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Anxiety in Fathers in the Perinatal Period: A Systematic Review

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Highlights

- Father's anxiety increased from the antenatal period to the time of birth
- From the time of birth to the later postnatal period father's anxiety decreased
- Anxiety impacts negatively on fathers physical and mental health
- Lower social support and work- family conflict contribute to perinatal anxiety

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Anxiety in Fathers in the Perinatal Period: A Systematic Review

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Ethical statement

There is no conflict of interest.

No funding was received for this research.

Ethical approval was not required for the review.

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Anxiety in fathers in the perinatal period: A systematic review

Abstract

Background: fatherhood in the perinatal period can be a time of great excitement, happiness and joy. However, a growing body of literature indicates that fathers are at risk for elevated levels of anxiety symptoms during the perinatal period.

Purpose: the purpose of this systematic review is to determine the prevalence and levels of anxiety in fathers during the perinatal period, identify the risk factors and impact of anxiety, and establish if there are effective interventions that reduce father's anxiety.

Design: systematic review.

Methods: a systematic review protocol was developed and registered with PROSPERO (Reference number: CRD42017073760). The review was guided by the PRISMA reporting process. Electronic databases Medline, CINAHL, Embase, the Cochrane Library, PsycARTICLES, PsycINFO, and Psychology were searched to identify eligible studies. Studies that researched fathers during the perinatal period were included if anxiety was the primary focus of the research or was an outcome or dependent variable. Data were extracted and presented in narrative form including tables and figures.

Findings: thirty-four studies met the inclusion criteria. Findings from these studies indicate that fathers experience anxiety in the perinatal period, particularly at the time of birth. Anxiety increased from the antenatal period to the time of birth, with a decrease in anxiety from the time of birth to the later postnatal period. The prevalence of anxiety ranged between 3.4% and 25.0% during the antenatal period and 2.4% and 51.0% during the postnatal period. Factors contributing to anxiety included lower education levels, lower income levels, lower co-parenting support, lower social support, work- family conflict, a

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partner' anxiety and depression, and being present during a previous birth. Anxiety had a negative impact on fathers' mental health, physical health, social relationships and parenting skills. Anxiety contributed to stress, depression, fatigue and lower paternal self-efficacy. Five studies reported on interventions to reduce anxiety and all the studies found that anxiety significantly decreased following the intervention.

Key conclusion: fathers experience increased anxiety from the antenatal period to the time of birth, with a decrease in anxiety from the time of birth to the later postnatal period. Anxiety during the perinatal period that can impact negatively on fathers physical and mental health, and social relationships.

Keywords: Fathers; Men's health; Mental health; Perinatal; Anxiety; Systematic review

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Anxiety in fathers in the perinatal period: A systematic review

Introduction

Becoming a father has a long-term positive and protective effect on men's health (Eggebeen et al., 2013), yet, a significant proportion of fathers' experience mental health problems during the perinatal period (Philpott et al., 2017). Paternal perinatal mental health is a public health issue because of its negative effects on paternal, family and infant outcomes, as well as significant economic cost to society if left untreated (Edoka et al., 2011; Ramchandani et al., 2013). Research examining paternal perinatal mental health has predominantly focused on depression (Philpott, 2016; Philpott et al., 2017). Paulson and Bazemore (2010) undertook a meta-analysis of 43 studies that assessed paternal postnatal depression (PPND) and reported a prevalence of 10.4%. Cameron et al. (2016) in their meta-analysis of 74 studies reported a prevalence of 8.4%.

Less clinical and research attention has been paid to paternal perinatal anxiety (Koh et al., 2015). A possible for this lack of attention on anxiety, may be due to the fact that the majority of research in relation to maternal mental health in the perinatal period has focused on depression, and fathers are often recruited into studies involving their partners (Cameron et al., 2016). Matthey et al. (2003) suggested that there is a hierarchical custom, where depression trumps anxiety and takes precedence even when anxiety symptoms are a prominent feature. This focus on depression has resulted in anxiety being undetected and undertreated (Koh et al., 2015). This is a notable omission given that anxiety may be more common than depression in the general population (Wittchen et al., 2011; Bandelow and Michaelis, 2015) and in the perinatal period (Matthey et al., 2003; Wynter et al., 2013). The prevalence of anxiety in the general population is estimated at 14%, compared to 6.9% for depression (Wittchen et al., 2011; Bandelow and Michaelis, 2015). In the perinatal period,

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Wynter et al. (2013) found that anxiety was more common than depression for fathers during the first six months postpartum with the prevalence of anxiety reported at 17.4%, compared to 4.1% for depression. Furthermore, there is ever-growing evidence that perinatal anxiety is associated with negative outcomes such as lower levels of parenting self-efficacy (Pinto et al., 2016), increased fatigue (Tzeng et al., 2009), decreased spousal support (Don et al. 2014), and impaired paternal/infant interactions (Vreeswijk et al., 2014). Paternal perinatal Anxiety has also been shown to increase the risk of stress (Prino et al., 2016) and depression (Vismara et al., 2016).

Anxiety has been described as a "subjective feeling of unease, discomfort, apprehension or fearful concern" (Shri, 2010 p.100). It is only since the 20th century, that distinctions have been made between normal, adaptive anxiety and abnormal, pathological anxiety (Crocq 2015). Anxiety is not typically pathological, as it is adaptive in many scenarios when it facilitates avoidance of danger (Beesdo et al., 2009). Anxiety becomes maladaptive when it interferes with functioning, and this is most likely to occur when anxiety becomes overly frequent, severe, and persistent (Beesdo et al., 2009). According to Spielberger (1983), there are two kinds of anxieties, state anxiety and trait anxiety. State anxiety refers to anxiety experienced in a specific situation, which fluctuates and varies in intensity (Spielberger, 1983). In contrast, trait anxiety refers to anxiety experienced across all situations, and is a relatively stable characteristic (Spielberger, 1983). Fathers with high trait anxiety, experience more situation-specific state anxiety and interpret anxiety less positively than fathers with low trait anxiety (Vreeswijk et al., 2014). Therefore, due to anxieties associated with difficulties in caring for an infant, and increased stress experienced in the perinatal period (Giallo et al., 2013; Shorey et al., 2017; Philpott et al., 2017), fathers with high trait

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anxiety are at greater risk of viewing fatherhood negatively during this life stage (Vreeswijk et al., 2014).

