**Doctorate in Clinical Psychology**

# The EXPECTING Study: **EXP**loring patt**E**rns of **C**ommon **T**hink**ING** styles in pregnancy

Erin M Beal

Supervised by:
Dr Charlotte Krahé and Professor Pauline Slade

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## Introductory Chapter: Overview of Thesis

This thesis explores factors associated with anxiety during pregnancy and Fear of Childbirth (FOC). General anxiety during pregnancy is common with more than 20% of women reporting clinical levels of anxiety during the perinatal period (Furtado et al., 2018). Anxiety can present as a range of symptoms, such as having to take a greater number of sick days from employment, multiple visits to the hospital and abdominal pain (Saisto & Halmesmäki, 2003). Not only are high levels of anxiety during pregnancy distressing for the expectant mother, but it can also increase the risk of negative outcomes, which include preterm birth (Furtado et al., 2018) and post-natal depression (Osborne et al., 2021). There have been three dimensions identified when assessing prenatal anxiety. These include the pregnancy, the birth and the potential for hospitalisation (Saisto & Halmesmäki, 2003).

Tokophobia, or FOC is a severe fear of giving birth but does not currently have diagnostic criteria listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (American Psychiatric Association, 2013) or the International Classification of Diseases (ICD-10) (World Health Organization, 1992). Therefore, it falls under the section in both the DSM-V and the ICD-10 for specific phobias, which the DSM-V defines as 'marked fear or anxiety about a specific object or situation' (American Psychiatric Association, 2013). FOC is a common experience for women globally and the overall pooled prevalence from 18 countries including both nulliparous and multiparous women was found to be 14% (O'Connell et al., 2017). When parity was considered, the prevalence for nulliparous women was 16% and multiparous women was 12% (O'Connell et al., 2017). Prevalence rates are increasing over time with rates in the 1980's increasing from 6% to 17% in 2016 (O'Connell et al., 2017).

This thesis is formed of two separate, but related papers. The first is a systematic review of anxiety during pregnancy after assisted reproductive treatments and compares this

to a group who conceived spontaneously (Chapter 1). This is then followed by an empirical paper that examines the relationships between three cognitive biases (attention, interpretation, and memory), general anxiety, low mood, worry, rumination and FOC (Chapter 2). This thesis has important clinical implications for women and birthing people presenting to perinatal clinics.

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# Chapter One: Systematic Review

## TITLE: A systematic review of anxiety during pregnancy following assisted reproductive treatments versus spontaneous conception

## Abstract

This systematic review sought to investigate whether there is evidence for differences in levels of anxiety during pregnancy between women who had conceived via assisted reproductive treatments (ART) and women who had conceived spontaneously. This review followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines and was pre-registered on PROSPERO (CRD42022297373). Quantitative studies that had used a standardised scale to measure anxiety during pregnancy in a population of any age group that had conceived via any kind of ART, on or after the year 2000 written in English were included. Studies that did not have a comparison group of spontaneously conceiving women, or collected data prior to conception or postpartum only were excluded. A comprehensive review of the literature was completed in three electronic databases (EMBASE, Medline and PsychInfo) which identified 11 studies that met the inclusion criteria and were included in the review. Most of the studies included used a measure of general anxiety during pregnancy and four studies included a measure of pregnancy-related anxiety. Gestation was also considered when viewing the results. Contrary to popular belief there is no substantive evidence that general, or pregnancy specific anxiety levels differ between women who conceived via ART and those who spontaneously conceived.

## Introduction

Globally, 186 million individuals and 15% of reproductive-aged couples are affected by infertility (World Health Organisation, n.d.). In the last three decades, nearly 600,000 people have received 1.3 million cycles of invitro fertilization (IVF) and 260,000 cycles of donor insemination in the UK (Human Fertilisation & Embryology Authority UK, 2021). A systematic review assessing studies between 2004-2013 worldwide reported over 7 million assisted reproductive treatments (ART) cycles and nearly 1.5 million live births after ART (Kushnir et al., 2017). One in six couples in the UK are impacted by infertility and since 1991 there have been nearly 400,000 babies born as a result of IVF or donor insemination. This number will most likely continue to rise as there has been a tenfold increase in women[1] freezing their eggs in the past decade in the UK alone (Human Fertilisation & Embryology Authority UK, 2021). The four types of ART listed by the National Institute for Health and Care Excellence (NICE) for the UK are: intrauterine insemination, IVF, IVF with intracytoplasmic sperm injection and the use of donor sperm or eggs (National Institute for Health and Care Excellence (NICE), 2013). These types of ART are regulated by law and they are controlled by the Human Fertilisation and Embryology Authority (HFEA, 2022). ART can cause psychological distress for women who use them to conceive (Thorn, 2009). This systematic review will assess anxiety during pregnancy after successful conception using ART and compare this to women who spontaneously conceive as this has not been reviewed to date.

Individuals and couples who require ART can experience high levels of psychological distress and uncertainty. When one or both members of a couple discovers they are struggling with their fertility, it can cause poor mental health and stigma (Vioreanu, 2021). If they

[1] The papers referenced all use the term ‘woman’ as opposed to the more inclusive ‘birthing people’; therefore, to best represent the previous literature the term ‘woman’ will be used throughout.

choose ART, they may face devastating disappointment if the treatments fail (Holter et al., 2021), which can also manifest as gestational grief and bereavement (de Castro et al., 2021). It can also induce financial stress, as one cycle can cost upwards of £5000 in the UK (NHS, n.d.) and the World Health Organisation highlights that treatment of infertility is not often prioritised in national policies globally (World Health Organisation, n.d.). Data indicates that women under 40 years of age have a 50% chance of conceiving after six cycles of IVF (National Institute for Health and Care Excellence (NICE), 2013). This can create huge economic burdens for those wishing to conceive via ART. The NICE guidelines recommend that 'counselling should be offered before, during and after investigation and treatment' (National Institute for Health and Care Excellence (NICE), 2013).

Not only are poor mental health outcomes distressing for the individuals accessing ARTs and their partners, but there are queries around its impact on the outcome of the treatment. There is a large body of research into this area, with conflicting findings. Some studies suggest that higher rates of infertility-related stress lead to lower IVF success rates (Aimagambetova et al., 2020; Eugster et al., 2004). However, in opposition to this, other studies have found that psychological distress does not impact the outcome of ART (Boivin et al., 2011; Nicoloro-SantaBarbara et al., 2018). Nevertheless, a large umbrella review found that couples who reported better mental health or those that had access to and engaged with psychological support services were more likely to have positive adjustment to ART (Paraskevi et al., 2021). Therefore, there is a need to further understand the prevalence of anxiety during pregnancy that women may experience that may continue from the stressful experiencing of conceiving via ARTs.

Qualitative studies assessing anxiety during pregnancy after ART highlight that anxiety can persist in the form of uncertainty and specific fears of miscarriage and carrying the pregnancy to term without complications (Maehara, et al., 2021). Additionally, women

reported fears regarding their ability to give birth due to their history of infertility and core beliefs that there was something 'wrong' with their ability to have a child (Dornelles, et al., 2014). In some cases, these fears have led to avoidance behaviours where couples report that they do not engage in mental or physical planning regarding their birth or for when the baby arrives as they are fearful that they will miscarry and be faced with further disappointment (French, et al., 2015).

It is widely known that poor mental health in women in the perinatal period can have negative outcomes for the mother and infant. A longer duration of infertility (Poikkeus et al., 2006) and a history of miscarriage can increase the risks for fear of childbirth (Smorti et al., 2021), which is a phobic-like response to the process of giving birth. Women higher in perinatal anxiety are also at higher risk of preterm delivery, a more difficult labour and pre-eclampsia (Furtado et al., 2018; Krishnamurti et al., 2019; Staneva et al., 2015). Additionally, high levels of worry during pregnancy have been found to significantly predict postpartum depression symptoms (Osborne et al., 2021). Not only are higher levels of stress and anxiety potentially detrimental for the mother, but also for her infant. There are implications for the baby's development cognitively and emotionally when the mother experiences high levels of anxiety (Capron et al., 2015; Kingston et al., 2015). Furthermore, women who have anxiety disorders during pregnancy are more likely to have infants who excessively cry (Petzoldt et al., 2014), are more irritable and restless (van den Heuvel et al., 2015), and have more health complaints and antibiotic use in the first year of their life (Beijers et al., 2010). Therefore, poor mental health in pregnancy and in particular, anxiety, has adverse effects on the woman and infant. Women receiving ART therefore could be considered an at-risk group for higher levels of anxiety, due to the aforementioned stress and uncertainty they face during their pregnancy in comparison to women who spontaneously conceive.

In sum, women who experience infertility and become pregnant through ART may be at risk for poor mental health throughout the perinatal period. Furthermore, the content of anxious thoughts may change depending on the perinatal stage, for example when specific tests are completed or when the women is approaching her due date. Assessing anxiety during pregnancy in an ART population is the first step in understanding how to support women during this long-anticipated time, especially considering that women who spontaneously conceived also report their experience to be anxiety provoking and stressful (Furtado et al., 2018; Huizink et al., 2004). Therefore, ART may add another level of stress and anxiety to the pregnancy experience.

### Objective

The aim of this study was to systematically review the current quantitative literature assessing women's levels of state and pregnancy-related anxiety during pregnancy after ART with a specific objective of assessing whether there are differences in rates of anxiety, reported using standardised scales, between women who conceived through ARTs and women who conceived spontaneously.

## Method

### Design

The review systematically examined available literature assessing levels of state anxiety and pregnancy-related anxiety in women who had received ART in comparison to women who spontaneously conceived. The method of study was based on the recommendations of the Cochrane guidelines (Higgins et al., 2022).

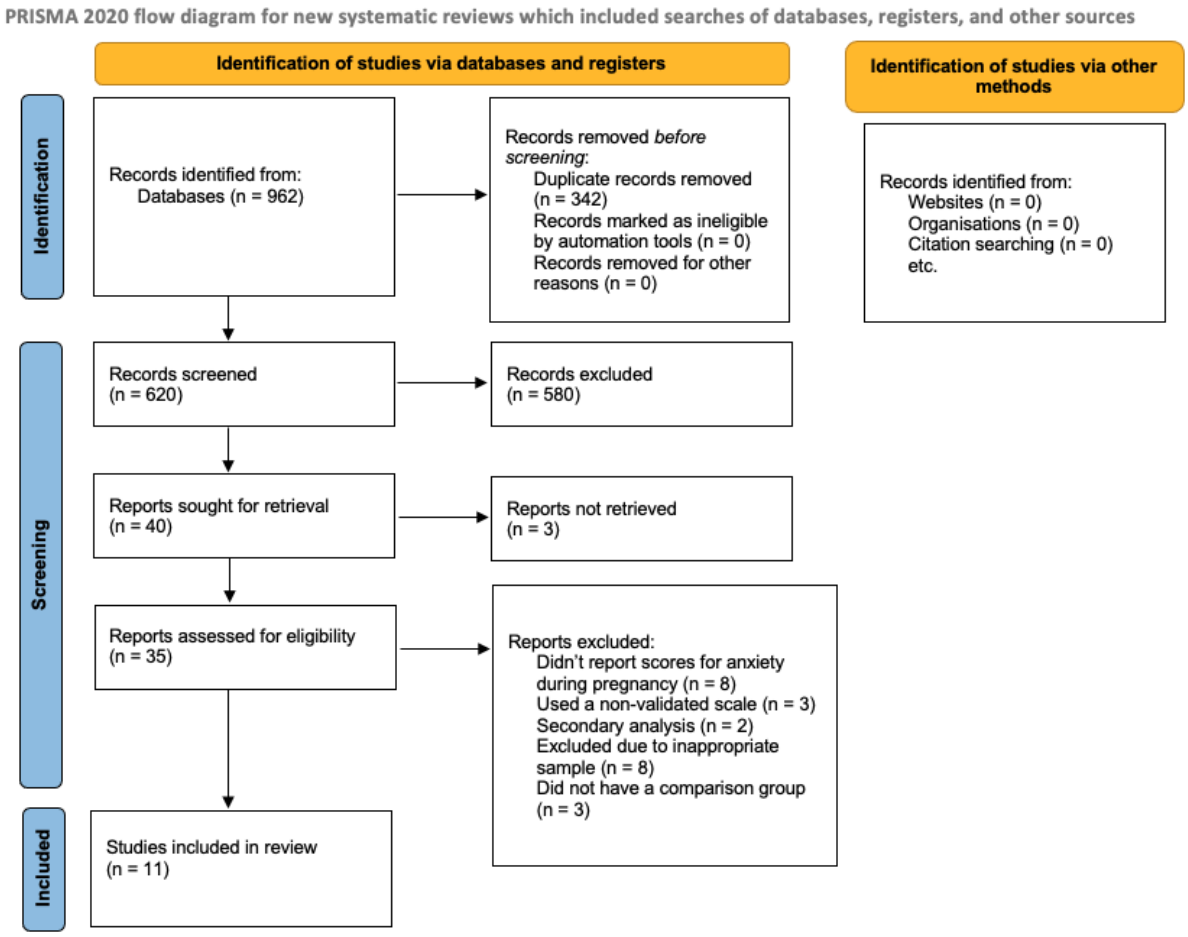
### Study Search

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). A protocol was also registered in PROSPERO (CRD42022297373). One reviewer completed the searches. A

systematic search of the literature was completed in three databases to search for relevant studies: EMBASE, Medline and PsychInfo. Key words were prepared in accordance with PICOS (patient, intervention, comparison, outcome, study type) criteria. Key word combinations and specific search terms were: “pregnan*” AND “fear*” OR “phobi*” or “anxiety*” OR “anxious*” OR “worry” AND “reproducti*” OR “fertility” OR “infertile*” OR “conception” OR “assist* OR “challeng*” OR “treat*” OR intervent*”. Search terms included both free text and Medical Subject Headings (MeSH) terms. Other methods of searching such as citation chaining of retrieved articles to identify additional papers were used. No grey literature was searched or included. Out of 962 studies identified in the searchers, 11 were retained for inclusion in the review (see Figure 1 for PRISMA flow diagram). Only full manuscripts were included.

**Figure 1**

*PRISMA Diagram*




## Study Selection

Research eligible for inclusion was required to meet the following criteria: i) sample population has gone through a procedure for assisted conception, ii) assessed anxiety (pregnancy-related anxiety or state anxiety) during pregnancy iii) used a validated scale to measure anxiety, iv) received any type of assisted conception (intrauterine insemination, IVF, intracytoplasmic sperm injection, donated sperm, donated eggs, or embryos), v) any age groups, vi) any geographical location, vii) papers published on or after 2000 (this was to ensure that due to the developments of ARTs since its conception in 1978 the research reviewed was based on relevant, contemporary information), ix) written in English, x) in a peer reviewed journal, xi) had a comparison group of women that spontaneously conceived. The following research was excluded from the review: i) assessed anxiety or pregnancy

related anxiety prior to conception or postpartum only, ii) assessed anxiety after unsuccessful assisted conception, iii) assessed anxiety of surrogates, or individuals using a surrogate to have a baby, iv) not written in English, v) not in a peer reviewed journal, vi) qualitative studies, review studies or secondary data analysis, vii) did not have a comparison group of women who spontaneously conceived.

Search results from the databases were exported and stored in Rayyan (Mourad et al., 2016) to be sorted. Any duplicates found were removed electronically and manually. Titles and abstracts were then examined to exclude irrelevant articles. Full text copies that met the inclusion criteria were then assessed against the eligibility criteria. The quality assessment and extraction of the data was completed by a single reviewer, using the criteria outlined. Using the AXIS tool, studies that met the inclusion criteria were then evaluated for methodological quality (Downes et al., 2016). This appraisal tool has been created for cross-sectional studies and has 20 items. It was felt that the items on this tool were also relevant for assessing the quality of the longitudinal studies found and therefore this appraisal tool was used for all studies in this review. The items measure various aspects of the quality of the study including sample size justification, the validity of the measures used, reporting of non-response bias and descriptions of funding sources and conflicts of interest (see Table 2). This tool allows for the assessment of individual characteristics of a study cumulatively. This was completed for all articles included by one researcher and a second reviewer assessed 20% of the articles retained for inclusion for rates of concordance.

## Results

All studies included in the review used the terms ‘women’ and ‘mothers’ as opposed to ‘birthing people’ and therefore these terms will be used in the results section.

*Methodological characteristics of included studies.* Study characteristics for the 11 included studies are summarised in Table 1. Using the AXIS tool (Downes et al., 2016) (see

Appendix B for AXIS tool) to critically appraise the quality of the studies, overall, they met the majority of the criteria (13 to 20 out of 20 items, mean = 16). The most common methodological weakness across the majority of the studies was the lack of inclusion of information (measurements, categorisation) about non-responders. Only four studies (Gourounti et al., 2013; Hjelmstedt, Widström, Wramsby, & Matthiesen, 2003; McMahon et al., 2011; Joelsson et al., 2017) included information on non-responders and no study used baseline normative population data to provide information on how representative their sample was. Additionally, only four studies (Darwiche et al., 2019; Gourounti et al., 2013; McMahon et al., 2011; Ranjbar et al., 2020) included a justification for their sample size.

**Table 1**

*Summary of Studies*

| Author, Year | Country | Study design/ assessment points | Sample size, ART group / comparison group | Inclusion criteria | Standardised assessment instruments to measure anxiety | Main Results |
|---|---|---|---|---|---|---|
| Cox et al., (2006) | UK | Longitudinal study / 18- and 28-weeks' gestation | ART: 70 / CG: 111 | ART: Resident of the UK, in a stable relationship, nulliparous, have reached 18th week for pregnancy, CG: (in addition to ART criteria) over the age of 24, have conceived without any form of medical or surgical treatment | Hospital Anxiety and Depression Scale – Anxiety subscale with 7 items | There were no significant differences between the ART group and the CG group in terms of anxiety during pregnancy. Anxiety at all time points was low and indicative of non-caseness |
| Darwiche et al., (2019) | Switzerland | Longitudinal Study / 10-12 weeks (T1), 14 weeks (T2) and 22 weeks (T3) gestation | ART: 53 / CG: 52 | Not explicitly stated | Spielberg State Anxiety Inventory 20 items | ART women were more anxious than the CG women at T1, however this difference was not seen at T2 and T3. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Furmli et al., (2019) | Canada | Longitudinal study / 12 – 16 weeks (T1) and 24 – 28 weeks' gestation (T2) | ART: 125 / CG: 1051 | Inclusion: less than 17 weeks' gestation, aged 18+, English speaking, able to provide consent, foetus was not known to have a major anomaly | Two item generalised anxiety disorder scale (T1 and 2) Six item state anxiety inventory (at T2) | At T1 ART women had lower anxiety scores. At T2 there were no significant differences between the ART and CG groups on any of the scales measuring anxiety. ART women experienced fewer symptoms of anxiety at T2. |
| Gourounti et al., (2013) | Greece | Cross sectional study / 11-26 weeks of gestation | ART: 19 / CG: 144 | Ability to read and write in Greek and not underage | Spielberg State Anxiety Inventory – 20 items, Cambridge Worry Scale (CWS) | Women who conceived after an IVF treatment had higher levels of state anxiety and pregnancy worries than the CG |
| Harf-Kashdaei, et al., (2007) | Israel | Cross sectional study / ART average 31 weeks' gestation, CG average 30 weeks' gestation | ART: 30 / CG: 30 | Nulliparous, singleton pregnancy, second or third trimester, Hebrew or English speaker, no known chronic mental health disorders, or physical illnesses | Spielberg State Anxiety Inventory | There were no differences between groups state anxiety. 10% of the women in the comparison group scored higher than the clinical anxiety cut off score, whereas none of the ART women scored within clinical range. |
| Hjelmstedt et al. (2003) | Sweden | Cross sectional / 11 – 17 weeks' gestation | ART: 57 / CG: 43 | 29-36 years old, primiparous, good health, pregnant with singleton, non-smoker, and adequate Swedish language | Spielberg State Anxiety Inventory | There were no significant differences between the women in the two groups on the Spielberger State Anxiety Scale. |
| Joelsson et al., (2017) | Sweden | Cross sectional study / not provided | ART: 143 / CG: 2972 | Not provided | Hospital Anxiety and Depression | There were no statistically significant differences found between the ART group and CG. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | Scale – Anxiety subscale | |
| McMahon et al., (2013) | Australia | Longitudinal study / during the third trimester of pregnancy | ART: 250 / CG: 262 | Nulliparous, able to speak English sufficiently well to complete study materials. | Spielberger State Anxiety Inventory (20 items), Anxiety Concerning Health and Defects in the Child scale from the Baby Schema Questionnaire | State anxiety means scores in the ART group were lower than the CG in the third trimester. Pregnancy focused anxiety had a higher mean score in the ART group than the CG. |
| McMahon et al., (2011) | Australia | Cross sectional study / third trimester of pregnancy | ART: 297 / CG: 295 | Women with inadequate English to complete the study measures were considered ineligible. | Spielberger State Anxiety Inventory (20 items), Anxiety concerning Health and Defects in the Child scale from the Baby Schema Questionnaire | ART women had lower state anxiety scores than the CG. There was a significant difference in scores on the pregnancy related anxiety measure with ART women having higher scores. |
| Poikkeus et al., (2006) | Finland | Longitudinal study / Average 20 weeks' gestation (SD = 3.2) | ART: 367 / CG: 379 | Finnish-speaking women, singleton pregnancy after either fresh or frozen IVF or intracytoplasmic sperm injection with their own gametes | Pregnancy Anxiety Scale | There were no statistically significant differences found between the ART group and CG. The nulliparous women in the control group showed the highest pregnancy related anxiety scores. |
| Ranjbar et al., (2021) | Iran | Longitudinal study / first (T1) | ART: 43 CG: 144 | Marrie, Iranian nationality, 18-45 | Pregnancy related anxiety | There were no statistically significant differences found between the ART group |

| | | | | |
|---|---|---|---|---|
| | and third trimester (T2) | years. Infertile women who became pregnant through ART, no pregnancy complications or mental health disorders. | questionnaire (17 items) | and CG. Both groups' scores reduced from T1 to T2. |

**CG comparison group, ART Assisted Reproductive treatment*

**Table 2**

*Risk of Bias Using the AXIS Tool*

| | Cox et al., (2006) | Darwiche et al., (2019) | Furmli et al., (2019) | Gourounti et al., (2013) | Harf-Kashdaei et al., (2007) | Hjelmstedt et al., (2003) | Joelsson et al., (2017) | McMahon et al., (2013) | McMahon et al., (2011) | Poikkeus et al., (2006) | Ranjbar et al., (2021) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Were the aims/objectives of the study clear? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Methods | | | | | | | | | | | |
| Was the study design appropriate for the stated aims? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Was the sample size justified? | No | Yes | No | Yes | No | No | No | No | Yes | No | Yes |
| Was the target/reference population clearly defined? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation? | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | Don't know |
| Was the selection process likely to select subjects/participants that were representative of the target reference population under investigation? | No | No | No | Yes | No | Yes | Yes | Yes | Yes | Yes | Don't know |
| were measures undertaken to address and categorise non-responders? | No | No | No | Yes | No | Yes | Yes | No | Yes | No | No |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Were the risk factor and outcome variables measured appropriate to the aims of the study? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted, or published previously? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Is it clear what was used to determine statistical significance and/or precision estimates? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| were the methods (including statistical methods) sufficiently described to enable them to be repeated? | Yes | Yes | No | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes |
| Results | | | | | | | | | | | |
| Were the basic data adequately described? | Yes | Yes | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Does the response rate raise concerns about non-responders described? | No | No | Don't know | Yes | Don't know | Yes | No | Don't know | Yes | Don't know | Don't know |
| If appropriate, was information about non-responders described? | No | No | No | Yes | No | No | No | No | Yes | No | No |
| Were the results internally consistent? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Were the results presented for all the analyses described in the methods? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Discussion | | | | | | | | | | | |
| Were the authors discussions and conclusions justified by the results? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Were the limitations of the study discussed? | No | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Other | | | | | | | | | | | |
| Were there any funding sources or conflicts of interest that may affect the authors interpretation of the results? | Don't know | No | No | No | Don’t know | No | No | No | No | No | No |
| Was ethical approval or consent of participants attained? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

