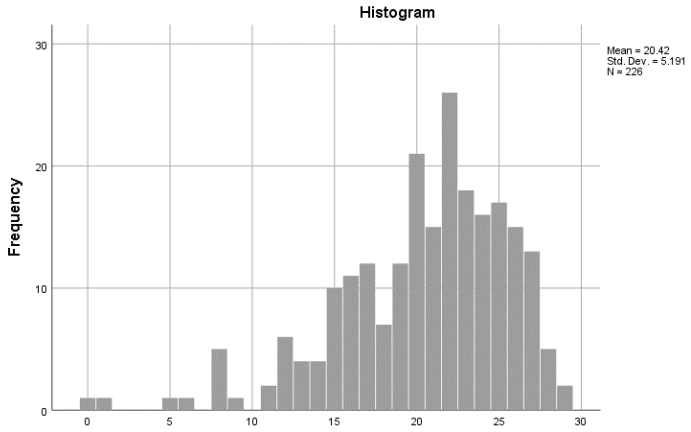


Figure L2. Histogram of 31-item Female Fertility Knowledge Inventory, data not transformed.

Appendix M

Final versions of the Male and Female Fertility Knowledge Inventories, answers in bold type

Below are some statements concerning fertility. Please indicate whether you believe they are "true" or "false" by ticking the appropriate box. If you do not know the answer, please tick "I don't know".

Table M1

Male Fertility Knowledge Inventory

1. An occlusion (blockage) in the male reproductive system can affect a man's fertility.	**True**	False	I don't know
2. Men do not experience a natural decline in their fertility.	True	**False**	I don't know
3. Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a man's fertility.	**True**	False	I don't know
4. If a man already has one biological child, he will not have trouble conceiving again.	True	**False**	I don't know
5. Use of anabolic steroids once a week can negatively affect a man's fertility (steroids contain Testosterone and are performance enhancing drugs used to increase muscular strength and body weight).	**True**	False	I don't know
6. A man's weight/BMI (Body Mass Index) can affect his fertility.	**True**	False	I don't know
7. A man's diet does not affect his fertility.	True	**False**	I don't know
8. Chronic consumption of alcohol can affect sperm quality.	**True**	False	I don't know
9. Smoking cigarettes can affect a man's fertility.	**True**	False	I don't know
10. Men continue to produce and mature new sperm every 72 days.	**True**	False	I don't know
11. Intense, sustained exercise can improve a man's sperm quality (i.e., 4-5 times a week for 2 hours).	True	**False**	I don't know
12. Men who have had mumps before puberty may experience fertility problems if left untreated.	**True**	False	I don't know
13. Some lubricants negatively affect sperm.	**True**	False	I don't know
14. Chromosomal changes can affect the production and transportation of sperm.	**True**	False	I don't know

Table M2

Female Fertility Knowledge Inventory

1. Sexually transmitted infections, including chlamydia, gonorrhoea and HPV (Human Papillomavirus), can affect a woman's fertility.	**True**	False	I don't know
2. A history of endometriosis can affect a woman's fertility.	**True**	False	I don't know
3. A woman's weight/BMI (Body Mass Index) can affect her fertility.	**True**	False	I don't know
4. A woman's diet does not affect her fertility.	True	**False**	I don't know
5. Toxins in the environment (i.e., chemicals, pesticides, heavy metals) can affect a woman's fertility.	**True**	False	I don't know
6. Smoking cigarettes can affect a woman's fertility.	**True**	False	I don't know
7. Moderate, sustained exercise can improve a woman's fertility (i.e., up to 4 hours of brisk walking a week).	**True**	False	I don't know
8. The risk of miscarriage for fit and healthy women is the same, whether they are in their 30s or their 40s.	True	**False**	I don't know
9. A woman in her 40s is equally as likely to become pregnant through IVF as a woman in her 30s (In Vitro Fertilisation[a]).	True	**False**	I don't know
10. More than half of women and their partners conceive on the first round of IVF (In Vitro Fertilisation[a]).	True	**False**	I don't know
11. Women continue to produce new eggs until they reach menopause.	True	**False**	I don't know
12. The primary role of a fertility specialist is to provide IVF (In Vitro Fertilisation[a]) to a woman.	True	**False**	I don't know
13. A woman who has a regular menstrual cycle is fertile.	True	**False**	I don't know
14. Taking vitamin supplements can increase a woman's ovarian reserve (the number of eggs available to her, and the number of fertile years she has remaining).	True	**False**	I don't know
15. Freezing her eggs guarantees a woman will be able to become pregnant in the future.	True	**False**	I don't know

Notes. [a] IVF = In Vitro Fertilisation: a medical procedure where fertilisation of the sperm and egg occurs in a laboratory to create an embryo that is transferred to a woman's uterus a few days later.