In the majority of research to date, the term perinatal anxiety is taken to mean generic anxiety symptomatology, assessed by non-specific self-report inventories such as the State Trait Anxiety Inventory (STAI) and the Taylor Manifest Anxiety Scale (Felter, 2013). The findings of these studies, relate to anxiety symptoms rather than specific anxiety diagnoses. The distinction between anxiety symptomology and disorders is not always clarified or delineated in the published literature that refers the terms 'anxiety' and 'anxiety disorder' interchangeably and without distinction (Brunton et al., 2015). However, it is important to make a distinction, because the majority of fathers experience subclinical anxiety levels anxiety, and are not diagnosed with an anxiety disorder (Matthey and Ross-Hamid, 2012). Most father's anxiety responses are transient and adaptive in nature (Aguis et al., 2016) and are linked to stresses associated with the transition to fatherhood, or the arrival of subsequent children. The use of a diagnosis label for fathers experiencing such anxiety may lead to stigma and the over medicalisation of fatherhood. However, transient and adaptive anxiety in the perinatal period can impair a fathers quality of life and functioning (Haller et al., 2014) and impinge negatively on fathers, their partners, and their infants (Koh et al., 2015).

To date, only one systematic review reporting on paternal perinatal anxiety has been published (Leach et al., 2016). These reviewers, reported anxiety prevalence rates between 2.4% and 18.0%. However, the review included post-traumatic stress disorder (PTSD), obsessive compulsive disorder (OCD), and acute adjustment disorder with anxiety which do not fall under the umbrella of anxiety and which has the potential to skew the true

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prevalence of anxiety during this life stage (American Psychiatric Association, 2013; Kupfer, 2015; Leach et al., 2016). While the review went some way to addressing the question on how many fathers experience anxiety in the perinatal period (Leach et al., 2016), risk factors, the impact of anxiety and interventions to reduce anxiety were not considered.

Due to the potential negative effects of anxiety on fathers and their families in the perinatal period (Tzeng et al., 2009; Vreeswijk et al., 2014), it is important to determine the prevalence and levels of anxiety, identify the risk factors and the impact of anxiety, and establish if there are effective interventions that reduce father's anxiety during this life stage. A review of risk factors will help identity fathers who are likely to develop anxiety, while a review of the impact of anxiety and effective interventions will help inform service planning and lead to more targeted supports for fathers and their families. The aim of this review is to examine anxiety symptomatology in fathers during the perinatal period, focusing on identifying the levels and prevalence of anxiety, how anxiety is measured, the contributing factors, the impact of anxiety on fathers in relation to their health and social relationships and effective interventions to reduce anxiety. For the purpose of this review, perinatal anxiety is taken to mean generic anxiety symptomatology, assessed by non-specific self-report inventories.

Methods

A systematic review was conducted according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). A systematic review protocol was developed and registered with the International prospective register of systematic reviews PROSPERO (Reference number: CRD42016035821).

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Search strategy

The search strategy was created in consultation with a health sciences librarian with expertise in systematic review searching. Electronic databases Medline, CINAHL, Embase, the Cochrane Library, PsycARTICLES, PsycINFO, and Psychology were searched to identify eligible studies based on pre-determined criteria. Backward and forward citation searches were also conducted. The search strategy included the Boolean terms "OR"/ "AND," and truncation. The following keywords and their synonyms were combined (father* OR paternal OR dad* OR male OR men) AND (prenatal OR prepartum OR antenatal OR antepartum OR perinatal OR peripartum OR postnatal OR postpartum OR preg* OR childbirth OR birth OR labour OR labor) AND (anxiety). Relevant 'Medical Subject Heading' (MeSH) and CINAHL headings were also used.

Studies for inclusion were quantitative designs of any type and published in English from October 2007 to October 2017. While there is no golden rule for limiting publications by date, however, scientific evidence published within a 10-year timeframe is considered recent (Cottrell and McKenzie, 2011). Studies that researched fathers during the perinatal period, which covers the time when a man's partner becomes pregnant through to the first year after birth (Leach et al., 2015), were included if anxiety was the primary focus of the research or was an outcome or dependent variable. Studies that reported anxiety in couples were included when the data specific to fathers and mothers was reported separately. Studies were excluded if they reported psychological distress expressed as stress, depression, posttraumatic stress disorder or pathological mental health disorders. Studies that reported findings from fathers whose infants were preterm, admitted to the neonatal unit, or had a perinatal diagnosis of a birth defect or who experienced perinatal loss of an infant through stillbirth, miscarriage, or neonatal death were excluded as fathers may

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experience additional anxiety in these circumstances. If the method of conception was by assisted reproductive technology (ART) in a study it was excluded as the majority of births are associated with naturally conceived pregnancies (Boostanfar et al., 2012) and ART is associated with additional anxiety beyond normal pregnancy (Malina and Pooley, 2017; Chen et al., 2017).

Study selection

The electronic search generated 3069 records. These records were exported to EndNote X8.1 and there were 1465 records after duplicates were removed. The titles and abstracts of these records were independently screened by two authors (LP, SF). In total, 1,403 papers were excluded for reasons such as the study was not assessing anxiety in the perinatal, the sample did not include fathers or fathers and mother's results were not reported separately. Follow this process 62 papers full text were review. The full text papers were independently assessed by LP and SF, PL-W assessed the papers where there were discrepancies. Thirty-six papers were identified for inclusion in the review, and a further 4 papers were identified from screening the reference lists of included papers. Therefore, the final search output was 40 papers, which reported on 34 studies. The selection process and output is presented in Fig. 1.

Data extraction, analysis and synthesis

One author (LP) extracted the relevant data from the studies which were: author names and country, year of publication, study setting, study aims, sample size and demographic data of the study sample (mean age, marital and employment status, education level and parity), anxiety scores, measurement tools and time points, factors contributing to anxiety, and the impact of anxiety on fathers. Data extraction was independently crosschecked by two co-authors (PL-W, SF). Discrepancies were resolved by consensus. Data extraction is presented

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in Table 1. Studies in the review were conducted in Europe, Asia, North America and Australia. Participant sizes ranged from 25 to 1243 and research designs were longitudinal, cross-sectional, randomized clinical/control trials and quasi-experimental. Data analysis was descriptive, and included prevalence rates across studies and levels of anxiety where evident such as mean and standard deviations. Prevalence rates and/or levels of anxiety were included in this systematic review, as this was how the included studies reported symptoms of anxiety. The diversity of measurement tools and study designs included in the review did not allow us to conduct a meta-analysis. Therefore, a narrative synthesis of results is presented.

Risk of bias assessment

Risk of bias for observational studies (i.e. cross-sectional, longitudinal) was assessed using criteria based on guidelines for 'STrengthening the Reporting of OBservational Epidemiological' (STROBE) studies which Sanderson et al. (2007) described as incorporating the key principal sources of bias. These criteria are: selection bias; measurement bias; design specific bias; confounding bias; statistical method bias; and conflict of interest or funding sources. For randomised controlled trials (RCTs), the Cochrane Collaboration Risk of Bias tool was used to assess for bias relating to selection, performance, detection, attrition, reporting, and other bias evident (Higgins et al., 2013). For quasi-experimental studies, the Cochrane Collaboration Risk of Bias In Non-randomised Studies of Interventions (ROBINS-I) was used to assess bias relating to confounding, selection, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes and reporting (Sterne et al., 2016). The assessment of the observational and RCT studies involved a judgement of low, high, or unclear risk of bias while the assessment of quasi-experimental studies involved a judgement of low, moderate, serious or critical risk of bias

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or no information. Two authors (LP, SF) completed the risk of bias assessments independently. Observational studies were crosschecked by PL-W (see Table 2); while ES crosschecked RCT and quasi-experimental studies (see Tables 3 and 4). Discrepancies were resolved through consensus between the authors.