**Table 3**

*Effect Sizes*

| Author/Year | M | SD | Effect Size | |
|---|---|---|---|---|
| Cox et al., (2006) | T1 = ART:6.4, SC: 6.3, T2 5.7, SC: 6.3 | T1 = ART: 3.9, SC: 3.3, T2: ART: 3.2, SC: 3.2 | T1 = 0.03, T2 = could not be computed | Trivial effect |
| Darwiche et al., (2019) | T1 = ART: 39.16, SC: 35.45, T2 = 35.10, SC: 34.76, T3 = ART: 33.21, SC: 33.94 | T1 = ART: 11.09, SC: 9.36, T2 = ART: 9.88, SC: 11.12, T3 = 9.35, SC: 9.14 | T1 = 0.4, T2 = 0.03, T3 = could not be computed | T1 = moderate effect, T2 – trivial effect |
| Furmli et al., (2019) | | | Could not be computed | |
| Gourounti et al., (2013) | | | Could not be computed | |
| Harf-Kashdaei, et al., (2007) | | | Could not be computed | |
| Hjelmstedt et al. (2003) | ART: 32.3, SC: 30.2 | ART:7.3, SC: 6 | 0.35 | Moderate effect |
| Joelsson et al., (2017) | | | Could not be computed | |
| McMahon et al., (2013) | | | Could not be computed | |
| McMahon et al., (2011) | ART: 19.3, SC: 17.9 | ART: 6.3, SC: 6.1 | 0.23 | Small effect |
| Poikkeus et al., (2006) | | | Could not be computed | |
| Ranjbar et al., (2021) | T1 = ART: 51.9, SC: 51.36, T2 = ART: 33.67, SC: 32.52 | T1 = ART: 18.2, SC: 9.59, T2 = ART: 11.68, SC: 13.36 | T1 = 0.06, T2 = 0.09 | T1 and T2 trivial effect |

*Effect size.* Six of the 11 studies did not provide enough data to compute the effect sizes, therefore the magnitude of difference between the groups could not be computed. Ten of the 11 studies reported no statistical difference between the groups. The one study that did find a significant difference between the group ART and the SC group (Gourounti, et al., 2013) did not report means and standard deviations and therefore the effect size of this difference could not be calculated. Additionally, the sample sizes in this study were very different with only $n = 19$ in the ART group in comparison to $n = 144$ in the SC group. For the five studies where the effect size could be computed, the majority had trivial or small effects sizes (Ranjbar et al., 2021; McMahon et al., 2011; Cox et al., 2006). Additionally, one of the studies that did find a moderate effect size for their non-significant results, Hjelmstedt et al., (2003) had small sample sizes for both their ART and SC group. They also do not report if they completed a power calculation prior to data collection, therefore this study may have been underpowered. The final study that did find a moderate effect size was Darwiche et al., (2019), but only at time point one in their longitudinal design, did report a-priori power calculation and their samples were not underpowered.

*Study location.* Two of the studies took place in Australia (McMahon et al., 2011, 2013), two in Sweden (Hjelmstedt et al., 2003; Joelsson et al., 2017), one in the UK (Cox et al., 2006), one in Switzerland (Darwiche et al., 2019), one in Finland (Poikkeus et al., 2006), one in Canada (Furmli et al., 2019), one in Greece (Gourounti et al., 2013), one in Iran (Ranjbar et al., 2020), and one in Israel (Harf-Kashdaei & Kaitz, 2007). The studies were completed in a wide range of countries that have differing health care systems. However, they are all mainly high-income countries, which is reflective of the availability of ART.

*Study design.* Six studies were longitudinal studies (Cox et al., 2006; Darwiche et al., 2019; Furmli et al., 2019; McMahon et al., 2013; Poikkeus et al., 2006; Ranjbar et al., 2020)

and five were cross-sectional cohort studies (Gourounti et al., 2013; Harf-Kashdaei & Kaitz, 2007; Hjelmstedt et al., 2003; McMahon et al., 2011; Joelsson et al., 2017). All studies collected data during pregnancy, and some also collected data postnatally, however only findings reported during pregnancy were reviewed. The majority of the studies used specific inclusion criteria such as being primiparous (Harf-Kashdaei & Kaitz, 2007; Hjelmstedt et al., 2003; McMahon et al., 2013) or singleton pregnancy (Harf-Kashdaei & Kaitz, 2007; Hjelmstedt et al., 2003). Others had broader inclusion criteria and accepted any woman of any age that had conceived via any form of ART.

*Samples.* The size of the samples ranged from $N = 19$ – $N = 367$ in the ART groups, and $N = 30$ – $N = 2972$ in the comparison groups. The women in both of the sample groups were aged between 18 – 45 years and causes of infertility was not reported in all the studies. The ART groups and control groups were well matched in the majority of the studies. Seven studies reported that the ART groups had a higher mean age than the controls (Cox et al., 2006; Darwiche et al., 2019; Furmli et al., 2019; Hjelmstedt et al., 2003; McMahon et al., 2013; Ranjbar et al., 2020; Joelsson et al., 2017) and three reported no differences in age (Furmli et al., 2019; Poikkeus et al., 2006; Harf-Kashdaei & Kaitz, 2007). Only one study commented on the ethnicity of the sample assessed, and that was to say that the majority of the participants in both groups (ART and controls) identified as white (Furmli et al., 2019). Six studies reported that their samples (both ART and control groups) were highly educated to a university degree (Harf-Kashdaei & Kaitz, 2007; McMahon et al., 2013), were in professional job roles (Cox et al., 2006; Poikkeus et al., 2006; McMahon et al., 2013), or were to be considered middle to upper socioeconomic status (Darwiche et al., 2019). Two studies reported that control groups had higher educational attainment than ART groups (Hjelmstedt et al., 2003; Joelsson et al., 2017), and two studies reported that the ART groups had higher educational attainment (Furmli et al., 2019) and higher household income (Furmli

et al., 2019; Ranjbar et al., 2020). One study reported high levels of unemployment in both groups (91% ART, 94% control) however this study was conducted in Iran which is known to have a low rate of employment for females with only 14% of women active in the workforce (The world bank, n.d.). Two studies did not report scores to assess for differences between groups for demographics (Gourounti et al., 2013; McMahon et al., 2011).

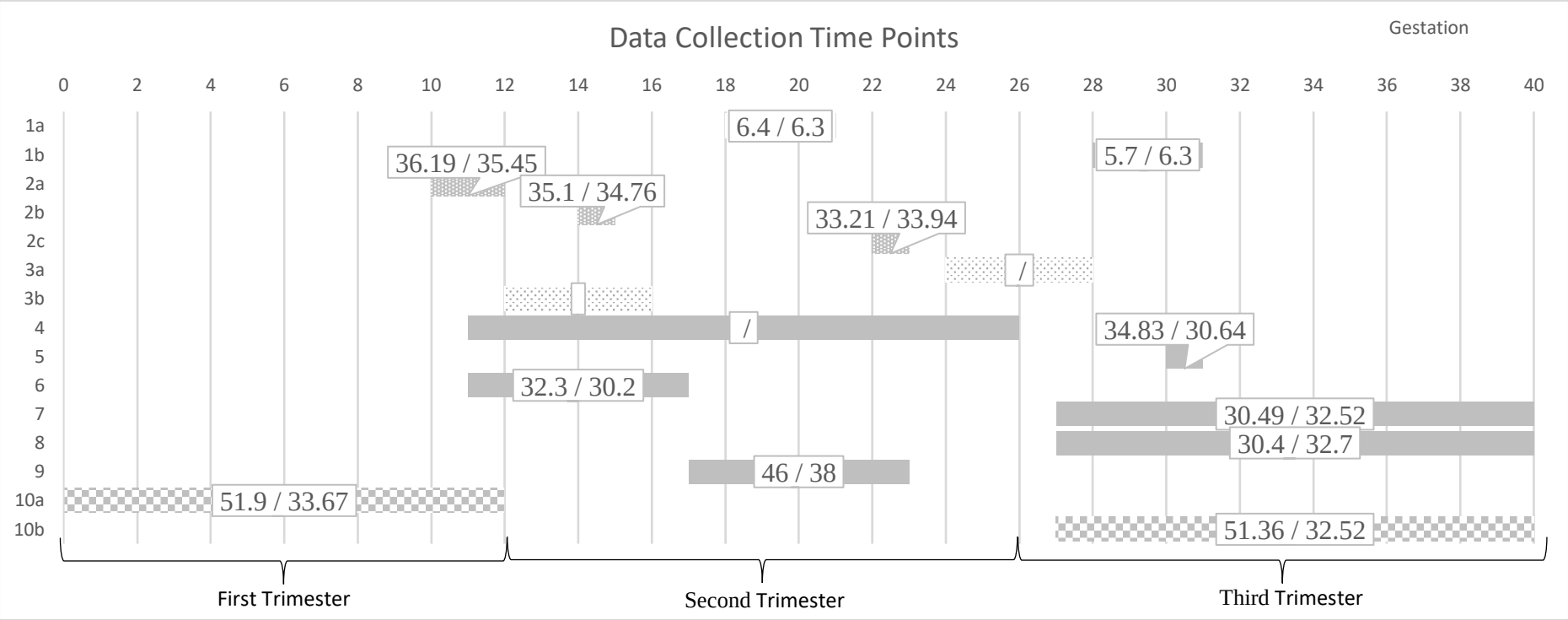
*Gestation data collection time points.* There was a wide range of time points during the pregnancy at which the anxiety measures were collected (see Figure 2). Some studies chose a more conservative range with only a two-, three- or four-week window for data collection. These were usually longitudinal studies where time points were perhaps perceived as more imperative (Darwiche et al., 2019; Furmli et al., 2019; Poikkeus et al., 2006). Other studies reported that they collected their data within specific trimesters, such as the third trimester (McMahon et al., 2011, 2013) or made comparisons from the first trimester to the third (Ranjbar et al., 2020). The remaining studies collected data from their participants during gestation with large participation windows. Ranjbar, et al. (2021) found no significant difference in pregnancy-related anxiety between an ART group and a comparison group after data collection in the first trimester and then again in the third trimester, however, they did report that both groups' anxiety reduced between these two time points, indicating that the time point when data is collected is an important factor when assessing anxiety levels.

As can be seen in Figure 2, the majority of the data was collected in the second and third trimester, with only one study (Ranjibar et al. 2021) collecting data in the first trimester, and then comparing it to data collected in the third trimester. No study gave a rationale for the chosen data collection time point, and no study highlighted the potential concerns that may be present at different timepoints during the pregnancy and the shifting focus of the individual's anxiety or worries. Many studies also did not include parity in their data analysis which could have given more insight into their findings for differing groups of women. Some

studies only included primiparous women and therefore their findings could not be generalised to multiparous women.

**Figure 2**

*Timeline for Data Collection in Each Study During the Women's Pregnancy*




*Note:* Pattern bars are multiple time points in the same study, solid-coloured bars are studies that collected data at only one time point. Bars without numbers in their data labels are studies that did not include the mean or median anxiety score in their reporting. The first score in the data label is the ART anxiety score and the second is the comparison group score. One study, Jolesson et al., (2017), did not report the times point during pregnancy that the data was collected.

| | Paper | Data reported | Scale used in figure |
|---|---|---|---|
| 1 | Cox et al. (2006) | Mean scores (T1 and T2) | Hospital Anxiety and Depression Scale |
| 2 | Darwiche et al. (2019) | Mean scores (T1, T2 and T3) | Spielberg State Anxiety Scale |
| 3 | Furmli et al. (2019) | Did not report mean or median scores | |
| 4 | Gourounti et al. (2013) | Did not report mean or median scores | |
| 5 | Harf-Kashdaei et al (2007) | Median scores | Spielberg State Anxiety Scale |
| 6 | Hjelmstedt et al. (2003) | Mean scores | Spielberg State Anxiety Scale |
| 7 | McMahon et al. (2013) | Mean scores | Spielberg State Anxiety Scale |
| 8 | McMahon et al. (2011) | Mean scores | Spielberg State Anxiety Scale |
| 9 | Poikkeus et al. (2006) | Mean scores | Pregnancy Anxiety Scale |
| 10 | Ranjbar et al. (2021) | Mean scores (T1 and T2) | Pregnancy Related Anxiety Scale |

***Psychological Instruments***

*General anxiety.* Anxiety was measured in all studies using a range of translated self-report measures. All studies employed the use of a validated measure to assess anxiety, although many of these had not been validated for use in a pregnant population. The most popular scale used by seven studies (Darwiche et al., 2019; Furmli et al., 2019; Gourounti et al., 2013; Harf-Kashdaei & Kaitz, 2007; Hjelmstedt et al., 2003; McMahon et al., 2011, 2013) was the Spielberg State Trait Anxiety Inventory (STAI) – State subscale (Spielberger et al., 1983). The state subscale from the STAI is a self-report measure that assesses the presence of anxiety symptoms and rates their severity. This subscale asks the participant how they are feeling 'right now', and 20 items look at apprehension, nervousness, worry, activation of the autonomic nervous system and tension. The range of scores for each subtest is 20 – 40 with a cut-off point of 39-40, which has been suggested to be indicative of clinically significant symptoms of anxiety on the state subscale in a general population (Julian, 2011; Knight et al., 1983). The validity of the state subscale was originally determined in high stress contexts, such as military training programs and with students taking exams. Additionally, it assesses transitory states, so its test-retest coefficients are lower than that of the trait subscale (Julian, 2011).

This was followed by two studies (Cox et al., 2006; Joelsson et al., 2017) that used the Hospital Anxiety and Depression Scale - Anxiety subscale (HADS-A) (Zigmond & Snaith, 1983). This scale was created to measure levels of anxiety in physical health populations. The scale has seven items and participants are asked to rate how they currently feel on a scale from 0 – 3. This scale can provide an overall measure of anxiety but as with the STAI the items are not sensitive to specific anxiety disorders. The range of scores is 0-7 normal, 8-10 mild, 11-14 moderate ad 12-21 severe anxiety (Julian, 2011).

One study used the two-item generalised anxiety disorder scale (GAD2) (Furmli et al., 2019). This scale has two items, measured from 0-3 and asks participants to rate how often in the past week they were 'feeling nervous, anxious or on edge' and how often they were 'not able to stop or control worrying'. This scale was shortened from the GAD-7 (Spitzer et al., 2006) for use in clinical settings to reduce time burden for patients and for clinicians to rapidly assess potential anxiety disorders. Studies using the GAD-2 with individuals presenting with generalised anxiety disorder report that it is a reliable measure (Donker et al., 2011; García-Campayo et al., 2012). One study used the Cambridge Worry Scale, which has 16 items to measure worry (Gourounti, et al., 2013). Six of the scales 16 items have been found to have moderate to strong psychometric properties when used with a pregnant population (Sinesi et al., 2019).

Additionally, the studies that used a general anxiety measure may have failed at capturing some of the specific anxieties with which a pregnant population may be presenting. In addition to this, there are suggestions that ART women and women who conceive naturally may differ on the content of their anxieties when pregnant (Dornelles et al., 2014). Therefore, using a measure of general anxiety alone may not capture all the anxieties present in a pregnant population.

*Pregnancy-related anxiety.* Four studies used a scale created to measure anxiety related to pregnancy for a pregnant population. Two of the papers (McMahon et al., 2011, 2013) used the Health and Defects in the Child scale from the Baby Schema Questionnaire (Gloger-Tippelt, 1983). Items assess concerns around the unborn baby and are rated on a six-point scale. Research has indicated that it has high face validity when assessing for pregnancy-related anxiety when comparing ART mothers and controls who conceive spontaneously (McMahon et al., 2011, 2013; McMahon et al., 1997).

One study (Ranjbar et al., 2020) used the Pregnancy-Related Anxiety Questionnaire (Van den Bergh, 1990). The original scale consisted of 58 items and was created using a range of other anxiety measures. Finally, one study (Poikkeus et al., 2006) used the Pregnancy Anxiety Scale (Levin, 1991). This scale has 10 items that assesses anxieties about: being pregnant, giving birth and hospitalization.

*Anxiety in ART populations vs. comparison groups.* Ten of the 11 studies reported no statistically significant differences between the state or pregnancy-related anxiety scores of women who conceived after ART when compared to a group of women who conceived spontaneously. Only one study reported that women who conceived after IVF ($n$ = 19) compared to a sample of spontaneously conceiving women ($n$ = 144) had higher levels of state anxiety and pregnancy-related worries as measured by the Cambridge Worry Scale (Gourounti et al., 2013). However, this study failed to report when these measures were taken during pregnancy for each group and if there was a difference in gestational period between the groups as they collected data between 11 – 26 weeks. Additionally, their sample of women who had received ART was very small.

Some studies reported that the mean scores for the ART groups were lower than the comparison group of spontaneously conceiving women. Furmli, et al. (2019) reported lower state anxiety scores for the ART group at 10-12 weeks' and at 24-28 weeks' gestation. Harf-Kashdaei and Kaitz (2007) reported that in their sample, 10% of the comparison group scored above the clinical cut-off score for caseness on a measure of state anxiety whereas none of the ART group scored within the clinical range. During the third trimester, McMahon et al., (2011) also found that the state anxiety scores were lower in the ART group in comparison to spontaneously conceiving women; however, the mean scores for the ART group were higher for pregnancy-focused anxiety compared to the comparison group. McMahon et al. (2013) then replicated these results. However, Poikkeus et al., (2006) reported no difference in

scores on a measure of pregnancy-related anxiety for the ART group and the comparison group. They did report, however, that the spontaneously conceiving nulliparous women scored the highest on pregnancy-related anxiety overall in their sample. Ranjbar et al. (2021) also found no difference in their groups for pregnancy-related anxiety. Therefore, it appears that on a measure of state anxiety, women who have conceived using ART do not have higher levels of anxiety than women that spontaneously conceive and appear, in some studies, to have lower levels of state anxiety. The results for differences between pregnancy-related anxiety in the ART samples and the comparison groups show mixed, unclear results and no firm conclusions can be drawn.

## Discussion

The aim of this systematic review of the literature was to further understand the findings from quantitative studies assessing levels of general anxiety and/or pregnancy-related anxiety in women after successful ART in comparison to women who conceived spontaneously. The search results highlighted that there have been a number of studies assessing anxiety globally for the past 22 years, however, there are still large gaps within the literature and areas for continued improvement to support the emotional wellbeing of women who become pregnant as a result of ART.

The results from this systematic review indicate that there was no difference in the levels of state anxiety for women who conceived via ART in comparison to women who spontaneously conceived. Only one study from the eleven found reported that women had statistically significant higher levels of state anxiety after IVF in comparison to women that spontaneously conceived in their sample (Gourounti et al., 2013). However, it is not reported when the data was collected from the ART group, nor the comparison group and their range for data collection time points were large with data being collected between 11 – 26 weeks' gestation.

Many studies did not include parity in their data analysis which could have given more insight into their findings for differing groups of women. Some studies only included primiparous women and therefore their findings could not be generalised to multiparous women. There are differences in anxiety presentations resulting from parity, such as pathways for fear acquisition in fear of childbirth (Rondung et al., 2016b). The content of the fears differ as nulliparous women's fear is usually focused on the uncertainties around birth, whereas parous women may have had a previous negative birth experience which will impact their emotional experiences of subsequent pregnancies (Waldenström et al., 2006). This is an important consideration when measuring anxiety during pregnancy. There were few differences found regarding socioeconomic factors that could create confounding factors. The samples in both groups (ART vs controls) in most studies were highly educated, in professional roles, in high income households and in a stable relationship. In addition, only five of the papers included had sufficient data information to enable effect size calculation. Of the studies that did provide this information which indicated a moderate effect size, only one provided evidence of a priori power calculation (Darwiche et al., 2019). However, this moderate effect size was only present for their time one data collection point, which was prior to an anxiety provoking medical exam for the mother, which would have created an inflated experience of anxiety in reaction to a potentially uncertain and threatening situation. Furthermore, this study does not provide clear inclusion criteria for its sample of women. Additionally, the only other paper retained that produced a moderate effect size (Hjelmstedt et al., 2003) does not provide any information regarding a power calculation to predict sample sizes, therefore, could potentially have used an underpowered sample, in addition to the groups not being equal in participant size which could have increased the potential for bias.

Four of the studies employed pregnancy-specific anxiety scales. However, only one of the studies measured worry within this population (Gourounti et al., 2013). The remaining seven studies used a general anxiety measure which it is felt may fail at capturing some of the specific anxieties with which a pregnant population may be presenting. In addition to this, there are suggestions that ART women and women who conceive naturally may differ on the content of their anxieties when pregnant (Dornelles et al., 2014). Therefore, using a measure of general anxiety alone may not capture all the anxieties present in a pregnant population.

None of the studies retained for review discussed the changing nature of anxiety throughout the gestation period. Some reported a reduction in anxiety; however, they failed to highlight the realistic concerns a woman may have in the first trimester of their pregnancy that could increase their scores on a measure of state anxiety. The first trimester is arguably the most anxiety-provoking during gestation as this is when there is a higher risk of miscarriage, with three out of every four miscarriages occurring within this time period (*Miscarriage - Causes - NHS*, n.d.). Previous research has found that women who conceived after ART are more anxious than pregnant controls about losing the pregnancy from early through to late gestation (Hjelmstedt, Widström, Wramsby, & Collins, 2003). Therefore, studies that were collecting data within this time frame should have accounted for this potentially inflated relevant experience of worry and anxiety or controlled for gestation in their analysis. It has also been found that during pregnancy, with a large sample of women who naturally conceived, 20% present with high levels of anxiety using the STAI (González-Mesa et al., 2019). Additionally, one study assessed for anxiety pre and post an antenatal screen for foetal abnormalities and reported that ART women were more anxious pre-antenatal testing (Darwiche et al., 2019).