Findings

Study Characteristics

The main characteristics of the studies are discussed in Table 1. The majority of the studies reviewed were conducted in Europe (n=17) (Hjelmsted and Collins, 2008; Castle et al., 2008; Skreden et al., 2008; Ekelin et al., 2009; Vilska et al., 2009; Teixeira et al., 2009; Sapountzi-Krepia et al., 2010; Parfitt et al., 2013; Thome and Arnardottir, 2013; Vreeswijk et al., 2014; Gawlik et al.,2014; Skjothaug et al., 2015; Arnal-Remón et al., 2015; Pinto et al., 2016; Prino et al., 2016; Vismara et al., 2016; Kannenberg et al., 2016). Eight studies were conducted in Asia (Tzeng et al., 2009; Li et al., 2009; Koh et al., 2015; Zerach and Magal, 2017; Alibekova et al., 2016; Labrague and McEnroe-Petitte, 2016; Charandabi et al., 2017; Mahmoodi et al., 2017), while six were completed in North America (Feinburg and Kan, 2008; Keeton et al., 2008; Armstrong et al., 2009; Lachance-Grzela and Bouchard, 2009; Biehle and Mickelson, 2011; Don et al., 2014) and three in Australia (Tohotoa et al., 2012; Wee et al., 2015; Leach et al., 2015). In total, 19 countries were represented in the review, with 17 of the countries classified as high income using World Bank categories (worldbank.org, 2017).

The majority of studies (n=15) included first time fathers only (Feinburg and Kan,2008; Castle et al., 2008; Keeton et al., 2008; Li et al., 2009; Lachance-Grzela and Bouchard, 2009; Biehle and Mickelson, 2011; Don et al., 2014; Parfitt and Ayers, 2014; Arnal-Remón et al., 2015; Leach et al., 2015; Labrague and McEnroe-Petitte, 2016; Pinto et al., 2016; Prino et al.,

2016; Vismara et al., 2016; Zerach and Magal, 2017). Thirteen studies had a mixed sample of both first time fathers and fathers with one or more children (Skreden et al., 2008; Tzeng et al., 2009; Armstrong et al., 2009; Ekelin et al., 2009; Teixeira et al., 2009; Sapountzi-Krepia et al., 2010; Gawlik et al., 2014; Vreeswijk et al., 2014; Wee et al., 2015; Koh et al., 2015; Skjothaug et al., 2015; Alibekova et al., 2016; Mahmoodi et al., 2017). Six studies made no reference to the status of fathers (Hjelmsted and Collins, 2008; Vilska et al., 2009; Tohotoa et al., 2012; Thome and Arnardottir, 2013; Kannenberg et al., 2016; Charandabi et al., 2017). Fathers were predominately recruited at hospitals or antenatal clinics. Two studies recruited fathers from the community (Sapountzi-Krepia et al., 2010; Leach et al., 2015), while one study recruited online from birth-related websites (Zerach and Magal, 2017). Two studies did not report where they recruited fathers (Prino et al., 2016; Vismara et al., 2016).

Research designs were: longitudinal in 21 studies (Hjelmsted and Collins, 2008; Castle et al., 2008; Keeton et al., 2008; Skreden et al., 2008; Vilska et al., 2009; Armstrong et al., 2009; Ekelin et al., 2009; Teixeira et al., 2009; Don et al., 2014; Gawlik et al., 2014; Parfitt and Ayers, 2014; Vreeswijk et al., 2014; Wee et al., 2015; Koh et al., 2015; Leach et al., 2015; Skjothaug et al., 2015; Alibekova et al., 2016; Pinto et al., 2016; Prino et al., 2016; Vismara et al., 2016; Zerach and Magal, 2017); cross-sectional in 7 studies (Tzeng et al., 2009; Lachance-Grzela and Bouchard, 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Arnal-Remón et al., 2015; Kannenberg et al., 2016; Mahmoodi et al., 2017); randomized clinical/control trials in 4 studies (Feinburg and Kan, 2008; Li et al., 2009; Tohotoa et al., 2012; Charandabi et al., 2017) and quasi-experimental in 2 studies (Thome and Arnardottir, 2013; Labrague and McEnroe-Petitte, 2016).

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Measurement tools used and assessment time points

All studies reviewed used self-report measures to assess anxiety symptoms in fathers during the perinatal period. The most common measure was the State-Trait Anxiety Inventory (STAI) used in 12 studies (Hjelmsted and Collins, 2008; Armstrong et al., 2009; Li et al., 2009; Ekelin et al., 2009; Thome and Arnardottir, 2013; Vreeswijk et al., 2014; Arnal-Remón et al., 2015; Kannenberg et al., 2016; Pinto et al., 2016; Prino et al., 2016; Vismara et al., 2016; Charandabi et al., 2017). The state subscale of the State-Trait Anxiety Inventory (STAI-S) was used in 7 studies (Keeton et al., 2008; Skreden et al., 2008; Teixeira et al., 2009; Gawlik et al., 2014; Alibekova et al., 2016; Labrague and McEnroe-Petitte, 2016; Zerach and Magal, 2017). Four studies used the Hospital Anxiety and Depression Scale (HADS) (Castle et al., 2008; Tohotoa et al., 2012; Parfitt and Ayers, 2014; Koh et al., 2015). The Symptom Checklist-90-Rm (SCL-90r) was used in 2 studies (Biehle and Mickelson, 2011; Don et al., 2014), as was the General Health Questionnaire (GHQ) (Vilska et al., 2009; Mahmoodi et al., 2017). Other measures included the Goldberg Depression and Anxiety Scales (Leach et al., 2015); the Depression, Anxiety and Stress Scale (DASS) (Wee et al., 2015); the Birmingham Interview for Maternal Mental Health (BIMMH) (Parfitt et al., 2013); the Kuopio Instrument for Fathers (KIF) (Sapountzi-Krepia et al., 2010); the Visual Analogue Scale - Anxiety (VAS-A) (Tzeng et al., 2009); the Taylor Manifest Anxiety Scale (Feinburg and Kan, 2008) and the anxiety subscale of the Psychiatric Symptom Index (Lachance-Grzela and Bouchard, 2009).

The time points of assessment varied across studies ranging from 1 month antenatal to 12 months postnatal. Anxiety assessed in the antenatal period only was reported in 10 studies (Tzeng et al., 2009; Lachance-Grzela and Bouchard, 2009; Ekelin et al., 2009; Biehle and Mickelson, 2011; Thome and Arnardottir, 2013; Vreeswijk et al., 2014; Arnal-Remón et al., 2015; Wee et al., 2015; Skjothaug et al., 2015; Kannenberg et al., 2016). The assessment

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time points for these studies ranged from 8 weeks antenatal (Skjothaug et al., 2015) to labor (Tzeng et al., 2009). One study did not specify the time-point of measurement (Kannenberg et al., 2016). The most frequently reported time-point for assessment in the antenatal period was the 3rd trimester of pregnancy, evident in 7 studies (Tzeng et al., 2009; Lachance-Grzela and Bouchard, 2009; Biehle and Mickelson, 2011; Thome and Arnardottir, 2013; Arnal Remón et al., 2015; Wee et al., 2015; Skjothaug et al., 2015). Anxiety assessed only in the postnatal period was reported in 5 studies (Skreden et al., 2008; Sapountzi-Krepia et al., 2010; Don et al., 2014; Gawlik et al., 2014; Mahmoodi et al., 2017). The assessment time points for these studies ranged from 1 week to 1 year postnatal. Anxiety was also measured longitudinally in both the ante and postnatal period in 17 studies (Hjelmsted and Collins, 2008; Keeton et al., 2008; Castle et al., 2008; Feinburg and Kan, 2008; Li et al., 2009; Armstrong et al., 2009; Vilska et al., 2009; Teixeira et al., 2009; Tohotoa et al., 2012; Parfitt and Ayers, 2014; Koh et al., 2015; Zerach and Magal, 2017; Vismara et al., 2016; Prino et al., 2016; Pinto et al., 2016; Alibekova et al., 2016; Charandabi et al., 2017). The assessment time points for these studies ranged from 1 month antenatal to 12 months postnatal.

Prevalence and Levels of Anxiety in Fathers

Studies reported anxiety as a mean score (n=21), prevalence estimates (n=6), or both (n=7). The State-Trait Anxiety Inventory (STAI) or its state subscale (STAI-S) was used in 20 studies and mean scores ranged from (M) 26.9 (SD 5.2) (Hjelmsted and Collins, 2008) to (M) 49.6 (SD 11.1) (Gawlik et al., 2014). Three studies reported mean scores above 40 (Li et al., 2009; Gawlik et al., 2014; Labrague and McEnroe-Petitte, 2016), which been used previously to indicate levels of clinically significant anxiety (Julian, 2011). A further 3 studies reported

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borderline scores (M) 39.7 (SD 9.3) (Charandabi et al., 2017), (M) 39.3 (Kannenberg et al., 2016), (M) 39.0 (Alibekova et al., 2016).

Prevalence rates ranged from 3.4% (Prino et al., 2016) to 25.0% (Parfitt and Ayers, 2014) in the antenatal period. In the postnatal period prevalence rates ranged from 2.4% (Tohotoa et al., 2012) to 51.0% (Sapountzi-Krepia et al., 2010). Tzeng et al. (2009) reported a prevalence rate of 42.6% during labor (see Table 5).

Overall from the longitudinal studies, findings revealed that anxiety levels decreased from the antenatal period to the postnatal period (Castle et al., 2008; Hjelmstedt and Collins, 2008; Armstrong et al., 2009; Vilska et al., 2009; Figueiredo and Conde, 2011 a, b). For example, a significant decrease ($p<0.001$) in anxiety was seen in the first 3 months postnatal compared to measures during the first (Figueiredo and Conde, 2011 a, b), second (Figueiredo and Conde, 2011 a, b) and the third trimesters (Castle et al., 2008; Armstrong et al., 2009; Figueiredo and Conde, 2011 a, b). In Armstrong et al.'s (2009) study, anxiety was found to have further decreased at 8 months postpartum ($p <. 001$). Keeton et al. (2008) assessed anxiety at 5 time-points (1 month antenatal; 1, 4, 6 and 12 months postnatal). They reported an ∩-shaped pattern whereby fathers' anxiety increased soon after birth but then lowered overtime in the postnatal period ($\beta = -.001$, $p < .05$). Similarly, Hjelmstedt and Collins (2008) and Vilska et al. (2009) reported that anxiety significantly declined from the antenatal period to the postnatal period ($p< .05$). Wee et al. (2015) focused on anxiety during the antenatal period and reported significantly higher anxiety at 25 weeks' gestation when compared to 18 weeks' gestation (< .05). Vismara et al. (2016) focused on the postnatal period and found that anxiety decreased from 3 months to 6 months postpartum ($t (180) =3.21$ and $p= 0.002$).

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Factors Contributing to Anxiety

Factors that contribute to anxiety were reported in 20 studies (Keeton et al., 2008; Hjelmsted and Collins, 2008; Castle et al., 2008; Armstrong et al., 2009; Vilska et al., 2009; Teixeira et al., 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Thome and Arnardottir, 2013; Parfitt et al., 2013; Gawlik et al., 2014; Vreeswijk et al., 2014; Wee et al., 2015; Koh et al., 2015; Skjothaug et al., 2015; Zerach and Magal, 2016; Pinto et al., 2016; Kannenberg et al., 2016; Alibekova et al., 2016; Mahmoodi et al., 2017). The findings revealed that anxiety can relate to father and relationship factors.

The most common father factors can be categorised into prior/existing mental health of fathers, experiences of becoming a father and demographic characteristics. Eight studies reported on fathers' mental health as contributing to anxiety including depressive symptoms in the antenatal (Parfitt et al., 2013; Parfitt and Ayers, 2014; Vreeswijk et al., 2014; Pinto et al., 2016) and postnatal period (Parfitt et al., 2013; Parfitt and Ayers, 2014; Pinto et al. 2016; postnatal depression (Gawlik et al., 2014; Vreeswijk et al., 2014; Skjothaug et al., 2015); post-traumatic stress disorder in the antenatal and postnatal period (Armstrong et al., 2009); anxiety sensitivity (fear of behaviours or sensations associated with the experience of anxiety) in the antenatal and postnatal period (Zerach and Magal, 2016, 2017); state anxiety in the antenatal period (Vreeswijk et al., 2014); anxiety at an earlier time in the perinatal period (Vreeswijk et al., 2014; Wee et al., 2015); and stress in the antenatal period (Wee et al., 2015). Factors relating to the experience of becoming a father include lower levels of prenatal quality attachment (Hjelmsted and Collins, 2008; Vreeswijk et al., 2014), insecure anxious attachment style (Figueiredo and Conde, 2011a, b), having twins (Vilska et al., 2009), anxiety surrounding the birth (Biehle and Mickelson, 2011; Kannenberg et al., 2016); presence during the delivery (Sapountzi-Krepia et al., 2010);

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presence during a past delivery (Sapountzi-Krepia et al., 2010) and subjective exposure to stress during birth (Zerach and Magal, 2016, 2017). Paternal demographic characteristics, personal attributes and lifestyle choices also contributed to anxiety and included lower education levels (Mahmoodi et al., 2017); lower income level (Mahmoodi et al., 2017); becoming a father at a younger age (Skjothaug et al., 2015; Koh et al., 2015, Kannenberg et al., 2016); intolerance of uncertainty (Zerach and Magal, 2016, 2017); lower self-esteem (Koh et al., 2015); lower levels of enduring control (Keeton et al., 2008); work-family conflict (Koh et al. 2015); frequent alcohol use (Alibekova et al., 2016); smoking in partners presence and smoking outside partners presence (Alibekova et al., 2016).