The results showed how the mean scores for anxiety were lower in the ART groups than in the comparison groups. Symptoms of anxiety can be transitory and therefore the

timing of assessment is crucial, especially for an ART population. The difficulty faced by women with a high desire to have a child can be deeply distressing (Thorn, 2009) and women have created their own coping skills to manage this in the face of repeated failed treatments (Bailey et al., 2017). Studies have found that after successful IVF, couples experience more stress during their pregnancy (Eugster & Vingerhoets, 1999). A systematic review assessing the experience of the transition to motherhood after ART using qualitative studies found that women who conceived following ART felt that their pregnancies were uncertain and found it difficult to truly believe they were pregnant. They also displayed high levels of fear around miscarriage and foetal abnormalities which led them to use strategies to increase 'peace of mind' such as limiting physical activities or staying at home which could potentially reduce levels of anxiety. They also found that women who experienced struggles with infertility had poor self-image and struggled not to view themselves as 'being infertile' after conception. This then led to doubts around 'capacity for childbirth and adequacy as a mother' (Maehara et al., 2021). Qualitative studies with women who conceived after successful ART show that women's concerns were predominately around the health and survival of their baby and their ability to be a mother and to give birth (Dornelles et al., 2014). Parents also report not preparing for birth due to fear around losing the pregnancy and further disappointment and distress (French et al., 2015).

From the qualitative literature, it can be seen how women report fears around the capacity to give birth due to their stigmatised self-identity of being infertile (Bailey et al., 2017; Dornelles et al., 2014). When reviewing the quantitative literature on pregnancy-related anxiety, it can also be seen how the scales used have factors that are loading onto the construct of fear of childbirth. However, only one paper was found during the literature search that assessed for fear of childbirth in an ART population (Poikkeus et al., 2006) and this is now 16 years old. The same authors also assessed the experience of delivery after ART

in comparison to controls and found that ART was not a risk factor for dissatisfaction with childbirth (Poikkeus et al., 2014). However, without further data assessing fear of childbirth and the birth experience of women after successful ART, conclusions cannot be drawn. This is a gap in the literature as women are vocalising that their main fears are around childbirth and the safety of their baby. Moreover, the literature suggests that women who become pregnant after ART feel 'different' from other mothers. They also report feeling as if they have 'no right' to complain and struggle to speak negatively about their pregnancy experience, especially the more difficult aspects (Fisher et al., 2008; French et al., 2015; Olshansky, 2003). This could lead to underreporting of symptoms on general, non-population specific measures.

**Future Research and Clinical Implications**

This review indicates that there are no differences in levels of general anxiety between women who conceive spontaneously and those who conceive via ART. It may be that anxiety is higher for ART populations while they are receiving treatments to support conception due to high levels of uncertainty and potential pregnancy loss. Additionally, there appears to be fears around the birth and post-partum. Therefore, during pregnancy, after the first trimester, the ART mothers appear to experience a period of comparable or reduced anxiety in comparison to controls.

Future research should take into account pregnancy testing timepoints and scan appointments that may impact the levels of state anxiety as these are not representative of the overall pregnancy journey. Additionally, there is a need for further research into fear of childbirth specifically in an ART group to see if their levels of fear of childbirth are above that of comparison groups as this is a common fear cited in the qualitative literature for ART groups and is not captured when using generic anxiety measures. There is also a need for future research to place more importance on gestation time point, infertility duration, history

of ART failure and parity when assessing anxiety and pregnancy-related anxiety in ART and comparison groups.

The clinical implications of this review indicate a need for clinical staff working with pregnant women after ART to discuss the content of their fears and not to rely on current anxiety measures alone. However, there is no substantive quantitative evidence that ART requires consideration as a risk factor for increased general levels of anxiety during pregnancy and it does not appear to be a prerequisite for additional specific care.

## Conclusion

The results from this review indicate that when using a scale to measure general levels of anxiety during pregnancy there are no differences between ART groups and controls. It also found that in many studies, ART groups have lower mean levels of anxiety than control groups. The results from studies that measure pregnancy-related anxiety are mixed and no conclusions can be drawn.

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# Chapter Two: Empirical Paper

## TITLE: The EXPECTING Study. EXPloring pattErns of Common ThinkING styles in pregnancy[2]

[2] Planned journal for submission: Journal of Anxiety Disorders

## Abstract

Fear of childbirth (FOC) is a phobic like response, and anxiety surrounding the process of giving birth. FOC can have negative implications for women during pregnancy and can impact their birthing experience. Cognitive processing biases have been previously found to maintain levels of general anxiety. To date, there has been no research assessing common cognitive processing biases and their relationship with FOC in a pregnant population. In this cross-sectional study, participants who were 12 weeks or more pregnant (*n* = 116) completed three tasks assessing attentional (emotional stroop task), interpretation (scrambled sentence task) and explicit memory (recognition task) bias. This study used voluntary response sampling and recruited women from the Liverpool Women's Hospital. They also completed three separate measures of FOC and measures of low mood, general anxiety, worry and rumination. The data was analysed by computing correlations and carrying out multivariate analysis. The findings showed that a negative interpretation bias (but not attention nor explicit memory) was associated with higher scores on the FOC measures. These findings therefore indicate that women presenting with higher FOC are more likely to present with negative interpretation biases for ambiguous information. This finding can inform future research to support women presenting with FOC. (Please see Appendix A for Journal requirements).


*Key words:* Tokophobia, Fear of Childbirth, Cognitive Biases, Attention Bias, Interpretation Bias, Memory Bias

## Introduction

Across cultures, pregnancy and childbirth are seen as a major life event and, while joyful, can also create high levels of stress (Epifanio et al., 2015; Hutteman et al., 2014) with many women reporting varying degrees of anxiety during this period (Huizink et al., 2004). Fear of Childbirth (FOC) is defined as anxiety about the process of giving birth. FOC is associated with specific worries centring around fear of the unknown, fear of pain, capacity of the body to give birth, adequacy of support from care providers, potential injury to mother and baby and losing control (Sheen & Slade, 2018; Slade et al., 2019). Although many of these are rational fears, they have the potential to cause women high levels of distress that can have negative implications for them and their babies in utero. Half of the women presenting with high levels of FOC report comorbid clinical levels of anxiety and depression (Storksen et al., 2012). Evidence suggests that state and trait anxiety are associated factors for FOC (Alipour et al., 2011) and higher levels of FOC is highly correlated with traumatic stress (Söderquist et al., 2004). Therefore, the research suggests that although this is an area requiring further research, FOC, anxiety and depression may have common underpinnings while simultaneously having distinct characteristics (Rondung et al., 2016). The present study investigated cognitive processing biases in relation to FOC. Cognitive processing biases have been found to underpin anxiety and depression (Hirsch et al., 2016; Hirsch & Mathews, 2012) and thinking styles related to anxiety and depression. There are no longitudinal studies looking at cognitive biases during pregnancy, and therefore, this research draws on studies looking at cognitive biases, anxiety and depression in non-pregnant samples. In particular, when viewing threatening information, individuals with high levels of anxiety are more likely to attend to the threat stimuli (Fontenot et al., 2015), more likely to interpret ambiguous information as threatening (Krahé et al., 2019) and more likely to remember threatening stimuli (Bomyea et al., 2017). Due to the overlap in general anxiety presentations and FOC,

there may be similar underlying cognitive biases in both, but this has not yet been explored. No study has previously assessed attention, interpretation and memory bias in pregnant women and assessed its potential associations with FOC. Therefore, the current study aims to assess if women presenting with higher levels of FOC will display more negative interpretation, attention, and memory biases.

**Fear of Childbirth**

FOC is a term used to encapsulate fear, concerns or anxiety symptoms in relation to childbirth (Saisto & Halmesmäki, 2003). The commonly cited distinction between primary and secondary FOC suggests there are different pathways for the acquisition of the fears (Rondung et al., 2016). Nulliparous women's fear is usually focused on the uncertainties that birth holds, such as fear of pain, the body's ability to give birth successfully, and general fear around the novel experience, which is defined as primary FOC (Shakarami et al., 2021). In contrast, parous women may have previous negative experiences of childbirth resulting in secondary FOC (Nilsson et al., 2010; Waldenström et al., 2006; Wigert et al., 2020). The overall pooled prevalence for clinical levels of FOC from 18 countries was found to be 14% (O'Connell et al., 2017). Prevalence rates can vary largely between countries, which is hypothesised to be a reflection of the tools used to measure for varying degrees of FOC and the lack of construct validity (Nilsson et al., 2018; Saisto & Halmesmäki, 2003). There is a clear rationale for further understanding of the cognitive processes underpinning FOC as there are many potential negative outcomes for mothers and their infants due to antenatal distress. These include premature delivery (Orr et al., 2007), higher risk of Post-Traumatic Stress Disorder (Slade et al., 2019), higher rates of prolonged labour (Adams et al., 2012; Laursen et al., 2008) and poorer mental health outcomes in the postpartum period (Sieber et al., 2006) for women with higher levels of FOC.

**Cognitive Biases**

Cognitive processing biases can underpin anxiety and depression presentations. Worry and rumination are categorised as repetitive negative thinking (RNT) styles and have been found to be associated with high levels of anxiety and low mood (Fresco et al., 2002). Worry is most commonly investigated in the context of anxiety (Fresco et al., 2002), and rumination has been extensively investigated in depressive disorders (Kovács et al., 2020). The difference between these two RNT styles is usually defined by their temporal focus. Rumination is a process that involves cognitively going over and thinking about events from the past, whereas worry involves thoughts and predictions about potential and actual future events. An evidenced-based theoretical model demonstrates how pathological worry is maintained by bottom-up processes of attentional and interpretation bias (Hirsch & Mathews, 2012). The model outlines how the cognitive characteristics of biases in the processing of emotive information and an inability to have control over attention leads to pathological worry. The emotional processing biases lead worry-prone individual's to automatically interpret ambiguous information as threatening (Krahé et al., 2019) and focus their attention on possible negative outcomes due to a lack of control over attentional resources (Stefanopoulou et al., 2014). This model states that selective attention towards threatening stimuli that match the individual's thought content (Mathews & MacLeod, 2005) coupled with a negative interpretation bias of neutral information maintains worry and rumination in individuals with high levels of anxiety (Hertel et al., 2014; Hirsch & Mathews, 2012). Worry and rumination are categorised as transdiagnostic as they are found in many different disorders (Ehring & Watkins, 2008), with evidence highlighting their role in generalised anxiety disorder (GAD) (Krahé et al., 2019) and depression (Everaert et al., 2014). Therefore, there is the potential for cognitive biases to also be present in FOC as this shares many features with general anxiety. Additionally, state and trait anxiety are risk factors for FOC,

and therefore there is the potential for similar cognitive mechanisms, such as selective attention towards threatening information and a negative interpretation bias of neutral information to also be present in FOC.

Attentional bias is defined by a tendency to pay attention to stimuli that are congruent to an emotional state. Attentional bias can be subdivided into three parts, or 'mental operations' (Koster et al., 2006). One observes the speed at which the individual transfers their attention to the threat, two is attentional avoidance and three is an observed struggle to disengage attention from a threat (Cisler & Koster, 2010). This concept can be measured using an emotional Stroop task (Stroop, 1935) which assesses reaction times to neutral and threat stimuli. Interpretation bias is associated with an increase in worry and rumination (Krahé et al., 2019) due to a tendency to consistently interpret ambiguous stimuli negatively (Hirsch & Mathews, 2012) and has been found to be present across emotional disorders (Hirsch et al., 2016). For example, if a person is worrying about their upcoming birth and wondering if they will be able to endure the pain, interpreting this situation in a negative way will increase their perception of the threat. These kinds of interpretations have the potential to lead to further negative conclusions (e.g., interpreting ambiguous bodily sensations as confirmation that birth will be unmanageable), which perpetuates the individual's worry. Interpretation bias has been examined in the literature in populations with GAD and depression (Everaert et al., 2014; Krahé et al., 2019). Mood congruent memory bias has also been shown to have links with low mood. It is defined as the more accurate retrieval of information that is consistent with an individuals present emotional state (Moritz et al., 2005) and has been shown to be biased towards threat-related information retrieval (Bomyea et al., 2017; Herrera et al., 2017). This can be assessed using a recognition task using both novel and encoded stimuli and asking participants to determine if they have seen the word previously.

Cognitive biases have been found in women who experience postnatal depression (Webb & Ayers, 2015). Women experiencing depression are more likely to have an attentional bias for infant faces that are expressing sad emotions, and are more likely to interpret ambiguous/neutral infant expressions as negative (Webb & Ayers, 2015). Women with higher levels of FOC report having more thoughts related to childbirth compared to women who report low levels or no fear (Hildingsson et al., 2010) and cognitive bias modification has been found to reduce negative thought intrusions for pregnant women (Hirsch et al., 2021). Hirsch et al., (2021) looked at interpretation bias and worry in a population of pregnant women. They measured levels of perinatal worry and found that they were able to induce a positive interpretation bias in the group who scored high on worry. However, they did not look at FOC specifically.

**Current Study**

This study investigated the relationship between three cognitive biases: attention, interpretation, and memory and FOC. We examined attention, interpretation, and memory bias in relation to worry, rumination, general anxiety, and mood in a sample of the general population which included women presenting with varying degrees of FOC. First, we examined the relationship between worry, rumination, general anxiety, mood and FOC. Then we investigated the relationships between attentional, interpretation, and memory biases and FOC. We used an emotional Stroop task to measure attentional bias, a scrambled sentence task to measure interpretation bias, and a word recognition task to assess explicit memory bias. To ensure the stimuli used in the task were disorder-specific (Hirsch et al., 2016) we created new FOC stimuli with experts by experience and used GAD specific stimuli as well as neutral stimuli. This was to assess differences between general, neutral, and disorder-specific stimuli across the three cognitive bias tasks.

*Aims.* The study objectives were to investigate in a general population sample of pregnant women: (a) whether FOC was positively correlated with worry, rumination, general anxiety, low mood, attention, interpretation, and memory bias scores, (b) if FOC scores were stronger for FOC related stimuli in comparison to GAD and/or neutral related stimuli in the three experimental tasks and (c) if attention, interpretation and memory bias were associated with varying levels of FOC.

*Hypotheses.* We employed three scales to measure FOC to see if this impacted the results, as there is currently no consensus on measurement scales (Nilsson et al., 2018; Saisto & Halmesmäki, 2003). The following hypotheses were based on a general population sample of pregnant women. We predicted that worry, rumination, general anxiety, low mood and FOC would be positively correlated with each other and that they would be correlated positively with attentional, interpretation and memory bias. We predicted that women with higher FOC scores would have faster reaction times towards FOC-related stimuli, as opposed to GAD or neutral on the stroop task for attention bias. We predicted that women with higher FOC scores would have a stronger negative interpretation bias for FOC stimuli over and above GAD stimuli on the scrambled sentence task. We predicted that women with higher FOC scores would have a stronger memory bias for FOC stimuli over and above neutral stimuli in the recognition task. Finally, we predicted that all three bias scores (attention, interpretation, and memory) would be associated with varying levels of FOC scores.

## Method

### Design

The study used a cross-sectional design and was conducted online using the Qualtrics software for data collection. Each participant completed a series of cognitive bias tasks assessing attentional bias using a stroop task, interpretation bias using a scrambled sentence task and memory bias using a word recognition task. They also completed three fear of

childbirth measures, a measure of general anxiety, mood, worry and rumination. We examined the associations between scores on the FOC, anxiety, worry, mood and rumination measures, and the association between cognitive bias tasks for attention, interpretation, and explicit memory and FOC. The measures for the attention, interpretation and memory task were scored so that lower scores were indicative of a more negative bias in each bias assessed.

**Participants**

Participants were 12 weeks or more pregnant. Participants were included if they were not currently receiving care from a psychiatrist for a severe mental illness, and they were not deemed to have a high-risk pregnancy. Participants that were colour blind were excluded as they would not have been able to complete the Stroop task. The estimated sample size was based on the multiple regression analysis as the main analysis of interest. The sample size was calculated for a multiple regression analysis and an increase $R^2$ of 0.1 (small effect size) specifying three predictor variables (representative of each cognitive process). The alpha was set to 0.017 (Bonferroni adjusted) , which then yielded a power of $> .08$, which required a sample of 108 cases. The final sample consisted of 116 participants. Participants were predominantly white (91.9%), with equal numbers identifying as Black and Asian (3.6%) and one participant identifying as Gypsy or Irish Traveller (0.6%). Participants highest level of education was most commonly a bachelor's degree (54.1%) followed by master's degree (18%), GCSE (9.9%), Vocational Training (9%), A-Levels (4.5%), doctorate degree (2.7%) and no formal education (1.8%). The mean age for the group was 30.33 years (SD = 4.5) and the mean gestation when completing the study was 21.3 weeks (SD = 6.27). Gender was all female with no participant identifying as non-binary.

**Procedure**

Participants were recruited from the Liverpool Women's Hospital via invite sheets (see Appendix J) that were placed in the envelope with their 20-week scan appointment letter. An advertisement was also placed on the hospital website and posters were placed in waiting rooms at the hospital with a TinyURL link to the study. Anyone who attended for a 12-week scan at the hospital or had access to the hospital website could access the study via this link. After receiving the invite sheet with the web link to the study or viewing the online advertisement, eligible participants took part online at a time and location of their choosing, and participation lasted 40 minutes. It was made explicit that this study could only be completed on a laptop and not a phone due to the Stroop task requiring a computer keyboard on the information sheet (see Appendix H). Participants provided informed consent (see Appendix I) and completed the Scrambled Sentence Task (interpretation bias), three FOC measures, Stroop task (attention bias), demographics questions, Generalised anxiety disorder scale (GAD7) (Spitzer et al., 2006), Patient health Questionnaire (PHQ9) (Kroenke & Spitzer, 2002), Penn State Worry Questionnaire (PSW) (Meyer et al., 1990), Ruminative Response Scale (RRS) (Nolen-Hoeksema & Morrow, 1991) and recognition task (memory bias) in this order. At the end of the study, participants were shown a debriefing sheet, thanked, and provided with referral information on where to seek support if they felt they experienced any distress associated with their participation in the study, or if they felt that they needed support with their pregnancy and mental health. They were also given the option to provide qualitative feedback and to provide their email to receive a £5 participation voucher as compensation for time and effort. Ethical approval was granted by the National Research Ethics Committee Yorkshire and The Humber – South Yorkshire Research Ethics Committee (IRAS 291313) (see Appendix F). The study was completed in accordance with the World Medical Association Declaration of Helsinki. The study was sponsored by the

University of Liverpool (see Appendix E) and reviewed by their research committee (see Appendix D).

**Materials and Measures**

*Fear of childbirth.* Three FOC scales were used in this study due to varying strengths and weaknesses that are highlighted below. The Fear of Birth scale (FOBs) was used first. The FOBs is a simple two item measure assessing FOC (Ternström et al., 2016). It assesses levels of fear and worry in relation to the individuals upcoming birth using a 100mm visual analogue scale. On this scale participants indicate to what extent they have felt (1) calm/worried and (2) no fear/fear in relation to their birth (Haines et al., 2011). Due to the scale only having two items, it can be used readily in clinical services, however, does not provide a high level of information regarding FOC. The cut off score for the FOBS used in the literature is .5 on the visual analogue scale (Haines et al., 2011). The second scale implemented was The Wijma Delivery Expectancy Questionnaire (WDEQ-A). This is a 33 item scale assessing expectancies of childbirth with higher scores indicating higher levels of FOC (Wijma et al., 1998). This scale is the most widely used measure for assessing FOC. However, as it has been translated from Swedish, studies using it with an English speaking population have found major issues in item interpretation (Johnson & Slade, 2002; Roosevelt & Low, 2016; Slade et al., 2019; Toohill et al., 2014). Validation of the WDEQ using a UK population is yet to be completed (Slade, et al., 2020), however, some studies report that studies should employ a cut-off score of >85 (Nilsson, et al, 2018). The final scale used was the Fear of Childbirth Questionnaire (FOCQ). This is a 20 item measure that assesses both emotional and physical fears rated on a scale of strongly disagree, slightly disagree, slightly agree or strongly agree (Slade et al., 2021). The items in this scale were created with women who reported high levels of FOC ensuring that this scale has high content validity. This is a relatively new scale and therefore other forms of validity and reliability are yet to be verified

by an empirical study. However, due to the concerns about the validity of other scales such as the WDEQ-A with English speaking samples, or the paucity of information collected with the FOBs, it was felt that the inclusion of this new scale would be useful. This scale does not yet have a clinical cut-off score as validation is currently underway and not yet available. Therefore, higher scores on this measure indicate higher levels of FOC. It was felt that due to the lack of consensus on a scale to measure FOC in a UK general sample of women, that using the three measures to assess levels of FOC was appropriate. Cronbach's alphas' in the present study were .83 for the FOBS, .93 for the WDEQ and .79 for the FOCQ.

*Measures of worry and rumination.* Worry was measured using the Penn State Worry questionnaire (PSWQ). The PSWQ (Meyer et al., 1990) assesses trait worry using 16-items with a 5 point scale from 1 (not at all typical of me) to 5 (very typical of me). Higher scores are indicative of higher trait worry. This scale has produced high internal consistency and validity when used with university and clinical samples and is used widely within research (Brown et al., 1992). The commonly used cut-off score in the literature using the PSWQ is 45 (Brown et al., 1992). Rumination was then measured using the Ruminative-response scale. (RRS). This 22-item scale measures levels of rumination on a rating scale from 1(almost never) to 4 (almost always) (Nolen-Hoeksema & Morrow, 1991). This is a widely used measure, and recent studies have shown satisfactory internal item consistency and good scale reliability and validity when used with a sample who have major depressive disorder (Parola et al., 2017). Higher scores on the scale indicate higher levels of rumination. Cronbach's alphas' in the present study were .8 for the PSWQ and .91 for the RRS.

*Anxiety and depression symptoms.* Levels of general anxiety were measured using the self-report Generalised Anxiety Disorder 7-item scale (GAD7) (Spitzer et al., 2006). Items are scored from 0 (not at all) to 3 (nearly every day) to assess the frequency of symptom occurrence in the past two weeks. It has high reported internal consistency, excellent

convergent validity and is used across the UK in many public health systems (Johnson et al., 2019). The cut off score for this scale is 10 for moderate anxiety (Spitzer et al., 2006). The Patient Health Questionnaire (PHQ9) was used to assess levels of low mood. The PHQ9 (Kroenke & Spitzer, 2002) is a self-report, nine item measure that assesses the frequency of depressive symptoms over the past two weeks. The items are scored on a scale from 0 (not at all) to 3 (nearly every day). Higher scores indicate higher levels of depression. This measure is widely used across health services in the UK. Acceptable diagnostic properties for major depressive disorder across ten different setting were recently found using a meta-analysis of the available literature (Moriarty et al., 2015). The cut off for this scale is 10 (Kroenke & Spitzer, 2002). Cronbach's alphas' in the present study were .8 for the GAD7 and .78 for the PHQ9. (For all scale items, please see Appendix G).

**Experimental Tasks**

*Creation of FOC stimuli.* All FOC related items used in the three bias tasks were co-created with ($n$ = 6) experts by experience for use in this study. They were generated and assessed through a rigorous process to ensure that they were applicable and salient to the study population. The general anxiety related stimuli were taken from previous research that had created these specifically for a population presenting with GAD (Krahé et al., 2019). After the newly created bias tasks were refined, they were then piloted with a new group of experts by experience ($n$ = 6) prior to use in this study. The pilot data was analysed and the final FOC stimuli were chosen for use in this study. The words generated and used in the Stroop task to assess for attentional bias were all matched across subtypes (FOC, GAD and neutral stimuli) for valence, length, and frequency to reduce bias. In addition, to ensure that all domains of the construct of FOC were represented, the words were matched to the most common fears reported by women in recent literature (Slade et al., 2019). This was replicated for the interpretation bias task where each construct was represented by a scrambled sentence

in the task. Twenty sentences were created, and pilot tested with a group of six women. From this, ten sentences were retained for use in the study. A full description of how the materials were created, tested, and validated can be found in Appendix C.