Relationship factors that contributed to anxiety were reported in 6 studies. These included: a partner's resilience (Zerach and Magal, 2016, 2017); partner's anxiety in the antenatal (Thome and Arnardottir, 2013; Koh et al., 2015) and postnatal period (Koh et al., 2015); partners' depression across the perinatal period (Koh et al., 2015); lower levels of dyadic adjustment (Lachance-Grzela and Bouchard, 2009; Zerach and Magal, 2016, 2017); lower co-parenting support (Pinto et al. 2016); perceived lower social support (Koh et al., 2015); not being married (Keeton et al., 2008), and lack of practical support (Castle et al., 2008).

Impact of Anxiety

The impact of anxiety on fathers in the perinatal period was reported in 8 studies (Tzeng et al., 2009; Biehle and Mickelson, 2011; Parfitt and Ayers, 2014; Don et al., 2014; Wee et al., 2015; Vismara et al., 2016; Prino et al., 2016; Pinto et al., 2016). Findings revealed that anxiety impacted on fathers' mental health; physical health; social relationships and parenting skills. Five studies reported that anxiety contributed to mental health issues in fathers across the perinatal period. These included pre and postnatal depression (Biehle and Mickelson, 2011; Don et al., 2014; Wee et al.,2015; Vismara et al., 2016), pre and postnatal

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anxiety (Don et al., 2014; Prino et al. 2016), and pre and postnatal stress (Wee et al., 2015; Prino et al., 2016). The impact that anxiety has on physical health was reported in 1 study (Tzeng et al., 2009). The researchers of this Taiwan study found that anxiety during labour was a strong risk factor for developing persistent fatigue. Anxiety was 93.4 times more likely to be in the persistent high-fatigue trajectory (OR, 93.4; $p < 0.0001$). The impact that anxiety has on fathers' relationships in the perinatal period was reported in 1 study. Don et al. (2014) found that increased anxiety levels were associated with decreased spousal support. Increased anxiety also impacted on fathers parenting. At the 1st trimester, fathers with higher anxiety showed lower levels of parenting self-efficacy ($p < .001$) and a lower increase of parenting self-efficacy from the 1st trimester to 6 months postnatal (Pinto et al., 2016). Antenatal anxiety was associated with low paternal control ($p < .05$) and high paternal unresponsiveness ($p < .05$) (Parfitt et al., 2013; Parfitt and Ayers, 2014).

Interventions to Reduce Anxiety

Five studies implemented an intervention to assess its effectiveness in reducing anxiety. The interventions varied and included a lifestyle-based training programme (Charandabi et al., 2017); an education program (Li et al., 2009; Tohotoa et al., 2012); a universal prevention program (Feinburg and Kan, 2008) and music therapy (Labrague and McEnroe-Petitte, 2016). Four of the 5 interventions were implemented in the prenatal period and showed significant change towards lower anxiety levels at two hours (Li et al., 2009) and six weeks postnatal (Feinburg and Kan, 2008; Tohotoa et al., 2012; Charandabi et al., 2017). The fifth study was a prospective quasi-experiment study during childbirth and it also showed significant changes towards lower anxiety levels (Labrague and McEnroe-Petitte, 2016).

Charandabi et al. (2017) conducted a single-blind randomized controlled clinical trial to determine the impact of a lifestyle-based training programme on paternal depression and

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anxiety (primary outcomes) during the perinatal period. Fathers were divided into two groups, one receiving two weekly group lifestyle-based training session (lasting 60–90 min) and a control group. They completed the STAI before the intervention (24–28 weeks gestation), 8 weeks after the intervention and at 6 weeks postpartum. There was a significant decrease in the anxiety levels of the fathers in the intervention group when compared with the control group at 8 weeks after the intervention ($p = 0.001$) and 6 weeks postpartum ($p < 0.001$).

Tohotoa et al. (2012) undertook a RCT to identify changes in self-reported levels of anxiety and depression among fathers in the perinatal period. The intervention utilised father inclusive practices consisting of an antenatal education session led by a male facilitator, followed by a six week postnatal social support/education intervention consisting of education and support materials. Fathers in the intervention group had less anxiety compared to the fathers in the control group from baseline to post test ($p=0.048$). Lower anxiety levels from baseline to six weeks were significant ($p = 0.012$) in the intervention group but were not significant in the control group ($p = 0.410$). Li et al. (2009) implemented an education program for expectant fathers who attended their partners' labour and reported that the childbirth program was significant for reducing postnatal levels of anxiety ($F = 3.38$, $p = 0.001$).

Labrague and McEnroe-Petitte (2016) undertook a prospective quasi-experiment study to determine the effects of music on paternal anxiety during childbirth. Ninety-eight first time fathers were included in the study, 50 were allocated in the experimental group (music group) and 48 in the control group (non-music group). Paternal anxiety was measured using the STAI. Results revealed that the fathers in the experimental group had lower STAI scores

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($p < .05$) than those in the control group. Music decreases the activity of the sympathetic nervous system, lowers serum levels of epinephrine and decreases cortisol (Sung et al., 2010), which would account for the reduction of paternal anxiety in the music group. Feinburg and Kan (2008) aimed to investigate the ability of a childbirth education program to enhance the co-parental relationship, parenting-based closeness and parental mental health and reported that levels of anxiety declined from pre- to post-test for fathers in the intervention group ($p < .05$). Intervention status was also significant for fathers report of co-parental support and for father report of parenting-based closeness ($p < .05$).

Risk of Bias Assessment

For the observation studies, risk of selection bias was high in all 28 studies (Castle et al., 2008; Hjelmsted and Collins, 2008; Keeton et al., 2008; Skreden et al., 2008; Ekelin et al., 2009; Lachance-Grzela and Bouchard, 2009; Armstrong et al., 2009; Tzeng et al., 2009; Vilska et al., 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Figueiredo and Conde, 2011a; Vreeswijk et al., 2014; Parfitt and Ayers, 2014; Gawlik et al., 2014; Don et al., 2014; Skjothaug et al., 2015; Leach et al., 2015; Koh et al., 2015; Wee et al., 2015; Arnal-Remón et al., 2015; Zerach and Magal, 2016; Vismara et al., 2016; Prino et al., 2016; Pinto et al., 2016; Kannenberg et al., 2016; Alibekova et al., 2016; Mahmoodi et al., 2017). Selection bias related to convenience sampling and/or self-selection.