*Cognitive bias tasks.* Three emotional processing biases were assessed using three different tasks. An emotional stroop task assessed attentional bias, the scrambled sentence task assessed interpretation bias, and a word recognition task assessed memory bias.

*Attention bias measures.* Many research studies have used a Stroop task to assess for attentional bias in individuals presenting with anxiety (Bar-Haim et al., 2007; Fontenot et al., 2015; Mogg & Bradley, 1998). This task was created by Stroop (Stroop, 1935) and is considered to be a valid assessment to measure attentional bias (Cisler & Koster, 2010). Participants completed a computerised emotional Stroop task consisting of 90 experimental trials: 30 FOC related words, 30 GAD words and 30 neutral words were used (see appendix C). The words were shown once in random order. The FOC related words were novel to this experiment and created with experts by experience for this study. The GAD and the neutral words were taken from previous successful and relevant research studies (Hirsch et al., 2018). Neutral words were chosen to match the FOC and GAD related words for valence, frequency, and length (e.g., scrapbook, parking, eyebrow, chair). Words in the GAD type were taken from previous research by Krahé et al., (2019) and included weak, nervous, failure, foolish and worried. The FOC word list that was created for this study included stillbirth, forceps, excruciating, induction and tearing.

The Stroop task was created using an online program called Lab.js, which is a free, open, online study builder for behavioural and cognitive sciences. The Stroop was then hosted on the website Netlify (Netlify, 2021) and embedded into the Qualtrics survey. Participants were provided with 15 practice trials before the stimuli were shown in random order to allow them to become familiar with the four response keys (see Appendix C). They

were given the following instructions “In this experiment, your task will be to identify the colour of the word shown on the screen. The word itself does not matter — you can ignore it”. Participants viewed randomised words in the colours blue, red, orange, and green and were asked to select the colour that each of the stimuli words appeared by pushing the corresponding key on their keyboard as fast as possible (press the R key for red, press the B key for Blue etc). They were asked to dismiss the meaning of the word and focus only on the colour it was presented in. Between each word trial was a fixation cross. Following the practice trial participants were shown each stimulus once, for a total of 90 trials. Reaction time was recorded for each trial.

Attentional bias was measured by mean interferences, calculated as the response time for the FOC or GAD items minus the neutral stimuli response times. This is consistent with contemporary practice within the literature for this experiment (Williams et al., 1996). Any trials that were more than two standard deviations from the grand mean were excluded as it was hypothesised that these were indicative of a lack of attention to the task (Kambouropoulos & Knowles, 2005).

Incorrect answers in the Stroop task were excluded from the data (overall error rate was FOC words 3.14%, GAD words 3.26% and neutral words 3.26%). Reaction times that were 2.5 SD below or above the mean were checked as it is advised to remove these from the data (Ben-Haim et al., 2016). It was not possible to remove any reaction times 2.5 SD below the mean as they were negative and therefore not meaningful. Any reaction times more than 2.5 SD above the mean were excluded.

*Interpretation bias measures.* The scrambled sentence task (SST) was chosen as it is a reliable assessment of interpretation bias implemented by many studies researching anxiety symptoms and presentations (Krahé et al., 2019). The SST used (adapted from Wenzlaff & Bates, 1998, 2000) 20 sentences, 10 of which were FOC related and 10 of which were GAD

related. Participants were given six words and asked to make as many grammatically correct sentences as possible within five minutes. They were also asked to keep in mind a string of six digits as a cognitive load task while they were "unscrambling" the sentences (Wenzlaff & Bates, 1998, 2000) and were asked to recall the six digits at the end of the task. An example item for the FOC related sentence was "won't as birth will planned go" which could be unscrambled to make the sentence "birth will go as planned" (positive interpretation) or "birth won't go as planned" (negative interpretation). An example of the GAD related sentence was "badly out everything turn fine will" which could be unscrambled to make the sentence "everything will turn out fine" (positive interpretation) or "everything will turn out badly" (negative interpretation). All participants were allowed to attempt to complete all 20 sentences within the five-minute time limit. If they were not finished within the five-minute limit the task ended and auto progressed them to the next page of the study. An overall individual SST index was then calculated by dividing the number of correctly generated positive sentences by the total number of grammatically correct sentences generated overall. This then produced an index for each participant with lower scores indicating a more negative interpretation bias that ranged from 0 to 1. This scoring method was utilised in order to be consistent with previous research using this bias task (Hirsch et al., 2018; Krahé et al., 2019).

*Memory bias measures.* Explicit memory was measured using a word recognition task (WRT) which has been commonly used in the literature with individuals presenting with anxiety (Bomyea et al., 2017; Herrera et al., 2017; Pauli et al., 2005). Participants were shown 44 words in random order and asked a dichotomous Y/N question as to whether they had seen this word previously in the Stroop task. There were 22 FOC words and 22 neutral words. In both sets of FOC and neutral word lists, 11 were shown in the Stroop and 11 were novel. The participant's task was to judge whether they had been previously shown the word

in the Stroop task by indicating ‘yes’ or ‘no’ underneath the word shown. Memory bias was then measured to assess whether word type (FOC vs. Neutral) and correct recognition (novel vs previously seen) were associated with levels of FOC. Correct answers were recorded as ‘hits’ and responses bias ‘false alarms’ were recorded.

For the memory bias task, d prime (*d’*) scores were created. D prime is a measure of participant’s ability to correctly discriminate between a signal (a previously shown stimulus) and a noise (a novel stimulus) (Stanislaw & Todorov, 1999). A participant’s *d’* value can range from 0 to infinity and larger *d’* scores indicate a superior ability to discriminate between signals and noise, or is an interpretation of a stronger memory bias for signals (Stanislaw & Todorov, 1999). Using each participant’s valence specific “Hit” and “False Alarm” scores, *d’* indexes were computed. A “Hit” was a correctly identified previously shown stimulus and a “False Alarm” was an incorrectly identified novel stimulus in the recognition task. This accounts for ‘guessing’ as a strategy for completing the task. *d’* indexes are therefore the net score that accounts for the range between each set of scores by computing the relative proportion of hits minus false alarms. The *d’* is calculated using the formula $d' = Z_{hit} - Z_{FA}$ where Z is a representation of the transformation of the two score’s distributions, which then allows for a comparison to be made of the measures that have different ranges of absolute values (Haatveit et al., 2010; Stanislaw & Todorov, 1999). *d’* scores of 0 indicates a 50% accuracy on both scores, a positive *d’* scores is indicative of better than chance accuracy on both sets of scores, whereas a negative *d’* score indicates less than 50% accuracy on both sets of scores.

**Statistical Analyses**

All analyses were completed using SPSS (Corp., 2020). Preliminary analyses were preformed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. Standardised residual scores were created for the stroop reaction times data

so that one variable could be used that controlled for the neutral stimuli used in the task. The memory bias data was represented using *d*' scores to control for guessing as a strategy. It was found that the scales did not violate the assumption of normality. This was assessed by checking the skewness and kurtosis values, which were both found to be within the ranges for normal data distribution for all scales used in the analysis. Values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution (George & Mallery, 2010). Therefore, parametric testing was completed. (see Appendix K for scatter plots).

To assess the first hypothesis, we completed correlation analyses to assess the relationship between FOC, worry, rumination, general anxiety, low mood, and interpretation bias scores. We then completed partial correlations to evaluate the relationship between FOC and reaction times on the stroop task for attentional bias to FOC and GAD stimuli while controlling for neutral stimuli. We then completed partial correlations to assess the relationship between FOC and *d*' prime scores for memory bias for FOC words while control for *d*' prime scores for neutral words. To address the second hypothesis, we completed a repeated measures analysis of covariance to assess the relationship between stimulus type (FOC, GAD and/or neutral stimuli) and the interaction with FOC to assess if there was a stronger association for FOC specific stimuli. To address the third hypothesis, we completed a multiple regression analysis to assess how the three cognitive biases measured (attention, interpretation, and memory) were associated with FOC. This gave us an understanding of how much of the variance was explained by each process.

## Results

### Descriptive Statistics, Correlations, and Group Differences

Respondents that did not meet the inclusion criteria were removed from the study. The demographics of the final sample can be seen in Table 1.

*Parity.* An independent samples t-test was conducted to compare the scores for nulliparous ($n$ = 31) and parous ($n$ = 74) women on the three measures of FOC, mood, general anxiety, worry and rumination (see Table 2). The differences found indicated that women who had previously given birth had significantly lower levels of FOC as measured by the WDEQ and lower levels of low mood, general anxiety, and levels of rumination than nulliparous women. Parity was then controlled for when assessing the potential relationship between the three measures of bias and levels of FOC.

*Gestation.* Gestation was not significantly correlated with any of the FOC measures or any measures assessing for mood, general anxiety, worry or rumination.

*Ethnicity, education, work status and relationship status.* The numbers in the groups for ethnicity were not large enough to complete any meaningful analysis. No differences were found between groups when completing a one-way analysis of variance to explore the impact of education, work status or education on any FOC measures.

*Clinical cut-off scores.* Nearly half (49.5%) of participants scored above the clinical cut off score for FOC as measured by the two item FOBS; 24.3% of participants scored above the clinical cut-off score for FOC as measured by the WDEQ and 64.8% of the participants scored above the clinical cut off score for worry as measured by the PSWQ. Furthermore, 35.7% of participants scored above the clinical cut off score for general anxiety as measured using the GAD7. 49.5% of participants scored above the clinical cut of score for low mood as measured by the PHQ9.

Mean questionnaire scores can be found in Table 3.

**Table 1**

*Demographics of Participants*

| Ethnicity | *n* | % | Education | *n* | % | Work Status | *n* | % | Marital Status | *n* | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| White | 98 | 92.5 | No formal Education | 2 | 1.9 | Employed full time | 48 | 45.3 | Single | 3 | 2.8 |
| Black / African / Caribbean / Black British | 4 | 3.8 | GCSE | 11 | 10.4 | Employed part time | 13 | 12.3 | In a relationship but not cohabiting | 4 | 3.8 |
| Asian / Asian British | 4 | 3.8 | A Levels | 5 | 4.7 | Self-employed / Freelance | 4 | 3.8 | Cohabiting | 16 | 15.1 |
| | | | Vocational Training | 10 | 9.4 | Unemployed – looking for work | 3 | 2.8 | Married | 83 | 78.3 |
| | | | Bachelor's degree | 56 | 52.8 | Home Maker | 36 | 34 | Parity | 105 | |
| | | | Master's degree | 19 | 17.9 | Student | 1 | .9 | Nulliparous | 74 | 70.5 |
| | | | Doctorate Degree | 3 | 2.8 | Other | 1 | .9 | Multiparous | 31 | 29.5 |

Note: No participants identified as no-binary in this sample. No participants identified as being Gypsy, Irish Traveller or Arab. No participants identified as being in a civil partnership, widowed or divorced.

**Table 2**

*Results of a t-test for Nulliparous and Multiparous Women*

| Variable | Nulliparous | | Multiparous | | T(103) | *p* | Eta squared |
|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | | | |
| FOBS | 48.62 | 15.65 | 47.52 | 22.21 | -.29 | .77 | |
| WDEQ | 72.39 | 22.42 | 48.62 | 15.65 | -2.36 | .02* | .05 |
| FOCQ | 28.99 | 6.97 | 26.13 | 7.97 | -1.84 | .07 | |
| PHQ9 | 9.89 | 5.08 | 7.65 | 5.5 | -2.02 | .05* | .04 |
| GAD7 | 8.66 | 4.72 | 6.42 | 4.93 | -2.19 | .03* | .04 |
| Worry | 47.72 | 8.22 | 44.42 | 12.31 | -1.37 | .178 | |
| Rumination | 47.97 | 11.39 | 39.77 | 12.32 | -3.18 | .001* | .09 |

*Note:* Scales: FOBS – Fear of Birth Scale, WDEQ - Wijma delivery expectancy/experience questionnaire, FOCQ – Fear of childbirth questionnaire, PHQ9 – Patient health questionnaire, GAD7 – Generalised anxiety disorder, Worry – Penn state worry questionnaire, Rumination – Ruminative response scale

**Association Between FOC, Worry, Rumination, GAD, and Low Mood**

To test Hypothesis 1; that there would be a positive association between levels of FOC, low mood, GAD, worry, and rumination, correlations were computed. Overall, worry, rumination, anxiety, mood and the three measures for FOC (FOBS, WDEQ and FOCQ) were significantly and positively correlated with each other (see Table 3). This indicates that women who scored higher on the three measures for FOC (indicating higher levels of FOC), also scored highly on worry, rumination, general anxiety, and low mood.

Partial correlations were also completed to assess the relationship between the threat indices on the attention and memory bias tasks and measures of FOC while controlling for the neutral stimuli (see Table 4 and 5 for partial correlations). These showed that there was a positive correlation between FOC stroop stimuli words and levels of FOC, but only when measured by the WDEQ, and the SST (interpretation bias) when controlling for the neutral stroop stimuli words. There were no other significant correlations. This indicates that participants had faster reaction times to FOC stroop stimuli words when they scored higher for FOC on the WDEQ and had higher negative interpretation bias scores.

The partial correlations for the memory bias task showed a significant negative correlation with the *d*' prime threat words and the WDEQ, low mood, general anxiety, rumination, and SST (interpretation bias). This indicates that poorer recall of FOC words were associated with higher scores on FOC as measured by the WDEQ, lower mood scores, higher general anxiety scores, higher rumination scores and higher negative interpretation bias scores. Thus, confirming our hypothesis that there would be a positive association between levels of FOC, low mood, GAD, worry, and rumination. Our hypothesis regarding attention bias was only confirmed when measuring FOC using the WDEQ, our hypothesis

regarding interpretation bias was confirmed and our hypothesis regarding memory bias was not confirmed, as there was a negative rather than a positive association found.

**Table 3**

*Descriptive Statistics and Correlations*

| Variable | n | M | SD | FOBS | WDEQ | FOCQ | PHQ9 | GAD7 | Worry | Rumination | SST | Gestation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOBS | 111 | 47.70 | 18.50 | - | .68** | .60** | .38** | .45** | .21* | .38* | .48** | .04 |
| WDEQ | 111 | 68.48 | 24.44 | | - | .69** | .52** | .42** | .27** | .50** | .55** | .17 |
| FOCQ | 111 | 27.76 | 7.45 | | | - | .47** | .44** | .30** | .42** | .56** | .06 |
| PHQ9 | 105 | 9.23 | 5.28 | | | | - | .79** | .43** | .75** | .68** | -.03 |
| GAD7 | 105 | 8.00 | 4.87 | | | | | - | .50** | .76** | .61** | -.02 |
| Worry | 105 | 46.74 | 9.66 | | | | | | - | .51** | .39** | -.03 |
| Rumination | 105 | 45.55 | 12.21 | | | | | | | - | .60** | .10 |
| SST | 111 | 45.55 | 0.20 | | | | | | | | - | -.07 |
| Gestation | 93 | 21.30 | 6.27 | | | | | | | | | - |

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

*Note:* Scales: FOBS – Fear of Birth Scale, WDEQ - Wijma delivery expectancy/experience questionnaire, FOCQ – Fear of childbirth questionnaire, PHQ9 – Patient health questionnaire, GAD7 – Generalised anxiety disorder, Worry – Penn state worry questionnaire, Rumination – Ruminative response scale, SST – scrambled sentence task to assess for interpretation bias

**Table 4**

*Descriptive Statistics and Partial Correlations Controlling for Stroop Neutral Scores*

| Variable | n | M | SD | FOBS | WDEQ | FOCQ | PHQ9 | GAD7 | Worry | Rumination | SST | Stroop FOC words | Stroop GAD words |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOBS | 111 | 47.7 | 18.5 | - | .64** | .58** | .27** | .32** | .17 | .28** | .47** | .05 | .02 |
| WDEQ | 111 | 68.48 | 24.44 | | - | .70** | .34** | .26* | .26** | .35** | .50** | .20* | .04 |
| FOCQ | 111 | 27.76 | 7.45 | | | - | .42** | .37** | .29** | .34** | .53** | .09 | .01 |
| PHQ9 | 105 | 9.23 | 5.28 | | | | - | .79** | .47** | .69** | .62** | .20 | .14 |
| GAD7 | 105 | 8 | 4.87 | | | | | - | .52** | .72** | .53** | .19 | .09 |
| Worry | 105 | 46.74 | 9.66 | | | | | | - | .54** | .38** | .02 | .08 |
| Rumination | 105 | 45.55 | 12.21 | | | | | | | - | .50** | .17 | .14 |
| SST | 111 | 45.55 | .2 | | | | | | | | - | .21* | .18 |
| Stroop FOC | 103 | 1316.38 | 608.65 | | | | | | | | | - | .48** |
| Stroop GAD | 103 | 1336.89 | 69.36 | | | | | | | | | | - |

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

*Note:* Scales: FOBS – Fear of Birth Scale, WDEQ - Wijma delivery expectancy/experience questionnaire, FOCQ – Fear of childbirth questionnaire, PHQ9 – Patient health questionnaire, GAD7 – Generalised anxiety disorder, Worry – Penn state worry questionnaire, Rumination – Ruminative response scale, SST – scrambled sentence task to assess for interpretation bias, Stroop FOC – reaction times for the FOC words shown in the emotional stroop task, Stroop GAD - reaction times for the GAD words shown in the emotional stroop task, Stroop threat – average reaction times for FOC and GAD words in the emotional stroop task

**Table 5**

*Descriptive Statistics and Partial Correlations Controlling for D Prime Neutral Scores*

| Variable | FOBS | WDEQ | FOCQ | PHQ9 | GAD7 | Worry | Rumination | SST | D Prime Threat |
|---|---|---|---|---|---|---|---|---|---|
| FOBS | | .65** | .60** | .32* | .36** | .15 | .32* | .49** | -.054 |
| WDEQ | | - | .70** | .42** | .27* | .18 | .41** | .53** | -.34** |
| FOCQ | | | - | .40** | .35** | .24* | .34** | .53** | -.20 |
| PHQ9 | | | | - | .76** | .34** | .71** | .63** | -.40** |
| GAD7 | | | | | - | .44** | .71** | .52** | -.35** |
| Worry | | | | | | - | .45** | .30* | -.05 |
| Rumination | | | | | | | - | .51** | -.37** |
| SST | | | | | | | | - | -.31* |
| D Prime Threat | | | | | | | | | - |

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

Note: Scales: FOBS – Fear of Birth Scale, WDEQ - Wijma delivery expectancy/experience questionnaire, FOCQ – Fear of childbirth questionnaire, PHQ9 – Patient health questionnaire, GAD7 – Generalised anxiety disorder, Worry – Penn state worry questionnaire, Rumination – Ruminative response scale, SST – scrambled sentence task to assess for interpretation bias, D prime threat – index score for memory bias for threatening words from recognition task

**Testing Specificity of Cognitive Biases Stimuli in Relation to FOC**

To test Hypothesis 2 that there would be a stronger association between negative biases for attention, interpretation, and memory for context specific material (i.e., relating to labour and birth) when compared to general anxiety related material an ANCOVA was completed for all three tasks (see Table 6). The critical alpha for this was set to .017 to account for multiple testing.

*Emotional Stroop task (attentional bias).* A repeated-measures analysis of covariance was conducted to assess the relationship between stimulus type (GAD, FOC, and neutral stimuli) and the interaction with FOC on reaction times in the emotional Stroop task. The within subjects factor was the stimuli type (FOC, GAD, or Neutral words) and the covariate was the FOC measure (FOBS, WDEQ, or FOCQ). Three separate analyses were conducted for each FOC measure, and the critical *p* was adjusted. There was no significant main effect of stimulus type found, no effect of FOC and no interaction between any of the three FOC measures. This suggested that the effects of stimulus type on reaction times were not influenced by FOC scores.

*Scrambled Sentence Task (interpretation bias).* For the SST ($N$ = 107) completed five or more grammatically correct FOC sentences and ($n$ = 60) GAD sentences. A repeated measures analysis of covariance was conducted to assess the effect of stimulus type (FOC and GAD), FOC scores, and their interaction on interpretation bias. The within subjects factor was the sentence type (GAD or FOC), and the covariate was the FOC measure (FOBS, WDEQ, or FOCQ). No significant interaction effect was found between sentence type and any of the three FOC measures. This suggests that the effect of stimulus type (FOC or GAD) on interpretation valence scores were not influenced by FOC.

*Recognition task (memory bias).* A repeated-measures ANCOVA was conducted to assess the effect of stimulus type (FOC and Neutral), FOC scores and their interaction on memory bias. The within subjects' factor was the word type (FOC or neutral) and the covariate was the FOC measure (FOBS, WDEQ, or FOCQ). No significant interaction effect was found between word type and any of the three FOC measures. This suggests that the effect of stimulus type (FOC or neutral) on *d*' scores for explicit memory bias was not influenced by FOC scores. Therefore, these results indicated that our second hypothesis was not supported as there did not appear to be a stronger association between attention, interpretation, and memory bias scores for context-specific material.

**Table 6**

*ANCOVA Results Cognitive Bias Tasks and FOC measures*

| | | | ANCOVA | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | FOBS | | WDEQ | | FOCQ | |
| Bias | M | SD | Main effect | Interaction | Main effect | Interaction | Main effect | Interaction |
| Attention | | | F(1, 101) = | F(1, 101) = | F(1, 101) = | F(1, 101) = | F(1, 101) = | F(1, 101) = |
| FOC words | 1316.38 | 608.65 | 0.25, p = | 0.80, p = .37 | 0.88, p = | 1.80, p = .18 | 0.12, p = .73 | 0.38, p = .54 |
| GAD words | 1336.89 | 696.36 | .62 | | .35 | | | |
| Neutral words | 136.01 | 738.96 | | | | | | |
| Interpretation | | | F(1, 58) = | F(1, 58) = | F(1, 58) = | F(1, 58) = | F(1, 58) = | F(1, 58) = 0.19, |
| FOC sentence | .24 | .25 | 2.59, p = | 1.88, p = .12 | 0.72, p = | 0.31, p = .56 | 0.44, p = .51 | p = .67 |
| GAD sentence | .25 | .22 | .12 | | .40 | | | |
| Memory | | | F(1, 109) = | F(1, 109) = | F(1, 109) = | F(1, 109) = | F(1, 109) = | F(1, 109) = |
| FOC Words | .34 | .77 | 0.15, p = | 0.21, p = .65 | 1.65, p = | 1.73, p = .19 | 0.11, p = .74 | 0.10, p = .76 |
| Neutral words | .33 | .68 | .70 | | .20 | | | |

Note: Scales: FOBS – Fear of Birth Scale, WDEQ - Wijma delivery expectancy/experience questionnaire, FOCQ – Fear of childbirth questionnaire. Bias: tasks Attention (stoop task), Interpretation (scrambled sentence task), Memory (recognition task)

**Association between Attention, Interpretation, Memory Biases and FOC**

Standardised residual scores were created for the Stroop data. The FOC and GAD stimuli scores were collapsed, and the standardised residual scores controlled for the neutral stimuli reaction times. The interpretation bias scores used were representative of the FOC and GAD sentences. Finally, the *d*' scores that were created for the recognition task data that accounted for guessing as a strategy were used in the following regression analyses. The alpha for this was set to $p < .017$ to account for multiple testing.