Risk of bias regarding the use of appropriate measures was high in 5 studies (Skreden et al., 2008; Tzeng et al., 2009; Leach et al., 2015; Kannenberg et al., 2016; Mahmoodi et al., 2017) and low in 23 studies as valid or psychometrically robust instruments were used (Keeton et al., 2008; Hjelmsted and Collins, 2008; Castle et al., 2008; Ekelin et al., 2009; Lachance-Grzela and Bouchard, 2009; Armstrong et al., 2009; Vilska et al., 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Figueiredo and Conde, 2011b; Vreeswijk et al., 2014;

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Parfitt et al., 2014; Gawlik et al., 2014; Don et al., 2014; Arnal-Remón et al., 2015; Skjothaug et al., 2015; Koh et al., 2015; Wee et al., 2015; Alibekova et al., 2016; Zerach and Magal, 2016; Vismara et al., 2016; Prino et al., 2016; Pinto et al., 2016).

Low risk for design specific sources of bias with evidence of reporting attrition rates and/or recall bias was identified in 15 studies (Keeton et al., 2008; Hjelmsted and Collins, 2008; Castle et al., 2008; Ekelin et al., 2009; Lachance-Grzela and Bouchard, 2009; Armstrong et al., 2009; Vilska et al., 2009; Teixeira et al., 2009; Gawlik et al., 2014; Don et al., 2014; Leach et al., 2015; Koh et al., 2015; Wee et al., 2015; Kannenberg et al., 2016; Prino et al., 2016), and unclear in 11 (Skreden et al., 2008; Tzeng et al., 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Vreeswijk et al., 2014; Arnal-Remón et al., 2015; Skjothaug et al., 2015; Pinto et al., 2016; Vismara et al., 2016; Mahmoodi et al., 2017; Zerach and Magal, 2017). Two studies were deemed high risk for inappropriate methods to deal with performance bias (Parfitt and Ayers, 2014; Alibekova et al., 2016).

Risk of bias in relation to control of confounders was high in 9 studies (Vilska et al., 2009; Ekelin et al., 2009; Armstrong et al., 2009; Gawlik et al., 2014; Don et al., 2014; Wee et al., 2015; Arnal-Remón et al., 2015; Pinto et al., 2016; Kannenberg et al., 2016). Three studies were found to have inappropriate use of statistics for primary analysis of effect and were therefore assessed as high risk of bias (Tzeng et al., 2009; Sapountzi-Krepia et al., 2010; Pinto et al., 2016). The remaining 19 studies were considered low risk for bias as confounders were controlled for in these studies (Castle et al., 2008; Hjelmsted and Collins, 2008; Keeton et al., 2008; Skreden et al., 2008; Lachance-Grzela and Bouchard, 2009; Tzeng et al., 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Figueiredo and Conde, 2011a; Vreeswijk et al., 2014; Parfitt and Ayers, 2014; Skjothaug et al., 2015; Leach

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et al., 2015; Koh et al., 2015; Zerach and Magal, 2016; Vismara et al., 2016; Prino et al., 2016; Alibekova et al., 2016; Mahmoodi et al., 2017).

Conflict of interest was low in 12 studies with explicit statements (Castle et al., 2008; Figueiredo and Conde, 2011a; Gawlik et al., 2014; Koh et al., 2015; Wee et al., 2015; Vismara et al., 2016; Prino et al., 2016; Pinto et al., 2016; Kannenberg et al., 2016; Alibekova et al., 2016; Mahmoodi et al., 2017; Zerach and Magal, 2017). The remaining 16 studies were deemed high risk as the authors did not make explicit statements related to conflict of interest and/or funding sources (Hjelmsted and Collins, 2008; Keeton et al., 2008; Skreden et al., 2008; Ekelin et al., 2009; Lachance-Grzela and Bouchard, 2009; Armstrong et al., 2009; Tzeng et al., 2009; Vilska et al., 2009; Sapountzi-Krepia et al., 2010; Biehle and Mickelson, 2011; Vreeswijk et al., 2014; Parfitt and Ayers, 2014; Don et al., 2014; Skjothaug et al., 2015; Leach et al., 2015; Arnal-Remón et al., 2015) (see Table 2).

In relation to the RCTs, 3 of the 4 RCT studies were low risk for selection bias as there was generation of randomised sequencing and/or allocation concealment (Feinberg and Kan, 2008; Li et al., 2009; Charandabi et al., 2017). In the other RCT risk of selection bias was unclear as there was no reference to sequencing (Tohotoa et al., 2012). Attrition bias and reporting bias was low in all 4 studies as loss to follow-up/missing data was accounted for, and all the studies reported on the items that they set out to report on (Feinberg and Kan, 2008; Li et al., 2009; Tohotoa et al., 2012; Charandabi et al., 2017) (see Table 3). In relation to non-randomised studies of interventions, both studies had a low risk for selection of bias, as selection into the study was based on participant characteristics observed before the start of intervention (Thome and Arnardottir, 2013; Labrague and McEnroe-Petitte, 2016). Both studies were classified as having no information in measurement of outcomes, and

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serious risk of bias for confounding (Thome and Arnardottir, 2013; Labrague and McEnroe-Petitte, 2016). There was low risk of bias in selection of the reported result in both studies, as there was no selective reporting that would prevent the estimate from being included in a meta-analysis (or other synthesis) (Thome and Arnardottir, 2013; Labrague and McEnroe-Petitte, 2016). An overall judgement of serious risk of bias was rendered for both studies, as there was a serious risk of bias in at least one domain (Sterne et al., 2016) (see Table 4).

Discussion

This review examined the evidence from studies that explored anxiety symptomatology in fathers during the perinatal period. Thirty-four studies were included, involving 7,694 fathers, from 19 countries. Overall, based on mean scores and prevalence rates, the findings indicate that fathers experience anxiety which increases from the antenatal period to the time of birth, with a decrease in anxiety from the time of birth to the later postnatal period (Keeton et al., 2008; Castle et al., 2008; Armstrong et al., 2009; Vismara et al., 2016; Figueiredo and Conde, 2011 a, b). In the early antenatal period, due to a lack of explicit evidence of the existence of their unborn child, fathers have commonly reported feeling somewhat ambivalent and disconnected from their partners' pregnancies (Genesoni and Tallandini, 2009; Fenwick et al., 2012). For example, in an ethnographic study by Draper (2003) participants generally lacked the structured transition that tends to guide women's experiences of pregnancy. In the absence of such structure, expectant fathers found themselves "in a kind of limbo … between social statuses, neither one thing or the other" (Draper 2003, p. 70). Similarly, in an Australian study of fathers-to- be, Fenwick et al. (2012) found that "men struggled to come to terms with the reality of the pregnancy" (p. 7). These feelings may account for fathers' lower levels of anxiety during the early antenatal period, compared to the later antenatal period and the time of birth (Wee et al., 2015).