*Two item measure Fear of Birth Scale (FOBS).* When controlling for gestation and parity at the first step, the results of the multiple regression indicated that the full model explained 27% of the variance, and the full model containing all of the predictors was significant $F(5, 84) = 6.25$, $p = <.001$. Attention bias did not significantly predict FOC ($B_1 = -0.87$, $p = .6$), interpretation bias did significantly predict FOC ($B_1 = 46.92$, $p = <.001$), and memory bias did not significantly predict FOC ($B_1 = 1.96$, $p = .27$) as measured by the FOBS. The analysis was then re-run to control for general anxiety as measured by the GAD7. When controlling for gestation, parity and general anxiety, the results of the regression indicated that the model explained 29% of the variance, and the full model containing all of the predictors was significant $F(6, 83) = 5.54$, $p = <.001$. It was found that attention bias did not significantly predict FOC ($B_1 = -.9$, $p = .58$), interpretation bias still significantly predicted FOC ($B_1 = 40.3$, $p = <.001$), memory bias did not significantly predict FOC ($B_1 = 2.33$, $p = .2$) as measured by the FOBS.

*Wijma delivery expectancy/experience questionnaire (WDEQ).* When controlling for gestation and parity, the results of the multiple regression indicated that the model explained 39% of the variance and the full model containing all of the predictors was significant $F(5, 84) = 10.66$, $p = <.001$. It was found that attention bias did not significantly predict FOC ($B_1$

= -0.3, $p$ = .89), interpretation bias did significantly predict FOC ($B_1$ = 64.1, $p$ = <.001), memory bias did not significantly predict FOC ($B_1$ = 3.37, $p$ = .14), parity did not significantly predict FOC ($B_1$ = 5.11, $p$ = .27) and gestation did significantly predict FOC ($B_1$ = 0.73, $p$ = .03) as measured by the WDEQ. The analysis was then re-run to control for general anxiety as measured by the GAD7. When controlling for gestation, parity and general anxiety, the results of the regression indicated that the model explained 39% of the variance and the full model containing all of the predictors (three cognitive biases) was significant $F$(6, 83) = 8.79, $p$ = <.001. It was found that attention bias did not significantly predict FOC ($B_1$ = -.29, $p$ = .89), interpretation bias did significantly predict FOC ($B_1$ = 65.67, $p$ = <.001), memory bias did not significantly predict FOC ($B_1$ = -3.45, $p$ = .14), parity did not significantly predict FOC ($B_1$ = 5.24, $p$ = .27), gestation did not significantly predict FOC ($B_1$ = .73, $p$ = .03) and general anxiety did not significantly predict FOC ($B_1$ = -.13, $p$ = .82) as measured by the WDEQ.

*Fear of Childbirth Questionnaire (FOCQ).* When controlling for gestation and parity, the results of the multiple regression indicated that the model explained 33% of the variance and the full model containing all of the predictors was significant $F$(5, 84) = 8.36, $p$ = <.001. It was found that attention bias did not significantly predict FOC ($B_1$ = -.52, $p$ = .45), interpretation bias did significantly predict FOC ($B_1$ = 21.49, $p$ = <.001), memory bias did not significantly predict FOC ($B_1$ = -0.07, $p$ = .92), parity did not significantly predict FOC ($B_1$ = 1.46, $p$ = .34) and gestation did not significantly predict FOC ($B_1$ = 0.1, $p$ = .38) as measured by the FOCQ. The analysis was then re-run to control for general anxiety as measured by the GAD7. When controlling for gestation, parity and general anxiety, the results of the regression indicated that the model explained 34% of the variance and the full model containing all of the predictors was significant $F$(6, 83) = 7.11, $p$ = <.001. It was found that attention bias did not significantly predict FOC ($B_1$ = -0.53, $p$ = .45), interpretation bias did

significantly predict FOC ($B_1$ = 19.37, $p$ = <.001), memory bias did not significantly predict FOC ($B_1$ = -0.04, $p$ = .96), parity did not significantly predict FOC ($B_1$ = 1.28, $p$ = .41), gestation did not significantly predict FOC ($B_1$ = .1, $p$ = .38) and general anxiety did not significantly predict FOC ($B_1$ = .18, $p$ = .34) as measured by the FOCQ. Therefore, our hypothesis was supported for interpretation bias, but not for attentional or memory bias.

Therefore, higher scores on the three measures for FOC were associated with higher levels of worry, rumination, general anxiety, and depression. Stimulus type (FOC, GAD and/or neutral) scores were not influenced by FOC scores across the three cognitive bias tasks. Finally, negative interpretation bias was found to significantly predict higher levels of FOC on all three measures even when controlling for parity, gestation, and general levels of anxiety. The measure of attentional bias and memory bias were not significant predictors of FOC.

**Table 7**

*Regression Results Cognitive Bias Tasks and FOC Measures*

| | **FOBS** | **WDEQ** | **FOCQ** |
|---|---|---|---|
| | **Regression 1** | **Regression 2** | **Regression 3** |
| Predictor Variables | | | |
| Step 1 | | | |
| Parity | -3.39 | 5.24 | 1.28 |
| Gestation | 0.25 | 0.73 | 0.10 |
| General Anxiety | 0.58 | -0.13 | 0.18 |
| | | | |
| Step 2 | | | |
| Attention bias | 0.87 | -0.29 | -0.53 |
| Interpretation bias | 46.92** | 65.67** | 19.37** |
| Memory bias | 1.96 | -3.45 | -0.04 |

*Note:* FOBS – Fear of Birth Scale, WDEQ – Wijma delivery expectancy/experience questionnaire, FOCQ – Fear of childbirth questionnaire

## Discussion

This cross-sectional study examined the association between three cognitive biases (attention, interpretation, and memory) and three measures of FOC (two item FOBS, WDEQ, and FOCQ) in a large sample of the general population of women who were 12 weeks pregnant or more. No study has previously assessed attention, interpretation and memory bias and their potential associations with fear of childbirth in a general sample of pregnant women.

In support of our first hypothesis, we found that there was a linear positive association between levels of FOC, low mood, GAD, worry and rumination; that is, women who scored higher for FOC on all three measures, had higher scores on the measures for worry, rumination, general anxiety, and depression. When controlling for the reaction times for neutral words shown in the stroop task, there was a significant positive linear relationship found between the reaction times to the FOC words, the scores on the WDEQ measure for FOC and the interpretation bias scores. This indicated that higher FOC scores were associated with increased reaction times on the FOC stimuli in the stroop task, meaning participants were slower to react. Additionally, higher scores on the interpretation bias task (indicating a more negative interpretation bias) had a linear relationship with longer reaction times to FOC stimuli in the Stroop task for attentional bias. There were no other significant associations between the reaction times to FOC or GAD words in the Stroop task nor any other measure. When controlling for the neutral words shown in the recognition task for memory bias, (measured by the D prime index) there was a negative linear relationship between FOC words and the WDEQ measure for FOC, low mood, general anxiety, and rumination. This indicated that women who had higher scores on the WDEQ measure for FOC, higher scores on the measures for low mood, general anxiety and rumination had a

poorer ability to recall FOC words they had previously seen. This was not found in the other two measures for FOC (FOBS and FOCQ). As has been found in previous literature assessing FOC, the prevalence of higher levels of FOC varies depending on which measure is employed, which was also displayed in this sample.

We did not find that the stimuli type in the three cognitive bias tasks for attention, interpretation or memory had any significant interaction with any of the three measures used to assess FOC. Therefore, in this study, there do not appear to be any differences in general or in interaction with FOC scores between FOC, GAD or neutral stimuli in the bias tasks used. This means that scores on the FOC stimuli, in comparison to the GAD and neutral stimuli in the three cognitive bias tasks, were not impacted by FOC scores.

In the present study, we did find, in support of our third hypothesis; that higher scores on all three measures of FOC were associated with a higher score for negative interpretation bias when presented with ambiguous sentences in the scrambled sentence task. Therefore, when presented with ambiguous information, individuals who scored higher on the measures for FOC were more likely to create negative sentences from ambiguous information. This relationship was still present when we controlled for parity, gestation, and general levels of anxiety. This finding gives evidence of the potential for a negative interpretation bias to predict levels of FOC in pregnant women beyond 12 weeks' gestation. We did not find that individuals who scored higher on FOC on the three measures used had faster reaction times for FOC related stimuli, nor did they have higher memory bias scores for FOC words.

Firstly, considering attention bias, in previous studies that investigated a general population sample, they found that increased levels of anxiety were associated with attention bias for stimuli that match the content of the worries generating the anxiety (Hirsch et al., 2011; Mathews & MacLeod, 2005). We did not see a difference in the reaction times for emotionally salient stimuli (FOC words or GAD words) in comparison to neutral words in

our sample. However, due to the task being completed in participant's homes and outside of the lab, there was perhaps an accuracy-speed trade-off that occurred (Wickelgren, 1977). The rationale for this is that the overall mean times taken for the three groups of words were larger than what has been found in previous research using an emotional stroop in a lab setting (Edvinsson et al., 2017; Staller et al., 2017) and there were very few errors (maximum three) across the 90-word trials. Additionally, our study did not recruit a specific group of individuals with clinically high levels of FOC and the average scores on the three measures used to assess FOC did not meet the clinical cut of score for caseness. When viewing the literature for attentional bias in anxiety, a large meta-analysis found that across disorders, attentional biases were only found in those with clinical levels of anxiety, and the effect was not observed in non-anxious individuals (Bar-Haim et al., 2007).

Although we examined these associations cross-sectionally, the current finding for interpretation bias is in line with other studies that have found an association between general anxiety and interpretation bias in non-pregnant populations (Krahé et al., 2019). In addition, our findings are also in line with research assessing interpretation bias, general anxiety and pregnancy-related anxiety in the perinatal period (Hirsch et al., 2020). Although this study assessed negative interpretation bias in relation to pregnancy-related anxiety and not FOC, they also found that women who scored higher on a measure of general and pregnancy-related anxiety were more likely to present with a negative interpretation bias. Additionally, a study that used interpretation modification training found that in a sample of pregnant women experiencing high levels of worry they were able to induce a positive interpretation bias (Hirsch et al., 2021). Therefore, our findings extend this literature into FOC. Our findings are theoretically informative as it adds to the literature on cognitive biases in the perinatal period. The findings indicate that women with higher levels of FOC are likely to negatively interpret ambiguous stimuli irrespective of their parity, gestation time point and general levels of

anxiety. This could potentially extend to their daily lives; when the individual is faced with ambiguity, they may interpret this negatively. This could then lead to an increase in negative thoughts. Previous literature has shown how this can lead to a rise in repetitive negative thinking, leading to a further increase in negative interpretations (Hirsch et al., 2016; Hirsch & Mathews, 2012).

In our study, memory bias did not predict levels of FOC, however there did appear to be a negative linear relationship with only the WDEQ scale for measuring FOC. This indicated that when measuring FOC using only the WDEQ scale, women who reported higher levels of FOC had a poorer ability to discriminate previously seen negative words that related to childbirth from novel negative words related to childbirth. This was not found on the two-item FOBS or the FOCQ measurements for FOC. However, when looking at the evidence for explicit memory bias in other anxiety disorders not in a pregnant population, the results are contradictory. A bias for recalling threatening stimuli has been observed in other anxiety disorders, however, this appears to occur only in free recall tasks (Herrera et al., 2017). Despite the poor evidence for memory bias, we included it as this research area has not previously been explored in FOC. Relatively few studies have addressed cognitive biases in the perinatal period, and none have assessed the three cognitive biases that were used in this study and assessed their relationship with FOC. The findings of this study represent a significant contribution to this field.

**Strengths and Limitations**

A limitation of this study is the cross-sectional nature as we cannot generalise or draw any conclusions regarding the potential for cognitive biases to maintain FOC. Additionally, we did not find an effect of stimulus type (FOC, GAD versus neutral) in our data. However, the GAD stimuli used in this study for the emotional Stroop task for attentional bias and the scrambled sentence task for interpretation bias were taken from previous research and were

written in the first person. Therefore, this may have inadvertently allowed for the GAD materials used in this study to be processed as personally salient and related to their upcoming childbirth due to their general nature, e.g., worries about money which was a GAD stimulus may have elicited fears regarding economic stability postpartum. It is suggested that in future studies phobic specific material, such as a fear of heights be used in order to reduce any dilution of specificity effects. Additionally, it should be acknowledged that there are also sample limitations within this study. Although we opened the study at a large maternity hospital with a diverse range of women and birthing people, our sample is predominately white, educated and in a stable relationship. Therefore, the results cannot be generalised to groups of women who identify differently. It also appears from the prevalence of FOC found that this is a particularly fearful sample of the general population. However, as with previous research findings, the prevalence differs depending on which measure is used to assess levels of FOC which has also been found in this sample. Perhaps the nature of the study allowed for individuals who were more fearful to elect to participate creating a sampling bias of individuals with higher levels of FOC to complete the study.

Regardless of the limitations identified, they are balanced out by noteworthy strengths. A major strength of this study was the involvement of the experts by experience in creating the cognitive bias task stimuli. The FOC stimuli used in the experimental tasks were created and piloted with women who identified as having high levels of FOC who were either pregnant or had given birth in the past year. The words used in the emotional Stroop task, and the sentences used in the scrambled sentence task were generated with six women over two sessions. Another strength of this study is the novel nature and the potential for the findings to guide future research.

## Future Research

Future studies could compare groups of women with clinical levels of FOC in comparison to a control group of women without FOC to investigate between-group differences. Additionally, they could add a measure of post-traumatic stress disorder as many multiparous women have had a previous negative experience of childbirth and this can be the cause of their current FOC symptoms (Ertan et al., 2021; Slade et al., 2021).

## Relevance to Clinical Practice

The clinical implications of this research are the contribution of the findings to the further understanding of FOC. The results add to the knowledge base that can research further how to further understand FOC presentations, both in a general sample and in clinical samples. This could then possibly, if results were replicated, lead to the creation of therapies to support women presenting with FOC. Previously, worry and rumination have been found to be modifiable and when reduced can decrease distress (Jones & Sharpe, 2017). Individuals with general anxiety presentation have benefitted from cognitive bias modification (CBM), which is a treatment that attempts to modify cognitive processing biases. There are multiple types of CBM, with one being specifically created for interpretation bias. A review of meta-analyses shows how CBM has been effective in reducing anxiety symptoms by targeting negative interpretation biases (Jones & Sharpe, 2017). Commonly used CBM for interpretation bias training are the Ambiguous Scenarios paradigm (Blackwell & Holmes, 2010), the Word Sentence Association Paradigm (Amir & Taylor, 2012) and the Homograph Paradigm (Grey & Mathews, 2009). Future research therefore could investigate the potential for the use of CBM, using the training methods outlined, for the reduction of negative interpretation biases' and assess if this has an impact on symptoms of FOC for pregnant women. However, further research using a between subjects design assessing clinical groups to non-clinical groups would first need to be completed to see if the results found in this

study on a normal sample were replicated before any studies attempting to modify interpretation bias in a pregnant sample could be conducted.

## Conclusion

In conclusion, this study found that a negative interpretation was present for individuals scoring higher on three measures of FOC, even when controlling for parity, gestation, and levels of general anxiety. It also found that higher levels of FOC, as measured by three scales, were associated with higher levels of low mood, general anxiety, worry and rumination in a pregnant population beyond 12 weeks' gestation. It also showed that higher levels of FOC when measured only by the WDEQ were associated with a poorer ability to recall threatening words. It did not find evidence of an attentional bias to threatening stimuli, nor did it find a memory bias for threatening words. Together, these findings contribute novel evidence in support of a relationship between FOC and a negative interpretation bias in pregnant women.

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# Appendices

## Appendix A

Author Guidelines for Journal of Anxiety Disorders

JOURNAL OF ANXIETY DISORDERS

AUTHOR INFORMATION PACK

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### DESCRIPTION

*Journal of Anxiety Disorders* is an interdisciplinary journal that publishes research papers dealing with all aspects of anxiety disorders for all age groups (child, adolescent, adult and geriatric). Manuscripts that focus on disorders formerly categorized as anxiety disorders (obsessive-compulsive disorder, posttraumatic stress disorder) and the new category of illness anxiety disorder are also within the scope of the journal. Research areas of focus include: traditional, behavioral, cognitive and biological assessment; diagnosis and classification; psychosocial and psychopharmacological treatment; genetics; epidemiology; and prevention. Theoretical and review articles that contribute substantially to current knowledge in the field are appropriate for submission.

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# Appendix B

Appraisal of Cross-Sectional Studies (AXIS) Tool

**Appraisal of Cross-sectional Studies**

| | Question | Yes | No | Don't know/ Comment |
|---|---|---|---|---|
| ***Introduction*** | | | | |
| 1 | Were the aims/objectives of the study clear? | | | |
| ***Methods*** | | | | |
| 2 | Was the study design appropriate for the stated aim(s)? | | | |
| 3 | Was the sample size justified? | | | |
| 4 | Was the target/reference population clearly defined? (Is it clear who the research was about?) | | | |
| 5 | Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation? | | | |
| 6 | Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation? | | | |
| 7 | Were measures undertaken to address and categorise non-responders? | | | |
| 8 | Were the risk factor and outcome variables measured appropriate to the aims of the study? | | | |
| 9 | Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously? | | | |
| 10 | Is it clear what was used to determined statistical significance and/or precision estimates? (e.g. p-values, confidence intervals) | | | |
| 11 | Were the methods (including statistical methods) sufficiently described to enable them to be repeated? | | | |
| ***Results*** | | | | |
| 12 | Were the basic data adequately described? | | | |
| 13 | Does the response rate raise concerns about non-response bias? | | | |
| 14 | If appropriate, was information about non-responders described? | | | |
| 15 | Were the results internally consistent? | | | |
| 16 | Were the results presented for all the analyses described in the methods? | | | |
| ***Discussion*** | | | | |
| 17 | Were the authors' discussions and conclusions justified by the results? | | | |
| 18 | Were the limitations of the study discussed? | | | |
| ***Other*** | | | | |
| 19 | Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results? | | | |
| 20 | Was ethical approval or consent of participants attained? | | | |

# Appendix C

Supplementary information on the creation of the materials for the cognitive bias experiential stimuli with experts by experience.

The following outlines how the fear of childbirth (FOC) stimuli for the bias tasks were created with experts by experience prior to the creation of the study tasks in chapter 2. It will explain how each task was created and validated prior to piloting. It will also outline the final changes that were made to ensure their robustness prior to being made live in the final experiment.

## Generation of the FOC Stimuli

*Session one.* The first group was run in January 2021 ($n$ = 3) via zoom video call and the second in March 2021 ($n$ = 3). There were six women across the two groups, four of whom were currently pregnant and two who had given birth in the past six months. All women indicated that they were afraid of their upcoming birth, or they had experienced high levels of fear prior to their most recent birth. Both sessions lasted for 1.5 hours, and the women were asked to talk about what they feared regarding childbirth and asked to describe their fears in detail. Both sessions were audio recorded.

The main themes that emerged were fear of not being in control during labour, fear of being or feeling sick during the labour, fear of a lack of support or explanation from services, fear of an absence of a safe space to talk about the experience of childbirth. There was also the fear of being told that you will be fine and then ‘going in blind’ to the birth or feeling rushed in perinatal appointments and not being given any time to speak about fears surrounding the birth. There were fears around people expecting you to ‘know everything on your first pregnancy’ and not being given enough information and then fears that ‘you’re not doing it right’. There was a fear of ‘not knowing what was happening’ to them, which also led to an overarching theme of a fear of the unknown.

Those that had previous experience of childbirth discussed how their previous birth did not go how they had envisaged, and this left them with uncertainty and fear for future pregnancies. There were themes of feeling unsafe and alone during their previous birth, which also led to a discussion between the women of being 'done to' in their previous birth leaving them with fears and anxiety for their upcoming birth. There was a shared sense of the upcoming birth feeling very overwhelming and this causing them fear and anxiety also.

The women in both groups were also asked to complete a free association task with single word prompts that related to childbirth (e.g., birth, labour, contractions). When they provided words that they associated with the prompt stimuli, they were asked to explore these further; what they meant, where it took them, what visuals it created for them and single words relating to childbirth were generated.

The sessions were audio recorded and listened to in detail after the group. Any words that were related to fear of childbirth were captured from the audio. These words were then entered into an excel file and were paired to the themes from a paper exploring the most common fears around childbirth (P. Slade et al., 2019). Sentences were also created for the scrambled sentence task as well as selecting individual words for the stroop task. The three researchers then then met via zoom and discussed the words collected from the sessions.

**FOC Stimuli for Stroop Task (Attention Bias)**

The Stroop task stimuli words were created for this project and had not been used in previous research as this is a novel area of investigation. The 30 words used in the final stroop task were generated from the previous sessions with the experts by experience knowledge generation sessions. These words were then paired with 30 neutral words and 30 general anxiety words. The general anxiety words were taken from previous research (Krahé et al., 2019) and the neutral words were chosen to match the FOC related words.

The words were matched for valence and length. For valence, the words were checked using a large norms database with 14,000 English lemmas (Warriner et al., 2013). The length was checked by counting the number of letters in each word in each list. The researcher also attempted to match the words on frequency, however due to the specific nature of the FOC words many (17/30) were not listed in the frequency table (Leech et al., 2001) and therefore a frequency score could not be generated for the FOC words.

A one way between groups analysis of variance was conducted to explore if there was a difference in the valence of the three groups of words (FOC, General anxiety and Neutral words). There was a statistically significant difference at the $p < .05$ level in the valance ratings for the three groups of words $F(2, 85) = 281.15$, $p = .001$. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for FOC words ($M = 2.69$, $SD = 0.10$) was significantly different from Neutral words ($M = 5.58$, $SD = 0.53$). However, there was no significant difference between FOC words and General Anxiety words ($M = 2.69$, $SD = 0.55$). These results indicated that the FOC words had a more negative valance rating than the neutral words but did not differ in valence from the general anxiety words.

Another one way between groups analysis of variance was conducted to explore if there was a difference in the word length of the three groups of words (FOC, General anxiety and Neutral words). There was no statistical difference found between the three groups $F(2, 87) = .03$, $p = .97$. Post-hoc comparisons using the Tukey HSD test indicated that there were no significant differences between the three groups. Therefore, the three groups of words did not differ in terms of word length. After the words were chosen, analysed for valence and length bias, then were entered into the Stroop test that was created on lab.js, hosted on Netlify and then embedded into the Qualtrics survey.

**Creation of Scrambled Sentence Task Materials (Interpretation Bias)**

The scrambled sentences task was modelled on previous studies seeking to investigate interpretation bias in individual with generalised anxiety disorder (Krahé et al., 2019). From the two group sessions, 20 FOC related scrambled sentences were created. The general anxiety sentences were taken from those used in the previous research looking at GAD and interpretation bias (Krahé et al., 2019). The 20 scrambled sentences created were pilot tested and 10 were retained for use in the study.

**Creation of Recognition Task Materials (Memory Bias)**

The memory bias task was an explicit Yes/No, forced recognition task. The words used ($n$ = 44) were a mix of novel and seen single words that were generated by the experts by experience sessions. The stimuli chosen were FOC words ($n$ = 11) and neutral words ($n$ = 11) that were presented in the Stroop task and novel unseen FOC words ($n$ = 11) and neutral words ($n$ = 11). The word lists were checked for differences in valence and word length. As before many (10/20) of the FOC words did not appear in the frequency table and therefore frequency could not be assessed.

A one way between groups analysis of variance was conducted to explore the impact of word type (FOC vs Neutral) on valence and word length, irrespective of if they had been seen previously or were novel. There was a statistically significant difference on the valence ratings for the FOC and neutral words $F(1, 39) = 149.69$, $p = < .001$. There was not a statistically significant difference found between the two groups for word length $F(1, 42) = 0.02$, $p = .90$ and frequency $F(1, 29) = 0.05$, $p = .91$. This indicated that the FOC words were more negative than the neutral but did not differ on length.

Another one way between groups ANOVA was conducted to see if there was a difference between the four groups of words (FOC Stroop, FOC Novel, Neutral Stroop, Neutral Novel). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for valence for FOC Stroop (previously seen FOC words) ($M$ = 2.77, $SD$ = 0.75) and

FOC Novel (*M* = 3.42, *SD* = 0.60) were not statistically different. The valence scores for FOC Stroop (previously seen FOC words) were statistically different from the Neutral Stroop (*M* = 5.53, *SD* = 0.58) and Neutral novel (*M* = 5.3, *SD* = 0.33) words and the Novel Stroop and Neutral Novel words were not statistically different. The FOC novel words were also statistically different from the Neutral Stroop and Neutral Novel words. Additionally, post-hoc comparisons using the Tukey HSD test indicated that the mean score for word length scores for FOC Stroop (*M* = 7.27, *SD* = 2.20) and FOC Novel (*M* = 8.90, *SD* = 2.91) words were not statistically different. The FOC Stroop and the FOC Novel did not differ statistically from the Neutral Stroop (*M* = 7.45, *SD* = 1.97) or the Neutral Novel (*M* = 3.42, *SD* = 2.77) words. The Neutral Stroop words and the Neutral Novel words were not significantly different from one another. Therefore, the analysis shows how the FOC words (both novel and previously presented in Stroop) were statistically different from the Neutral (both novel and from the Stroop) on valence, showing that the FOC words were perceived as more negative than the neutral words. Finally, none of the word lists were statistically different on word length (number of letters in each word

**Pilot Study**

The study tasks were piloted with a group of experts by experience after the materials were created. In order to replicate the future study population, the experts by experience were a mix of women with high and low levels of FOC. A new group of experts by experience (*n* = 6) were asked to pilot the three bias tasks (Stroop, scrambled sentences task and recognition task) on their laptop and to feedback any changes or queries they had via email. This allowed the experts by experience to complete the study in their own time and was the most accessible option for the group. The participants were reimbursed for their time. No major changes were requested. There was general feedback provided that can be seen below and was taken into consideration prior to distributing the survey to participants. From the data

provided by the experts by experience, 10 FOC related sentences were retained for use the larger study from the 20 that were used in the pilot study. Finally, the experts by experience were also asked to provide feedback on the participant invitation letter that would be circulated to advertise the study. Feedback was collected via email. Please see Tables 1, 2 and 3 containing the words for the stroop task, sentences for the scrambled sentence task and words for the recognition task generated from the two sessions.

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**Table 1 Stroop Stimuli with corresponding text colour shown in experimental task**

| Practice trial | Word text colour |
|---|---|
| Walk | Orange |
| Expand | Red |
| Potato | Blue |
| Decide | Green |
| Expand | Orange |
| Pod | Green |
| Walk | Orange |
| Decide | Red |
| Potato | Green |
| Walk | Blue |
| Expand | Orange |
| Potato | Red |
| Decide | Blue |
| Expand | Orange |
| Pod | Orange |
| Walk | Red |
| Expand | Green |
| Potato | Blue |
| Decide | Red |
| Expand | Orange |
| Pod | Blue |
| Decide | Green |
| Walk | Red |
| Expand | Blue |
| Pod | Red |

| Neutral words | A* | B* | C* | Colour | FOC | A | B | C | Colour | General anxiety | A | B | C | Colour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Umbrella | 5.84 | 8 | N/A | Blue | Overdue | 3.39 | 7 | N/A | Red | Weak | 2.95 | 4 | 45 | Orange |
| Categorized | 5.05 | 11 | 34 | Red | Stillbirth | N/A | 10 | N/A | Orange | Nervous | 3.56 | 7 | 31 | Blue |
| Locker | 4.97 | 6 | N/A | Green | Premature | 4.1 | 9 | N/A | Green | Insecure | 2.3 | 8 | N/A | Red |
| Writing | 6.45 | 7 | 53 | Orange | Breech | 3.14 | 6 | N/A | Blue | Pathetic | 3.11 | 8 | N/A | Orange |
| Scrapbook | 5.71 | 9 | N/A | Blue | Unbearable | 2.1 | 10 | N/A | Orange | Inferior | 3.43 | 8 | N/A | Green |
| Parking | 4.75 | 7 | 15 | Red | Agony | 2.46 | 5 | 10 | Green | Failure | 2.15 | 7 | 88 | Blue |
| Residential | 6.05 | 11 | 29 | Orange | Cutting | 3.9 | 7 | 16 | Blue | Indecisive | 3.52 | 10 | N/A | Green |
| Forehead | 5.04 | 8 | 14 | Green | Tearing | 3.14 | 7 | 88 | Green | Assault | 2.05 | 7 | 26 | Orange |
| Pencil | 5.65 | 6 | 14 | Red | Forceps | 3.8 | 7 | N/A | Red | Debts | 1.95 | 5 | 73 | Red |
| Translate | 5.67 | 9 | 22 | Orange | Immobile | 2.89 | 8 | N/A | Orange | Incompetent | 2.26 | 11 | N/A | Red |
| Metaphor | 6.11 | 8 | 12 | Green | Induction | 5.32 | 9 | 22 | Blue | Injury | 2.32 | 6 | 72 | Orange |
| Doubled | 5.78 | 7 | 12 | Orange | Abandoned | 2.84 | 9 | 44 | Orange | Criticised | 2.41 | 10 | 21 | Green |
| Currency | 5.9 | 8 | 43 | Red | Rushed | 4.05 | 6 | 15 | Green | Boring | 2.71 | 6 | 16 | Blue |
| Chair | 5.89 | 5 | 97 | Blue | Damage | 2.98 | 6 | 93 | Red | Inadequate | 2.57 | 10 | 23 | Red |
| Routine | 4.95 | 7 | 35 | Blue | Traumatic | 2.22 | 9 | N/A | Green | Ashamed | 2.52 | 7 | 11 | Orange |
| Collage | 5.05 | 7 | N/A | Green | Unsafe | 2.84 | 6 | N/A | Blue | Foolish | 3 | 7 | 12 | Orange |
| Screwdriver | 5.76 | 11 | N/A | Red | Stuck | N/A | 5 | 13 | Red | Accident | 2.55 | 8 | 84 | Blue |
| Particular | 5.05 | 10 | 223 | Blue | Pain | 2 | 4 | 84 | Orange | Violence | 2.71 | 8 | 56 | Red |
| Intermediate | 5.05 | 12 | 13 | Orange | Emergency | 2.72 | 9 | 43 | Green | Threatened | 2.6 | 10 | 70 | Orange |
| Baseline | 5.4 | 8 | N/A | Green | Uncontrollable | 3.84 | 14 | N/A | Orange | Worried | 3.27 | 7 | 38 | Green |
| Demonstration | 5.47 | 13 | 33 | Blue | Excruciating | 2.1 | 12 | N/A | Blue | Embarrassed | 3.51 | 11 | 13 | Blue |
| Essence | 6.75 | 7 | 20 | Red | Bleeding | 2.47 | 8 | N/A | Red | Tensing | 2.75 | 7 | 33 | Green |
| Florist | 6.55 | 7 | N/A | Orange | Rupture | 3.21 | 7 | N/A | Green | Panicking | 2.56 | 9 | 18 | Orange |
| Giveaway | 6.17 | 8 | N/A | Green | Needles | 3.97 | 7 | 23 | Orange | Powerless | 2.9 | 9 | N/A | Red |
| Hibernation | 6.05 | 11 | N/A | Red | Restrained | 4.42 | 10 | 15 | Red | Disaster | 1.71 | 8 | 34 | Green |
| Limestone | 5.05 | 9 | N/A | Blue | Unaccompanied | N/A | 13 | N/A | Blue | Worthless | 1.89 | 9 | N/A | Orange |
| Inch | 5.4 | 4 | 41 | Orange | Clots | 2.95 | 5 | N/A | Green | Catastrophe | 2.7 | 11 | N/A | Blue |
| Indicate | 5.05 | 8 | 124 | Green | Infection | 2 | 9 | 34 | Orange | Anxious | 3.8 | 7 | 31 | Red |
| Magnet | 5.65 | 6 | 15 | Red | Unheard | 4.16 | 7 | N/A | Red | Failure | 2.15 | 7 | 88 | Orange |
| Measure | 5.14 | 7 | 112 | Orange | Miscarriage | 2.48 | 11 | N/A | Blue | Trembling | N/A | 9 | 9 | Blue |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Average | 5.58 | 8.2 | N/A | | 3.17 | 8.1 | N/A | | 2.69 | 8.0 | N/A |

*Note: A* Valence of each word, B* Length of each word (number of letters), C* Frequency Score of each word*

**Scrambled sentence task 20 sentences used in final experimental study**

The dimensions from (Slade et al., 2019)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Fear of not knowing and not being able to plan for the unpredictable | Fear of harm or stress to the baby | Fear of inability to cope with the pain | Fear of harm to self in labour and postnatally | Fear of being done to | Fear of not having a voice in decision making | Fear of being abandoned and being alone |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fear of Childbirth Sentences | | | | | | |
| 1 | birth | *will* | *Won't* | go | as | Planned | 1* |
| 2 | I | will | feel | very | *safe* | *Unsafe* | 1 |
| 3 | My | birth | will | be | *Traumatic* | *Uncomplicated* | 1 |
| 4 | My | Baby | will | be | *Harmed* | *Unharmed* | 2 |
| 5 | I | *Do* | *don't* | trust | my | Body | 3 |
| 6 | my | body | will | be | *fine* | *damaged* | 4 |
| 7 | I | *will* | *Won't* | feel | In | control | 5 |
| 8 | My | wishes | will | be | *followed* | *Disregarded* | 6 |
| 9 | I | will | feel | very | *supported* | *abandoned* | 7 |
| 10 | staff | will | be | very | *sympathetic* | *Unsympathetic* | 7 |
| | General Anxiety Sentences | | | | | | |
| 11 | My | life | will | be | *fulfilling* | *Unfulfilling* | |
| 12 | I | *can* | *can't* | manage | my | finances | |
| 13 | I | am | performing | *above* | *below* | expectations | |
| 14 | I | *will* | *wont* | earn | enough | money | |
| 15 | I | find | maintaining | relationships | *difficult* | *easy* | |
| 16 | Others | can | see | my | *merits* | *faults* | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | I'm | *worried* | *indifferent* | about | Other's | opinions |
| 18 | I'm | *able* | *unable* | to | support | myself |
| 19 | Everything | will | turn | out | *fine* | *badly* |
| 20 | Approaching | new | people | is | *fine* | *scary* |

Note: 1* numbers correlate to themes found by Slade, et al. (2019) to ensure that all main fears reported were represented in the stimuli used. Words in italics were optional. Participants were asked to make a grammatically correct sentence using five of the six words shown.

**Recognition Task Stimuli**

| Neutral words | Valence | Word length | Frequency | FOC Words | Valence | Word length | Frequency |
|---|---|---|---|---|---|---|---|
| Previously Presented in Stroop | | | | | | | |
| Scrapbook | 5.71 | 9 | N/A | Premature | S | 9 | N/A |
| Writing | 6.45 | 7 | 53 | Forceps | 3.8 | 7 | N/A |
| Intermediate | 5.05 | 12 | 13 | Excruciating | 2.1 | 12 | N/A |
| Translate | 5.67 | 9 | 22 | Emergency | 2.72 | 9 | 43 |
| Pencil | 5.65 | 6 | 14 | Damage | 2.98 | 6 | 93 |
| Metaphor | 6.11 | 8 | 12 | Bleeding | 2.47 | 8 | N/A |
| Locker | 4.79 | 6 | N/A | Breech | 3.14 | 6 | N/A |
| Parking | 4.75 | 7 | 15 | Tearing | 3.14 | 7 | 88 |
| Chair | 5.89 | 5 | 97 | Pain | 2 | 4 | 84 |
| Measure | 5.14 | 7 | 112 | Rupture | 3.21 | 7 | N/A |
| Magnet | 5.65 | 6 | 15 | Stuck | N/A | 5 | 13 |
| Novel Words | | | | | | | |
| Qualification | 5 | 13 | NA | Complications | 3.05 | 13 | 12 |
| Fashion | 5.26 | 7 | 49 | Bedridden | N/A | 9 | N/A |
| Installation | 5.06 | 12 | 19 | Intervention | 4.14 | 12 | 36 |
| Document | 5.42 | 8 | 95 | Struggle | 3 | 8 | 44 |
| Aluminium | 5.1 | 9 | 10 | Ambulance | 3.71 | 9 | 18 |
| Huge | 5.72 | 4 | 79 | Loss | 2.9 | 4 | 154 |
| Eyebrow | 5.26 | 8 | 14 | Soreness | 2.8 | 8 | N/A |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Establish | 5.58 | 9 | 176 | Disregard | 4.52 | 9 | N/A |
| Kayak | 5.68 | 5 | N/A | Blood | 3.48 | 5 | 102 |
| Meeting | 4.55 | 7 | 215 | Surgery | 3.18 | 7 | 28 |
| Transaction | 5.26 | 11 | 44 | Haemorrhage | N/A | 11 | N/A |

# Appendix D

## Research Review Committee Approval Letter

D.Clin.Psychology Programme
Division of Clinical Psychology
Whelan Building, Quadrangle
Brownlow Hill
LIVERPOOL
L69 3GB

Tel: 0151 794 5530/5534/5877
Fax: 0151 794 5537
www.liv.ac.uk/dclinpsychol

Erin Beal
Clinical Psychology Trainee
Doctorate in Clinical Psychology Programme
University of Liverpool
L69 3GB

14 October 2020

**RE:** Cognitive biases and the Fear of Childbirth
**Trainee:** Erin Beal
**Supervisors:** Charlotte Krahé, Pauline Slade and Gillian Houghton

Dear Erin,

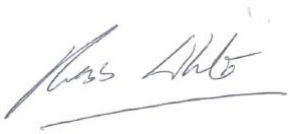
Thank you for your notification of amendment to your proposal submitted to the Chair of the D.Clin.Psychol. Research Review Committee.

I can now confirm that your proposal (*version number 1.2, dated 11th August 2020)* meets the requirements of the committee and have been approved by the Committee Chair.

Please take this Chairs Action decision as ***final*** approval from the committee.

You may now progress to the next stages of your research.

I wish you well with your research project.



Dr Ross White
Vice Chair D.Clin.Psychol. Research Review Committee

# Appendix E

## University of Liverpool Sponsorship Approval Letter and Insurance Certificate

Professor Pauline Slade
Institute of Life and Human Sciences
University of Liverpool
Brownlow Hill,
Liverpool,
L69 3BX
United Kingdom

**Miss Karen Wilding**
**Clinical Research, Sponsorship and Governance Manager**

Clinical Directorate
4th Floor Thompson Yates Building
Faculty of Health and Life Sciences
University of Liverpool
Liverpool L69 3GB

Tel: 0151 794 8739
Email: sponsor@liverpool.ac.uk

08 July 20221

Sponsor Ref: UoL001611

**Re: Sponsor Permission to Proceed notification**

**"EXPloring pattErns of Common ThinkING styles in pregnancy"**

Dear Professor Slade

All necessary documentation and regulatory approvals have now been received by the University of Liverpool Research Support Office in its capacity as Sponsor, and we are satisfied that all Clinical Research Governance requirements have been met. You may now proceed with any study specific procedures to open the study.

The following REC Approved documents have been received by the Research Support Office. Only these documents can be used in the recruitment of participants. If any amendments are required please contact the Research Support Office.

| Document title | Version | Date |
|---|---|---|
| EXPECTING Study Poster | 1.0 | 21 Feb 2021 |
| Participant Invitation letter | 1.0 | 29 Jan 2021 |
| Demographics | 1.0 | 01 Sep 2020 |
| The Fear of Childbirth questionnaire | 1.1 | 21 Apr 2021 |
| Debriefing sheet | 1.0 | 22 Oct 2020 |
| Participant consent form | 1.0 | 11 Feb 2021 |
| Participant Information Sheet | 1.0 | 17 Dec 2020 |
| EXPECTING Study Protocol | 1.0 | 24 Jan 2021 |
| GAD7 | 1.0 | 01 Sep 2020 |
| PHQ 9 | 1.0 | 01 Sep 2020 |
| Ruminative-response scale | 1.0 | 01 Sep 2020 |
| Penn State Worry Questionnaire | 1.1 | 21 April 2021 |
| The Fear of Birth Scale | 1.0 | 21 April 2021 |

Insurance Brokers
12 Princes Parade
Princes Dock
Liverpool L3 1BG

0151 236 5656
info@griffithsandarmour.com
griffithsandarmour.com

Griffiths & Armour

Our Ref: 31040883
26th July 2021

**TO WHOM IT MAY CONCERN**

Dear Sirs,

**CONFIRMATION OF INSURANCE – THE UNIVERSITY OF LIVERPOOL**

As requested by the above client, we are writing to confirm that we act as Insurance Brokers to the client and that we have arranged insurance(s) on its behalf as detailed below:-

**CLINICAL TRIALS**

| | |
|---|---|
| Insurer: | Newline Insurance Company |
| Policy Number: | B1028 DL000050U |
| Period of Insurance: | 1 August 2021 – 31 July 2022 |
| Indemnity Limit: | GBP10,000,000 any one event and in all the period of Insurance or any applicable Extended Discovery period. |
| Deductibles: | GBP5,000 any one claim including costs and expenses. |

We have placed the insurance which is the subject of this letter after consultation with the client and based upon the client's instructions only. Terms of coverage, including limits and deductibles, are based upon information furnished to us by the client, which information we have not independently verified.

This letter is issued as a matter of information only and confers no right upon you other than those provided by the policy. This letter does not amend, extend or alter the coverage afforded by the policies described herein. Notwithstanding any requirement, term or condition of any contract or other document with respect to which this letter may be issued or pertain, the insurance afforded by the policy (policies) described herein is subject to all terms, conditions, limitations, exclusions and cancellation provisions and may also be subject to warranties. Limits shown may have been reduced by paid claims.

We express no view and assume no liability with respect to the solvency or future ability to pay of any of the insurance companies which have issued the insurance(s).

We assume no obligation to advise yourselves of any developments regarding the insurance(s) subsequent to the date hereof. This letter is given on the condition that you forever waive any liability against us based upon the placement of the insurance(s) and/or the statements made herein with the exception only of wilful default, recklessness or fraud.

# Appendix F

NHS Ethical Approval Letter

**Yorkshire & The Humber - South Yorkshire Research Ethics Committee**
NHSBT Newcastle Blood Donor Centre
Holland Drive
Newcastle upon Tyne
NE2 4NQ

Telephone: 0207 1048091

11 May 2021

Professor Pauline Slade
Prof in Clinical Psychology/Consultant Clinical Psychologist
The University of Liverpool
Whelan Building, Brownlow Hill
Liverpool
L69 3GB

Dear Professor Slade

| | |
|---|---|
| **Study title:** | **EXPloring pattErns of Common ThinkING styles in pregnancy** |
| **REC reference:** | **21/YH/0073** |
| **Protocol number:** | **UoL001611** |
| **IRAS project ID:** | **291313** |

Thank you for your letter of 1 May 2021, responding to the Research Ethics Committee's (REC) request for further information on the above research [and submitting revised documentation].

The further information has been considered on behalf of the Committee by the Chair.

**Confirmation of ethical opinion**

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation [as revised], subject to the conditions specified below.

**Good practice principles and responsibilities**

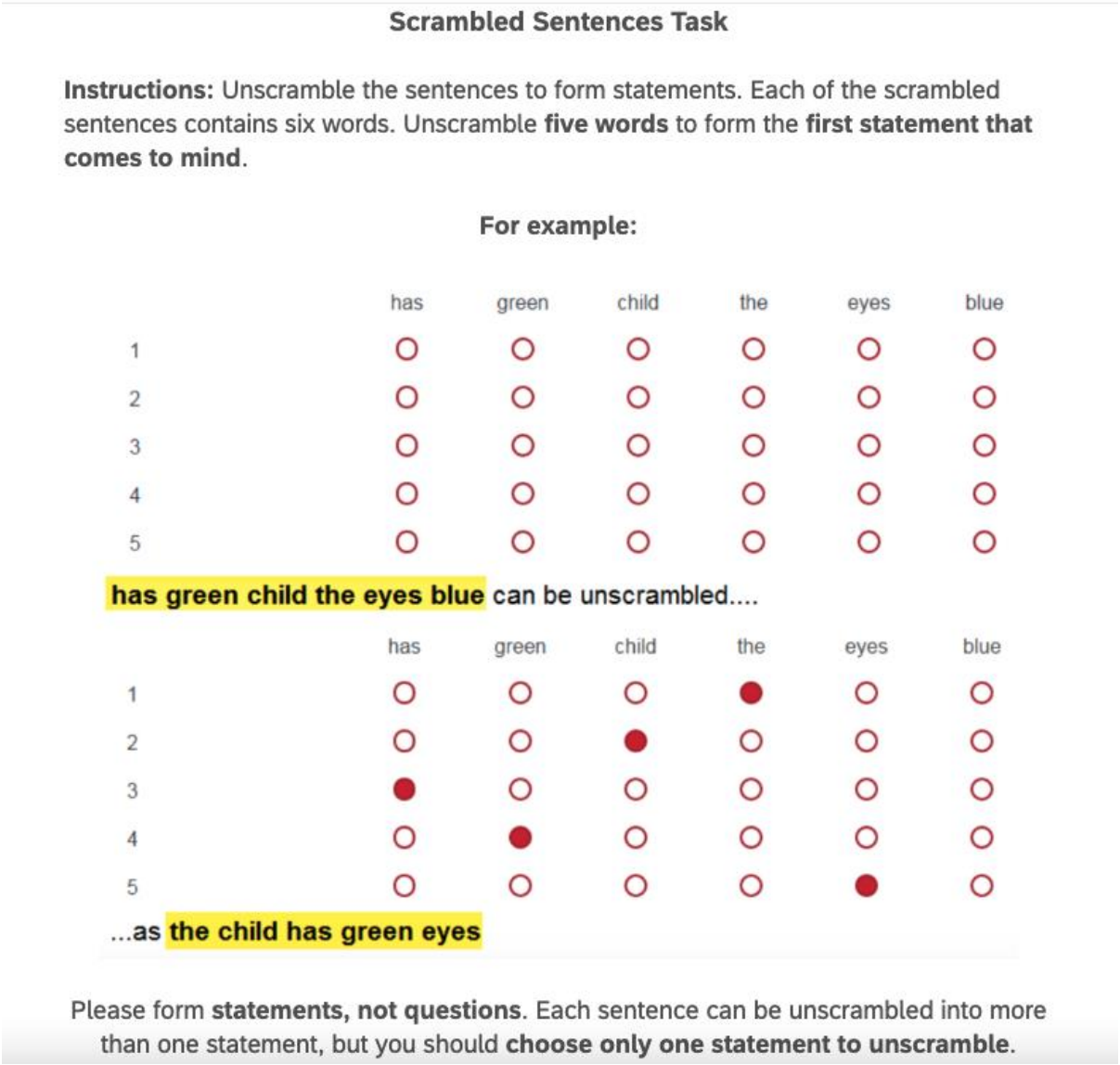
The UK Policy Framework for Health and Social Care Research sets out principles of good practice in the management and conduct of health and social care research. It also outlines the responsibilities of individuals and organisations, including those related to the four elements of research transparency:

1. registering research studies
2. reporting results

# Appendix G

All Measures Used in the Study and Accompanying Instructions In Order of Appearance in the Study

Scrambled Sentence Task Instructions and Filler Task



**Instructions:** before you begin unscrambling the sentences, you will be shown a timed image with a string of six digits, such as:

396710

Please try to remember this string of digits. You will be asked to recall it after unscrambling the sentences.