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Transitions encompass a range of aspects, including emotional, social and physical effects as well as the chronological transition from pregnancy to fathering (Steen et al., 2012). Fathers need to adjust and transition into a new set of expectations (Fenwick et al., 2012). In the third trimester, the reality of fatherhood becomes more tangible for men as they change their focus towards preparing for the birth of their unborn infant (Johansson et al., 2015). This change of focus can evoke negative feelings around concerns for the health and life of the baby and their partner (Eriksson et al., 2007). During this time, fathers also experience anxiety around their own abilities to cope with the labour and birth process (Premberg et al., 2011). These feelings may account for the increased anxiety experienced by fathers in the 3rd trimester.

Paternal anxiety continues into the process of labour where fathers are expected to be a strong calm companion, which can be challenging and an emotionally over- whelming experience (Sapkota et al., 2012). Fathers experience feelings of helplessness (Erlandsson and Lindgren, 2009; Premberg et al., 2011; Johansson et al., 2013), powerlessness (Johansson et al. 2013) and frustration (Kululanga et al., 2012; Sapkota et al., 2012) which intensives anxiety. Anxiety is further compounded as fathers struggle with knowing what to do and how to help their partner (Darwin et al., 2017). Anxiety decreases after birth and in the later postnatal as it is a time of relief and happiness, and represents the moment that fathers experience the reality of fatherhood (Erlandsson and Lindgren, 2009; Longworth and Kingdon, 2011; Premberg et al., 2011; Johansson et al., 2013).

There was substantial heterogeneity among study prevalence estimates of anxiety, indicating that estimates should be interpreted with caution. Prevalence rates varied between 2.4% (Tohotoa et al., 2012) and 51% (Sapountzi-Krepia et al., 2010), which may be

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attributed to diverse settings, recruitment strategies, and inclusion and exclusion criteria. While prevalence estimates can vary depending on when the assessment is performed. For example, assessing anxiety symptoms in the postnatal period may inadvertently capture common physiological responses of anxiety such as diminished sleep and increased fatigue. The findings from this review suggest that the way in which anxiety was measured in studies was most strongly associated with heterogeneity. Many different measurement instruments were used to identify anxiety symptoms, with scores on questionnaire measures interpreted using a variety of different threshold to define anxiety symptoms, making synthesis of the data difficult, across and within measurement instruments.

Variations in prevalence rates between studies may also be related to cultural gender-based issues such as the availability of paternity leave. For example, in countries that have generous paternity leave policies such as Portugal (20 days), fathers reported lower prevalence rates of anxiety (Teixeira et al., 2009; Figueiredo and Conde, 2011a, b) compared to countries such as Taiwan and Greece where there is little or no paternity leave (Tzeng et al., 2009; Sapountzi-Krepia et al., 2010).

A number of factors that contribute to anxiety in fathers in the perinatal period were identified. Factors such as stress (Wee et al. 2015) or lower education levels (Mahmoodi et al., 2017) could affect men in the general population who are not fathers, however, it has been suggested that fathers may be more susceptible to these factors in the perinatal period (Genesoni and Tallandini, 2009). For example, less educated fathers are often faced with employment-related inequalities, in which they are more likely to be working in occupations with temporary contracts, inflexible hours, or that are paid less per hour (Staff 2009). This requires fathers, to take on multiple jobs simultaneously in order to financially

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support their families (Fong and Bainbridge, 2016). As a result, they tend to spend more time at work and less time with their families, which increases work-family conflict, a cause of anxiety (Koh et al., 2015). Three studies reported that the risk of anxiety was significantly decreased related to the number of children a father had previously (Skjothaug et al., 2015; Kannenberg et al., 2016; Mahmoodi et al., 2017). This may be because fathers who already have child face less pronounced role changes and lifestyle adjustments, when compared to first time fathers (Kowlessar et al., 2014).

In this review, lower levels of parental self- efficacy, and a lower increase of parental self-efficacy from the antenatal period to 6 months postnatal, was associated with anxiety (Pinto et al., 2016). The concept of self-efficacy can be interpreted as a self-belief in one's ability to execute certain tasks, specific to a given situation (Bandura, 2012). Self-efficacy is an important component in the transition to fatherhood and to adequate parenting (Cowan and Cowan, 2000; Hudson et al., 2001). Anxiety negatively effects fathers' self-efficacy as they experience a lack of control and stressful cognitions, which can result in negative judgements about their ability to cope with the challenges of fatherhood (Kuhn and Carter, 2006).

Relationship factors contributed to anxiety. For couples whose life activities are intertwined, each partner's personal attributes—mood, attitudes, behaviour, health, anxieties, and lifestyle—effect each other (Kiecolt-Glaser and Wilson, 2017). Solmeyer and Feinberg (2011) reported a positive association between co-parenting support and fathers' adjustment during the postnatal period. Fathers who report more co-parenting support from their partner, perceive themselves as more capable of executing parenting tasks (Pinto et al. 2016), which would suggest that co-parenting support is important for the development of

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parental self-efficacy. Keeton et al. (2008) reported that married fathers had significantly less anxiety than cohabiting fathers ($p < .05$). Beyond simply living with a partner, marriage provides unique benefits to mental health and well-being (Wiik et al., 2009; Wiik et al., 2012). Marriage is often a social sign of commitment, and the symbolic promise of marriage may provide couples with a long-term perspective that the future of their relationship is secure (Perelli-Harris and Styrc, 2018). This reduction in life uncertainty can result in psychological or cognitive changes that promote mental well-being (Li et al., 2015). The mental health benefits may be enhanced further through personal networks, such as in-laws, who provide structural social support and coping resources to married couples because the relationships are more defined (Marcussen, 2005).

The review found that anxiety impacted on fathers' mental health, physical health, relationships and parenting skills in the perinatal period. Similar to the findings from research within the general population, the onset and existence of mental health problems such as stress and depression are associated with anxiety (Burcusa and Iacono, 2007; Schonfeld et al., 2016). Research has shown that higher anxiety levels lead to decreased serotonergic activity, and increased cortisol levels, which has a clear link to stress and depression (Albert et al., 2014). Higher anxiety levels also impacted on fathers fatigue levels (Tzeng et al., 2009). These findings are comparable to findings from a qualitative study, where fathers reported that increased anxiety led to fatigue through a lack of sleep and emotional exhaustion (Darwin et al. 2017). The negative impact of paternal anxiety highlights the need to examine effective interventions to address the problem. Interventions to reduce anxiety are common in healthcare (Blom et al., 2016; Gotink et al., 2017), however, only 5 studies on interventions were identified in this review. All 5 studies reported significant reductions in paternal anxiety. These findings suggests that use of

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interventions, may be a window of opportunity to address the problem of paternal anxiety in the perinatal period (Tohotoa et al., 2012). However, as each of these interventions were only examined with one cohort of fathers, further research to corroborate the findings with other cohorts of fathers is necessary before they can be recommended for implementation in clinical practice.