When you click the arrow to continue, you have **5 minutes** to unscramble as many sentences as possible. Please work as quickly and as accurately as possible, while keeping in mind the string of digits.

**Click the arrow to see the string of digits...**

Sentences in Table 2, Appendix C then shown in random order.

Fear of Birth Scale (FOBS)

How do you feel right now about the approaching birth? Please indicate on the lines below - use the slider with your mouse to indicate your answer

Calm — Worried

0 10 20 30 40 50 60 70 80 90 100

No fear — Strong fear

0 10 20 30 40 50 60 70 80 90 100

The Wijma Delivery Expectancy/Experience Questionnaire (W-DEQ) version A

Instruction

This questionnaire is about feelings and thoughts women may have at the prospect of labour and delivery. The answers to each question appear as a scale from 1 to 6.

The outermost answers (1 and 6 respectively) correspond to the opposite extremes of a certain feeling or thought.

Please complete each question by drawing a circle around the number belonging to the answer which most closely corresponds to **how you imagine** your labour and delivery will be.

Please answer how **you imagine** your labour and delivery will be - not the way you hope it will be.

How do you think your labour and delivery will turn out as a whole?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely fantastic | | | | | Not at all fantastic |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely frightful | | | | | Not at all frightful |

How do you think you will feel in general during the labour and delivery?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely lonely | | | | | Not at all lonely |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely strong | | | | | Not at all strong |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely confident | | | | | Not at all confident |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely afraid | | | | | Not at all afraid |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely deserted | | | | | Not at all deserted |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely weak | | | | | Not at all weak |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely safe | | | | | Not at all safe |
| 1 | 2 | 3 | 4 | 5 | 6 |

| | | | | | |
|---|---|---|---|---|---|
| Extremely independent | | | | | Not at all independent |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely desolate | | | | | Not at all desolate |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely tense | | | | | Not at all tense |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely glad | | | | | Not at all glad |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely proud | | | | | Not at all proud |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely abandoned | | | | | Not at all abandoned |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Totally composed | | | | | Not at all composed |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely relaxed | | | | | Not at all relaxed |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely happy | | | | | Not at all happy |

How do you think you will feel during the labour and delivery?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extreme panic | | | | | No panic at all |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extreme hopelessness | | | | | No hopelessness at all |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extreme longing for the child | | | | | No longing for the child at all |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extreme self-confidence | | | | | No self-confidence at all |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extreme trust | | | | | No trust at all |
| 1 | 2 | 3 | 4 | 5 | 6 |

| | | | | | |
|---|---|---|---|---|---|
| Extreme pain | | | | | No pain at all |

What do you think will happen when labour is most intense?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| I will behave extremely badly | | | | | I will not behave badly at all |
| 1 | 2 | 3 | 4 | 5 | 6 |
| I will dare to totally surrender control to my body | | | | | I will not dare to totally surrender control to my body at all |
| 1 | 2 | 3 | 4 | 5 | 6 |
| I will totally lose control of myself | | | | | I will not lose control of myself at all |
| 1 | 2 | 3 | 4 | 5 | 6 |

How do you imagine it will feel the very moment you deliver the baby?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely funny | | | | | Not at all funny |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely natural | | | | | Not at all natural |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely self-evident | | | | | Not at all self-evident |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Extremely dangerous | | | | | Not at all dangerous |

Have you, during the last month, had fantasies about the labour and delivery, for example…

… fantasies that your child will die during labour/delivery?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Never | | | | | Very often |

… fantasies that your child will be injured during labour/delivery?

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Never | | | | | Very often |

The Fear of Childbirth Questionnaire (FCQ)

**This questionnaire is for women who are pregnant. It aims to see how you are feeling about the labour and birth of your baby.**

**Please think about how you have felt over the last 2 weeks.**

**Please read each of the statements below and say how much you agree with them by clicking the box from strongly disagree to strongly agree.**

**There are no right or wrong answers, just give your first response.**

| | | STRONGLY DISAGREE | SLIGHTLY DISAGREE | SLIGHTLY AGREE | STRONGLY AGREE |
|---|---|---|---|---|---|
| 1 | **I feel fine about my labour and giving birth to my baby** | | | | |
| 2 | **I worry my labour or birth will not go to plan** | | | | |
| 3 | **I am confident that staff will always respect my wishes** | | | | |
| 4 | **I am worried about the long-term effects that labour or birth could have on my body** | | | | |
| 5 | **I am confident I will be able to cope with the pain** | | | | |
| 6 | **I am worried that my baby will be harmed during labour and birth** | | | | |
| 7 | **I worry I will lose control of myself during labour** | | | | |
| 8 | **I am confident my body can give birth to my baby** | | | | |
| 9 | **I worry I will not have a voice in decision making during labour** | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 10 | **I am confident I am emotionally strong enough to cope with labour and birth** | | | | |
| 11 | **I worry that labour is unpredictable** | | | | |
| 12 | **I am worried about things being 'done' to me during labour and birth** | | | | |
| 13 | **I am worried I will be harmed during labour** | | | | |
| 14 | **I am confident that staff will be there when I need them** | | | | |
| 15 | **I worry that my baby will feel distressed during labour and birth** | | | | |
| 16 | **I worry about having unpleasant procedures during labour and birth** | | | | |
| 17 | **I am confident I will get the pain relief I want** | | | | |
| 18 | **I worry about being left alone, without my chosen birth partner, during labour** | | | | |
| 19 | **I am worried about labour and birth and I don't know why** | | | | |
| 20 | **I am confident my body will work well during labour and birth** | | | | |

Stroop Task Instructions

## Welcome to the Stroop Task

In this experiment, your task will be to **identify the colour of the word shown on the screen**.
The word itself is immaterial — you can safely ignore it.

Please

Click Here

to load the instructions and examples.

In this experiment, your task will be to **identify the colour of the word shown on the screen**.
The word itself does not matter — you can ignore it.

To indicate the colour of the word, please use the keys `r`, `g`, `b` and `o` for red, green, blue and orange, respectively.
Please answer quickly, and as accurately as you can.

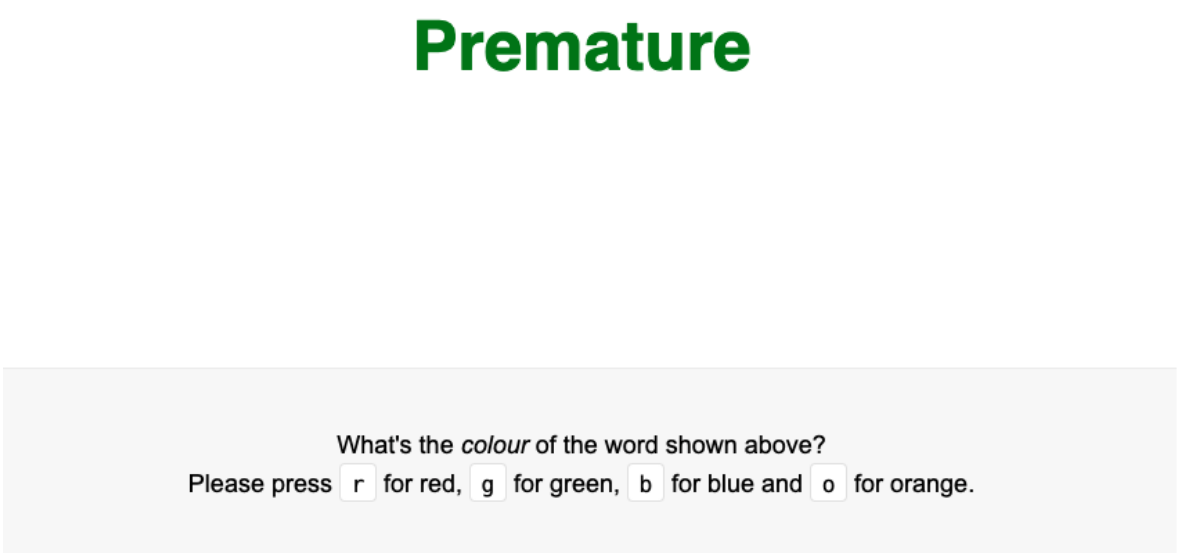
**Some Examples:**

| | | |
|---|---|---|
| **green** | press `r` | the colour is red. |
| **orange** | press `o` | the colour is orange. |
| **blue** | press `b` | the colour is blue. |
| **red** | press `g` | the colour is green. |

Focus on the colour and not the word.

Please press the space bar when you're ready.

Example of FOC related word on screen with instructions at bottom of screen



Demographics




**Age**
(free text)
**Ethnicity**

| | | | |
|---|---|---|---|
| White | Gypsy or Irish Traveller | Mixed / multiple ethnic groups | Asian / Asian British |
| Black / African / Caribbean / Black British | Arab | Other ethnic group (please specify) | |

**Gender**

| | |
|---|---|
| Female | Transgender |

**Have you discussed any fears concerning childbirth with your midwife in this pregnancy?**

| | | |
|---|---|---|
| Yes | No | Not yet, but want to |

**Parity/gravity**
**Have you previously given birth?**

| | |
|---|---|
| Yes | No |

*If yes, thinking about your childbirth (and any time in hospital after) was there any time during this when you felt:*
*1) horror or helplessness about what was happening?*

| | |
|---|---|
| Yes | No |

*2) really frightened about your own or your baby's wellbeing?*

| | |
|---|---|
| Yes | No |

**Education – What is the highest level of school you have completed? Or the highest degree you have received?**

| | | | |
|---|---|---|---|
| No formal education | GCSE | A Levels | Vocational training |
| Bachelor's degree | Master's degree | Doctorate degree | Other (please specify) |

**Marital status**

| | | | |
|---|---|---|---|
| Single | Cohabiting | Married | Civil partnership |
| Widowed | Divorced | | |

**Work Status**

| | | | |
|---|---|---|---|
| Employed full time | Employed part time | Self-employed/Freelance | Unemployed – Looking for work |
| Homemaker | Students | Retired | Not able to work |
| Other (please specify) | | | |

Generalised Anxiety Disorder Questionnaire (GAD7)

Over the last 2 weeks, how often have you been bothered by the following problems?

| | Not at all | *Several days* | *More than half the days* | *Nearly every day* |
|---|---|---|---|---|
| 1. Feeling nervous, anxious or on edge | 0 | 1 | 2 | 3 |
| 2. Not being able to stop or control worrying | 0 | 1 | 2 | 3 |
| 3. Worrying too much about different things | 0 | 1 | 2 | 3 |
| 4. Trouble relaxing | 0 | 1 | 2 | 3 |
| 5. Being so restless that it is hard to sit still | 0 | 1 | 2 | 3 |
| 6. Becoming easily annoyed or irritable | 0 | 1 | 2 | 3 |
| 7. Feeling afraid as if something awful might happen | 0 | 1 | 2 | 3 |

Patient Health Questionnaire (PHQ9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?

| | Not at all | Several days | More than half the days | Nearly every day |
|---|---|---|---|---|
| 1. Little interest or pleasure in doing things | 0 | 1 | 2 | 3 |
| 2. Feeling down, depressed, or hopeless | 0 | 1 | 2 | 3 |
| 3. Trouble falling or staying asleep, or sleeping too much | 0 | 1 | 2 | 3 |
| 4. Feeling tired or having little energy | 0 | 1 | 2 | 3 |
| 5. Poor appetite or overeating | 0 | 1 | 2 | 3 |
| 6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down | 0 | 1 | 2 | 3 |
| 7. Trouble concentrating on things, such as reading the newspaper or watching television | 0 | 1 | 2 | 3 |
| 8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual. | 0 | 1 | 2 | 3 |

| | | | | |
|---|---|---|---|---|
| 9. Thoughts that you would be better off dead or of hurting yourself in some way | 0 | 1 | 2 | 3 |

Penn State Worry Questionnaire

Use your mouse to click the number that best describes how typical or characteristic each item is of you:

| | Not at all typical | Not very typical | Somewhat typical | Fairly typical | Very Typical |
|---|---|---|---|---|---|
| 1. If I don't have enough time to do everything, I don't worry about it | 0 | 1 | 2 | 3 | 4 |
| 2. My worries overwhelm me | 0 | 1 | 2 | 3 | 4 |
| 3. I don't tend to worry about things | 0 | 1 | 2 | 3 | 4 |
| 4. Many situations make me worry | 0 | 1 | 2 | 3 | 4 |
| 5. I know I should not worry about things, but I just cannot help it | 0 | 1 | 2 | 3 | 4 |
| 6. When I am under pressure I worry a lot | 0 | 1 | 2 | 3 | 4 |
| 7. I am always worrying about something | 0 | 1 | 2 | 3 | 4 |
| 8. I find it easy to dismiss worrisome thoughts | 0 | 1 | 2 | 3 | 4 |
| 9. As soon as I finish one task, I start to worry about everything else I have to do | 0 | 1 | 2 | 3 | 4 |
| 10. I never worry about anything | 0 | 1 | 2 | 3 | 4 |
| 11. When there is nothing more I can do about a concern, I do not worry about it anymore | 0 | 1 | 2 | 3 | 4 |
| 12. I have been a worrier all my life | 0 | 1 | 2 | 3 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| 13. I notice that I have been worrying about things | 0 | 1 | 2 | 3 | 4 |
| 14. Once I start worrying, I cannot stop | 0 | 1 | 2 | 3 | 4 |
| 15. I worry all the time | 0 | 1 | 2 | 3 | 4 |
| 16. I worry about projects until they are all done | 0 | 1 | 2 | 3 | 4 |

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Ruminative Response Scale

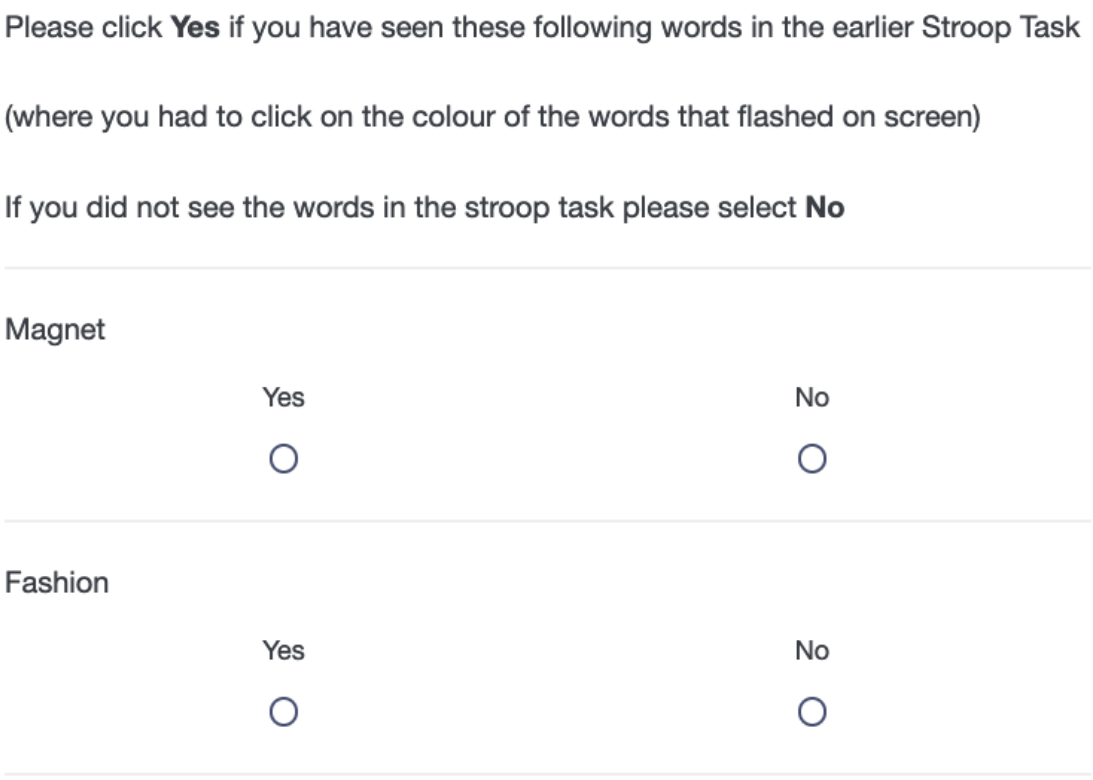
People think and do many different things when they feel depressed. Please read each of the items below and indicate whether you almost never, sometimes, often, or almost always think or do each one when you feel down, sad, or depressed. Please indicate what you generally do, not what you think you should do.

| | Almost never | Sometimes | Often | Almost always |
|---|---|---|---|---|
| 1. think about how alone you feel | 1 | 2 | 3 | 4 |
| 2. think “I won’t be able to do my job if I don’t snap out of this” | 1 | 2 | 3 | 4 |
| 3. think about your feelings of fatigue and achiness | 1 | 2 | 3 | 4 |
| 4. think about how hard it is to concentrate | 1 | 2 | 3 | 4 |
| 5. think “What am I doing to deserve this?” | 1 | 2 | 3 | 4 |
| 6. think about how passive and unmotivated you feel. | 1 | 2 | 3 | 4 |
| 7. analyse recent events to try to understand why you are depressed | 1 | 2 | 3 | 4 |
| 8. think about how you don’t seem to feel anything anymore | 1 | 2 | 3 | 4 |
| 9. think “Why can’t I get going?” | 1 | 2 | 3 | 4 |
| 10. think “Why do I always react this way?” | 1 | 2 | 3 | 4 |
| 11. go away by yourself and think about why you feel this way | 1 | 2 | 3 | 4 |
| 12. write down what you are thinking about and analyse it | 1 | 2 | 3 | 4 |
| 13. think about a recent situation, wishing it had gone better | 1 | 2 | 3 | 4 |
| 14. think “I won’t be able to concentrate if I keep feeling this way.” | 1 | 2 | 3 | 4 |
| 15. think “Why do I have problems other people don’t have?” | 1 | 2 | 3 | 4 |
| 16. think “Why can’t I handle things better?” | 1 | 2 | 3 | 4 |
| 17. think about how sad you feel. | 1 | 2 | 3 | 4 |
| 18. think about all your shortcomings, failings, faults, mistakes | 1 | 2 | 3 | 4 |

| | | | | |
|---|---|---|---|---|
| 19. think about how you don't feel up to doing anything | 1 | 2 | 3 | 4 |
| 20. analyse your personality to try to understand why you are depressed | 1 | 2 | 3 | 4 |
| 21.go someplace alone to think about your feelings | 1 | 2 | 3 | 4 |
| 22. think about how angry you are with yourself | 1 | 2 | 3 | 4 |

Recognition Task Instructions

All words shown can be found in Table 3 Appendix C



Participant Debriefing Sheet at end of study

If you have any feedback about this survey, or anything you would like the researchers to know or consider, we would really appreciate you adding this here

**Participant debriefing sheet**

**The EXPECTING Study**
**EXP**loring patt**E**rns of **C**ommon **T**hink**ING** styles in pregnancy

Thank you for taking the time to participate in the study today. Your participation is greatly appreciated and will add to the knowledge base on common thinking patterns pregnant women use. We hope that you have found it interesting and have not been upset by any of the topics discussed. However, if you have found any part of this experience to be distressing and you wish to speak to one of the researchers, please see the contact details at the end of this sheet. If you have any concerns about your mental health or physical health, please contact your GP or midwife to discuss these concerns.

Again, thank you for your time.

If you have any further questions, please contact the researchers at:

Erin Beal

Appendix H

Participants Information Sheet

## The EXPECTING Study

**EXP**loring patt**E**rns of **C**ommon **T**hink**ING** styles in pregnancy

You are being invited to take part in a study to help us understand common thinking patterns in pregnancy. The study is being run by Erin Beal.

Erin is a Trainee Clinical Psychologist. She is completing her doctoral degree at the University of Liverpool to become a Clinical Psychologist. She is supervised by Professor Pauline Slade and Dr Charlotte Krahé. Before you decide if you would like to take part, it is important for you to understand why the study is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. You can contact the study team if there is anything that is not clear or if you would like more information. It is up to you to decide whether or not you wish to take part.

1. **Why are we doing this research?**

This study is looking at common thinking patterns in pregnancy. You will be asked some brief questions so we can get a better understanding of how pregnant people commonly think.

2. **Why have I been invited to take part?**

We are inviting women who are more than 12 weeks pregnant to take part in the study. You have been invited to take part because you are currently at this stage or beyond in your pregnancy. We are asking people who are *not* seeing a psychiatrist for a serious mental health difficulty to take part in the study.

3. **Do I have to take part?**

No, it is up to you to decide whether or not you want to take part in the study. If you do decide to take part, you will be asked to complete a consent form. When you are taking part, you may withdraw from the study at any time if you change your mind. Whether or not you decide to take part in the study, your health care provision will not be changed or affected by your decision regarding the study.

4. **What will happen if I agree to take part?**

If you decide to take part, you can click next at the bottom of the page and it will take you to the study tasks. Your participation should last no longer than 45 minutes and

on average people take less time than this to complete the study. You will be asked to answer some questions and then you will be asked to do three short tasks, which will have fully detailed instructions on each page that they appear on. There are no right or wrong answers. We just ask that you complete the study in one sitting as you can't start, stop and then come back to it another day. When you finish, at the end, you will be asked to provide your email address to receive a £5 voucher to compensate for your time.

**5. What are the potential risks and benefits of taking part?**

*5.1 What are the potential benefits of taking part?*

Your participation will inform the treatment and support of future pregnant women. By taking part in this study you will be directly helping us to do this. We also hope that you will find taking part interesting. There are no other direct benefits to taking part in the study at this time.

*5.2 What are the potential risks or disadvantages of taking part?*

We do not anticipate any potential risks of taking part in this study. Some of the questions ask you about your mood and anxiety levels, if you have any concerns about these please speak to your midwife. There is no further treatment or intervention as part of this study. You will be asked to give up some of your time, however we are offering a £5 voucher to anyone who completes the study to compensate for this.

***6.*** **What can I do if I have a problem?**

If you have a concern about any aspect of this study, you should ask to speak to the researchers (details below) who will do their best to answer your questions. If you wish to seek advice or reassurance about your own health, then contact your GP. If you remain unhappy and wish to complain formally, you can do this by contacting the local NHS Patient Services Team:

PALS Team based at Liverpool Women's NHS Foundation Trust, Crown Street, Liverpool, L8 7SS Y**ou can telephone them on 0151 702 4353**

**7. What else do I need to know?**

*7.1 Will my taking part in the study be kept confidential?*

Liverpool University is the sponsor for this study and will act as the data controller for this study. We will not be asking you to provide any personal details, such as your name, address or phone number. When you complete the online study tasks you will be given an ID number and the researchers will not have access to your name or any identifiable details attached to your data. Some basic information about your age, sex and ethnicity will be collected, but this will not be linked to your responses in any publications.

The University of Liverpool will keep electronic copies of the task responses you have given for 10 years after the study has finished. Your rights to access, change or move your information are limited, as we need to manage your information in specific

ways in order for the research to be reliable and accurate. Furthermore, due to the anonymous nature of the data, we will not be able to identify your responses from the other participants. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

If you are willing to complete the study and would like to receive the £5 voucher, we will ask for your email address. This will not be linked to the answers you give in the study and will be stored in a separate file. Your email will be used only to send you the voucher.

**8. Use of my data**

Everyone involved in this study will keep your data safe and secure. We will also follow all privacy rules. We will make sure no-one can work out who you are from the reports we write.

*8.1 How will we use information about you?*

This information will include your age, stage of pregnancy, ethnicity and employment status but will not be linked to any identifiable data. Your data will have a code number instead. We will keep all information about you safe and secure. We will write our reports in a way that no-one can work out that you took part in the study.

*8.2 What are your choices about how your information is used?*

You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have. We need to manage your records in specific ways for the research to be reliable. This means that we won't be able to let you see or change the data we hold about you.

*8.3 Where can you find out more about how your information is used?*

- You can find out more about how we use your information at www.hra.nhs.uk/information-about-patients/
- by asking one of the research team
- by emailing us on erin.beal1@nhs.net

**9. What happens when the research study stops?**

The study is expected to be completed in September 2022. After you complete the online tasks there is no further participation required in the study.

**10. What will happen to the results of the research study?**

The results of this study will be published in scientific journals and presented at scientific meetings. You can get in touch with the study team if you would like to know the results of the study. We will make the results available through patient organisations and health information websites that are open to the public and the media.

**11. Who is organising and funding the research?**

The project is being carried out by a team of researchers from the University of Liverpool.

**Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given a favourable opinion by the Yorkshire and the Humber - South Yorkshire NHS Research Ethics Committee (REC ID 21/YH/0073). Further information and contact details can be found here:

Email: southyorks.rec@hra.nhs.uk

Phone: 0207 104 8079

Finally, in case some issues remain unclear to you, please contact the study team who will be happy to explain details of the study.

You can contact the study team via:
Email: Erin.beal1@nhs.net
Post: F.A.O. Erin Beal, University of Liverpool, Whelan Building, Brownlow Hill, University of Liverpool, L69 3GB

The views expressed are those of the author(s) and not necessarily those of the NHS.

***Thank you for taking the time to read this information sheet, we hope that it has been helpful in enabling you to decide if you would like to participate in the EXPECTING study. If you would like to participate, please click next to bring you to the consent page.***

THE EXPECTING STUDY

UNIVERSITY OF LIVERPOOL

Liverpool Women's NHS Foundation Trust

# Appendix I

Participant Consent Form

IRAS ID: 291313

## CONSENT FORM

Title of Project: The EXPECTING Study: **EXP**loring patt**E**rns of **C**ommon **T**hink**ING** styles in pregnancy

Name of Researcher: Erin M Beal

1. I confirm that I have read the information sheet dated..... (version V1.0) for the
   above study. I have had the opportunity to consider the information, ask questions and have
   had these answered satisfactorily.

2. I understand that taking part in the study involves completing a web-based questionnaire and three short online tasks.

3. I understand that my participation is voluntary and that I am free to withdraw at any time
   without giving any reason, without my medical care or legal rights being affected. In addition, I understand that I am free to decline to answer any particular question or questions.

4. I understand that the information collected about me will be used to support other research in the future and may be shared anonymously with other researchers.

5. My data will be anonymised and once my data has been submitted, I cannot withdraw it. I can choose to stop participating at any time, but the data already collected cannot be withdrawn.

6. I understand that the information that I provide will be held securely and in line with data protection requirements at the University of Liverpool.

7. I agree to take part in the above study.

If you are satisfied with these and agree to take part, please click 'Yes' confirming that you understand the participant information and consent form and that you consent for your responses to be used in this project. This will then take you to the next page.

**Appendix J**

Participant Invite Sheet

**The EXPECTING Study:**

**EXP**loring patt**E**rns of **C**ommon **T**hink**ING** styles in pregnancy

We would like to invite you to participate in a research project looking at common thinking styles in pregnancy.
We are offering £5 vouchers for those who are willing to take part.

You **can** take part if you are:

- More than 12 weeks pregnant
- Fluent in English
- Have access to internet and computer
- Are over 18 years

You unfortunately **cannot take** part if:

- You are considered to have a high-risk pregnancy*
- Pregnant in your first 12 weeks
- Currently under the care of a psychiatrist for serious mental health difficulties*
- Colour-blind
- Under 18 years of age

**Please contact me if you would like to ask*

The research involves participating in a study online at a time that suits you. We will ask you to answer some questions online using a computer. It should not take longer than 45 minutes to complete, but most people do it in less time. You will be asked to give consent before you start the study and can change your mind about your participation at any time.

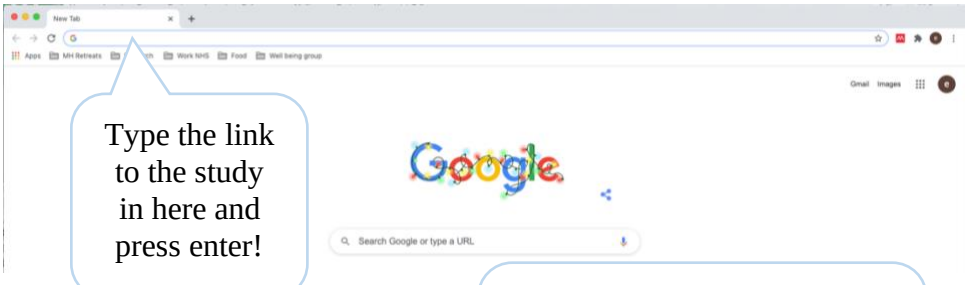
Before you decide whether to take part or not, you may wish to read the full information sheet which you will see when you follow the link for the study below. If you have any questions, please contact me using the details at the bottom of this invitation.

If you are interested, and would be willing to take part, please access the study via the link below. If you type in this web address to your internet browser, it will bring you to the study.

Thank you for your time and if you have any queries then please do not hesitate to contact me.

Kind Regards,

Erin Beal
Trainee Clinical Psychologist
Erin.beal1@nhs.net

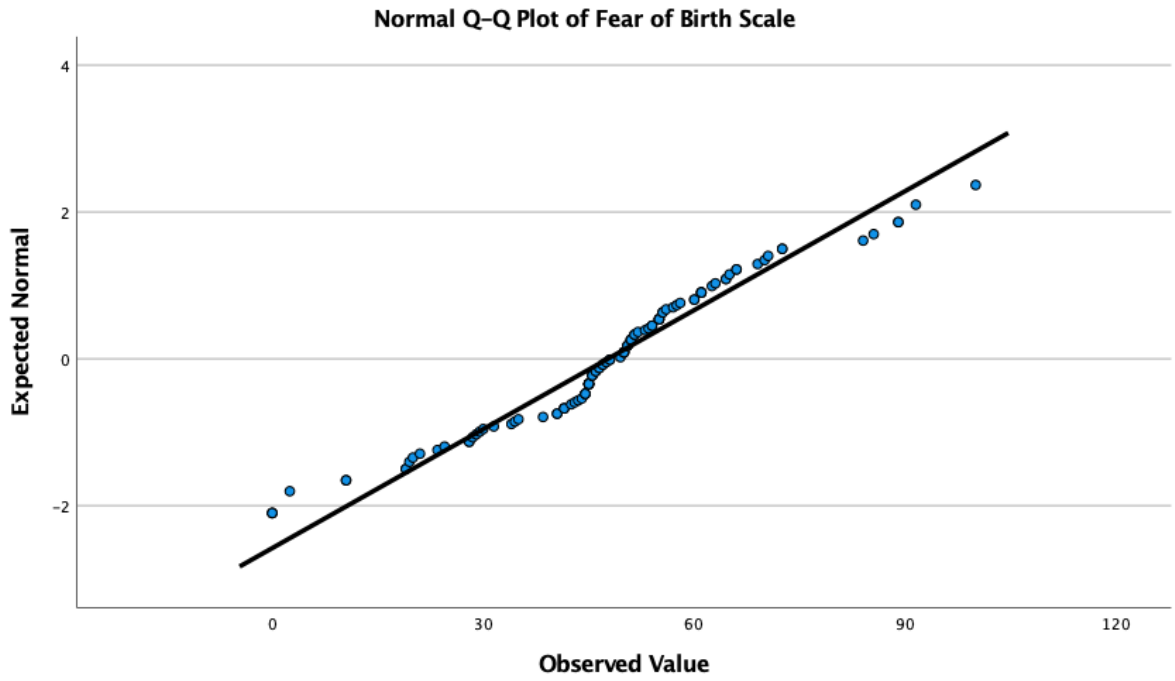



Link to study:
**tiny.cc/ec9iuz**

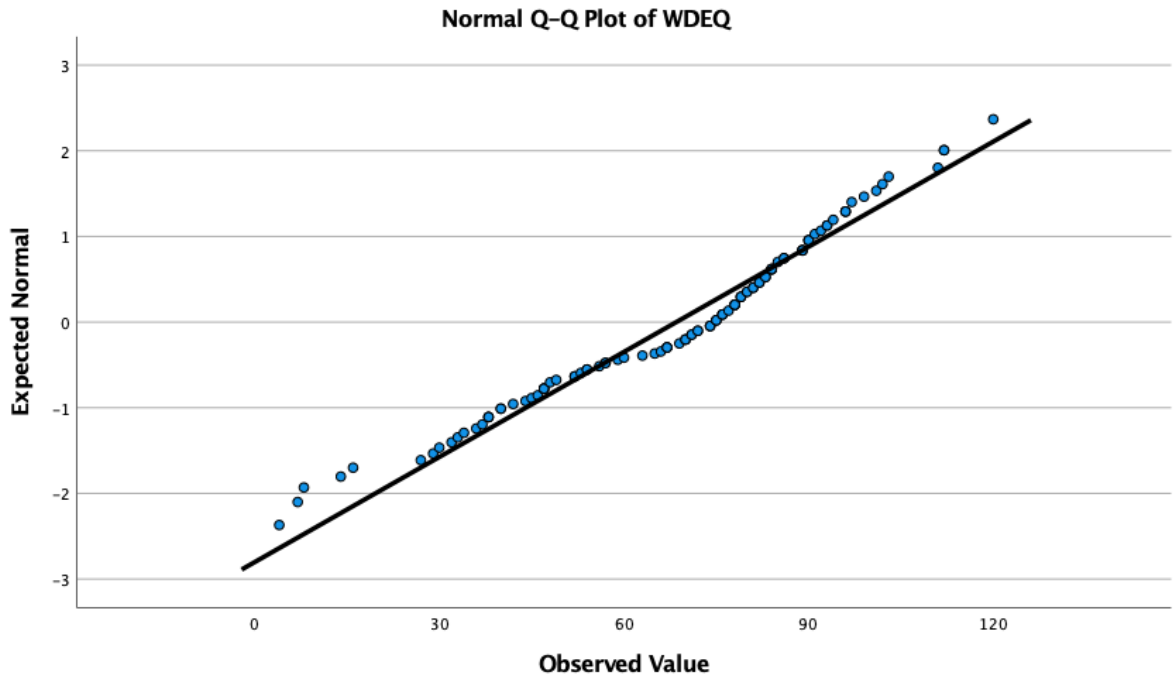
# Appendix K

## Scatter Plots

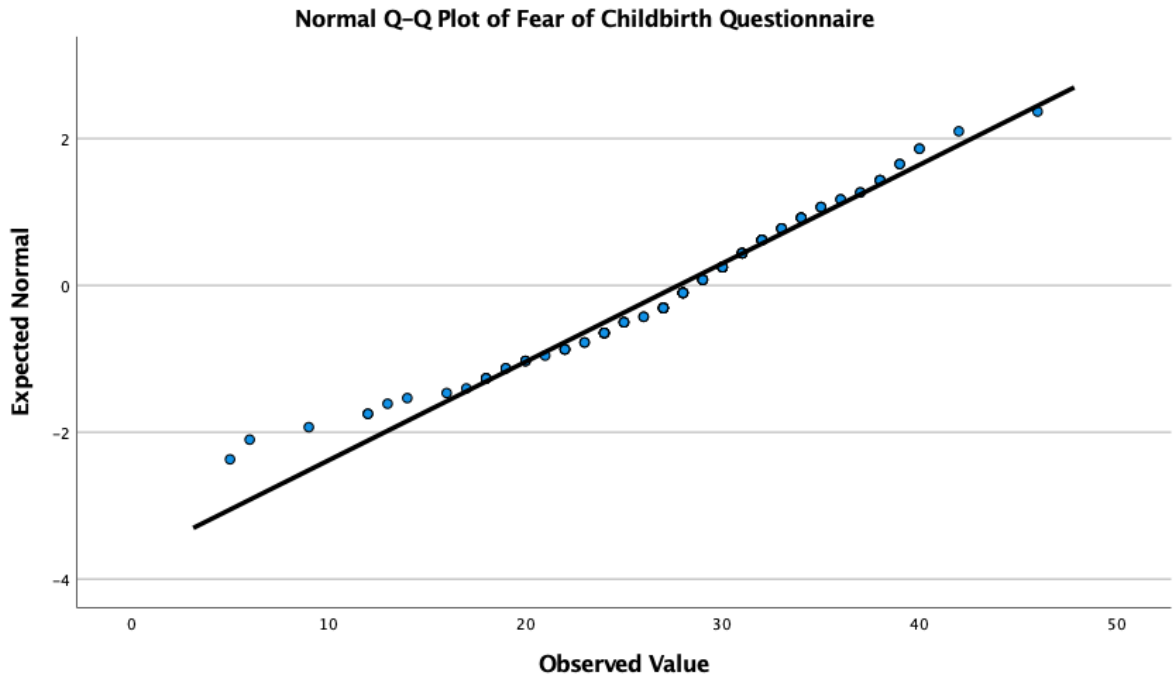
Scatter Plot for Two Item Fear of Birth Scale



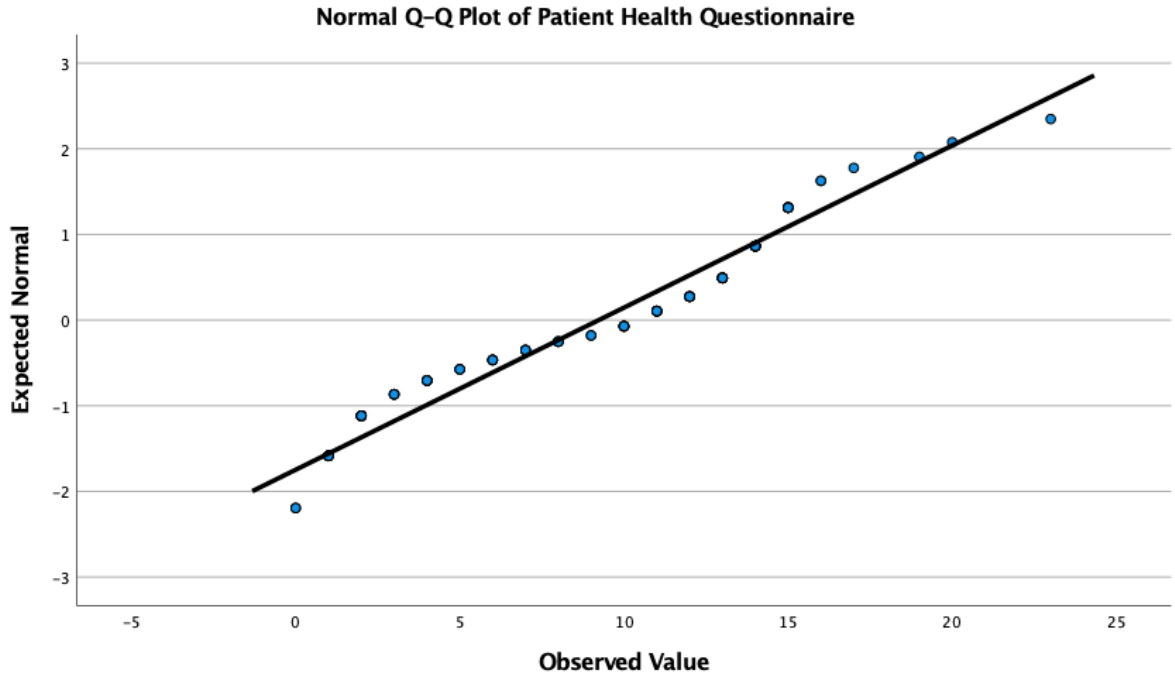

Scatter Plot for the WDEQ



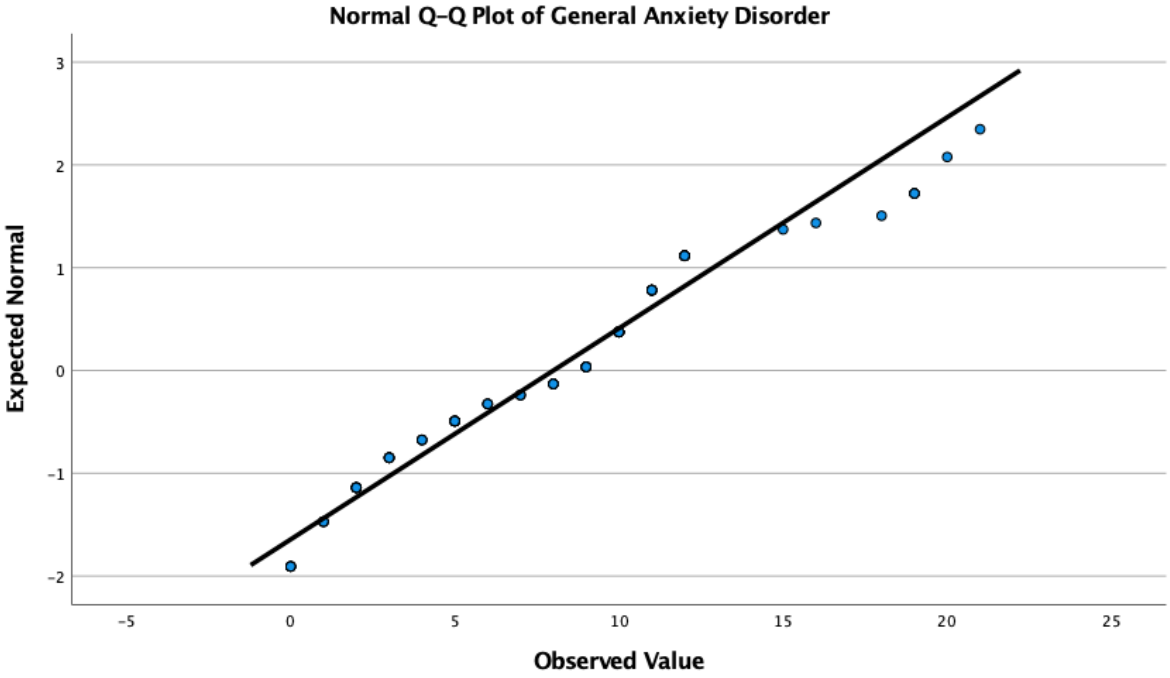
Scatter Plot for the Fear of Childbirth Questionnaire



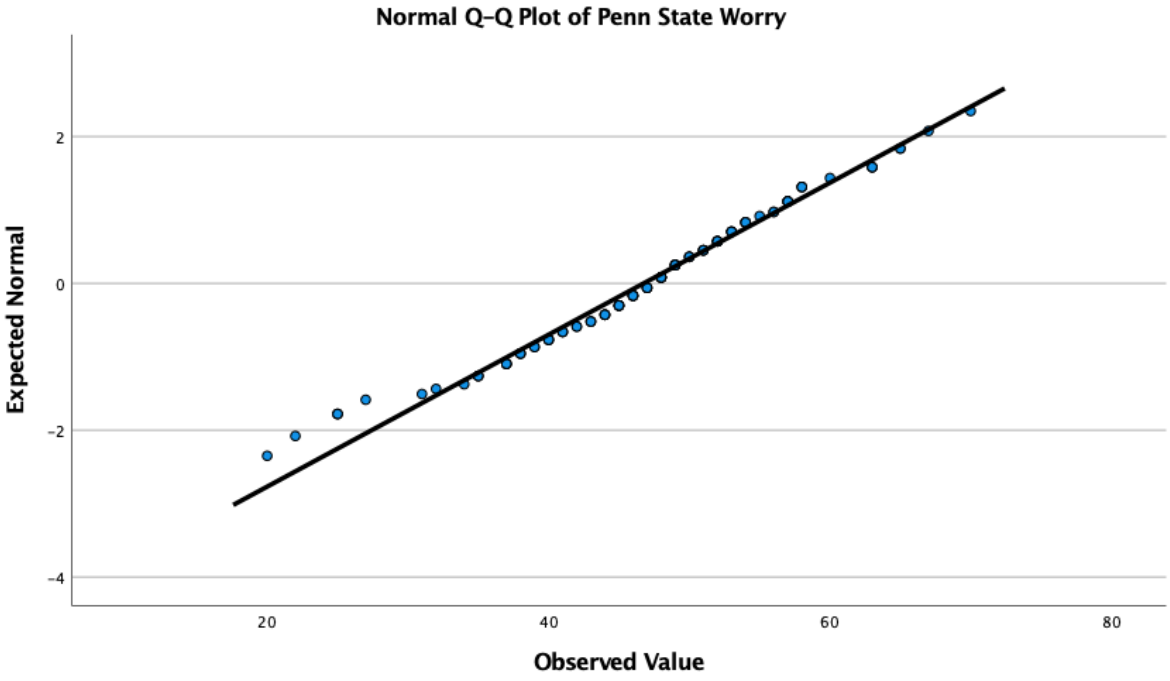

Scatter Plot for the Patient Health Questionnaire (PHQ9)



Scatter Plot for the General Anxiety Disorder Questionnaire (GAD7)




Scatter Plot for the Penn State Worry Questionnaire



Scatter Plot for the Ruminative Response Scale