Limitations

The results of the review should be interpreted in light of its limitations. Some of our selection criteria may have led to a scope bias that limited the availability of studies included for review. This includes potential language bias toward English-only publication language and publication bias where grey literature such as unpublished research and conference proceedings was excluded. The diversity of measurements and study designs included did not allow us to conduct a meta-analysis in this systematic review. The Cochrane Collaboration Risk of Bias In Non-randomised Studies of Interventions (ROBINS-I) which was used to assess risk of bias in the quasi-experimental studies has not been subject to a formal test of construct validity (Sterne et al., 2016; Waddington et al., 2017). However, it underwent an extensive development program involving many methods experts, has considerable face validity, and was developed from a well-established and validated instrument (the Cochrane Risk of Bias tool for RCTs) (Bilandzic et al., 2016).

Future research

The review highlighted the fact that higher anxiety levels contributed to mental health issues such as stress and depression. The co-existence of anxiety and depression is well documented in the general population (Wittchen et al., 2011; Bandelow and Michaelis, 2015) and in the perinatal period (O'Hara and Wisner, 2014; Agius et al., 2016). A number of

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studies have also reported the co-existence of anxiety and stress (Wee et al., 2015; Leach et al., 2016). However, no study investigating the triple co-existence of stress, anxiety and depression among fathers in the perinatal period has been identified. Understanding if triple co-existence occurs and establishing its prevalence is important, as fathers may present with complex and mixed symptoms, making it hard to identify and manage them (Agius et al., 2016). Furthermore, the coexistence of stress, anxiety and depression during the perinatal period may perpetuate the course of each, maintain the occurrence, and result in higher intensity of distress and/or impact on fathers, their partner and their infant (Agius et al., 2016).

The findings from the review suggested that the anxiety experienced by fathers in the perinatal period may be linked to cultural gender-based issues such as the availability of paternity leave. In countries that have generous paternity leave policies such as Portugal (20 days), fathers reported lower prevalence rates of anxiety (Teixeira et al., 2009; Figueiredo and Conde, 2011a, b) compared to countries such as Taiwan and Greece where there is little or no paternity leave (Tzeng et al., 2009; Sapountzi-Krepia et al., 2010). The risk of anxiety may be reduced in fathers who receive paternity leave due to increased involvement with their infants and partner, which has shown to increase paternal self-efficacy and social support (Tanaka and Waldfogel, 2007). A recent Irish study found an association between paternal postnatal depression and the paternity leave benefits that a father receives (Philpott and Corcoran, 2018). Currently, there is no research addressing the impact that paternity leave has on anxiety levels in the perinatal period. The findings from such a study would establish if there is a link between anxiety and the paternity leave benefits that a father receives. The findings from the study could be used by governments to inform policy related to leave benefits for fathers and their partner in the perinatal period.

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Studies in the review reported that interventions such as a lifestyle-based training programme, a co-parenting programme, and music therapy have the potential to significantly reduce anxiety in fathers in the perinatal period. While the findings point to the potential benefits that such intervention could have for fathers, it has been suggested that before an intervention is introduced into practice, it should have been found to produce meaningful effects in more than one implementation site (Gorman-Smith, 2016). As all the interventions in this review were only implemented in one research site, further research is needed to corroborate the findings of such programmes before they can be recommended for implementation by healthcare professionals.

Clinical Implications

The results of this review should alert healthcare professionals to be vigilant for fathers who may present with anxiety. During the perinatal period, there are many opportunities for healthcare professionals to include and involve fathers. The majority of expectant fathers accompany their partners to antenatal consultations, scans and education classes and almost all fathers are present at the birth of their infant (Redshaw and Henderson, 2013; Yogman and Garfield, 2016). Despite this, healthcare professionals are slow to include and involve fathers in the perinatal period (Li et al. 2009; Longworth and Kingdon 2011; Widarsson et al., 2015). Healthcare professionals need to tailor services to include the needs of fathers. One example is antenatal classes exclusively for fathers. These classes have been reported as beneficial by fathers, and can reduce anxiety through the provision of information about pregnancy, birth and postnatal care that is tailored to the needs and experiences of fathers (Nash, 2017). This review suggests that fathers need to be supported during the perinatal period. It has been argued that the most effective support for fathers is likely to come from their partner (Wee et al., 2013). More than 90% of fathers rely on their

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partner as a source of emotional and/or informational support in the perinatal period (Forsyth et al., 2011). When promoting mental health and well-being in the perinatal period healthcare professionals need to implement a couples-focused approach. A couples-focused approach recognizes both maternal and paternal needs (Don and Mickelson, 2012) and the support that each partner provides in adjusting to new circumstances during this life stage (Pilkington et al., 2016). The third trimester has been identified as a key time point for elevated paternal anxiety, and this may be the most applicable time to provide information, and implement programmes that reduce anxiety.

Conclusion

The findings from this systematic review indicate that experience anxiety which increases from the antenatal period to the time of birth, with a decrease in anxiety from the time of birth to the later postnatal period (Keeton et al., 2008; Castle et al., 2008; Armstrong et al., 2009; Vismara et al., 2016; Figueiredo and Conde, 2011 a, b). An increase in anxiety from the antenatal period to the time of birth, was followed by a decrease in anxiety from the time of birth to the later postnatal period. A number of factors contribute to anxiety and these include being frightened at preparatory visit to an obstetric hospital, being present during the delivery, poor antenatal quality attachment, a partner's anxiety and depression, lower levels of dyadic adjustment, and lower co-parenting support. The review found that anxiety impacted on fathers' mental health, physical health, relationships and parenting skills. Anxiety contributed to mental health issues such as stress, and depression. It is important for future research to investigate if the triple co-existence of paternal stress, anxiety and depression occurs during the perinatal period, as fathers may present with complex and mixed symptoms, making it hard to identify and manage them, resulting in a higher intensity of distress and/or impact on fathers, their partner and their infant.

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Ethical statement

There is no conflict of interest.

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Author's contribution LP designed and executed the study, created the tables, and wrote the paper. SF collaborated with the design, writing, and editing of the study. ES collaborated with the design, writing, and editing of the study. PL-W collaborated with the design, writing, and editing of the study.

ACCEPTED MANUSCRIPT

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Author(s), year, country Study design	Study Aim	Participants details and recruitment	Measures and time points	Anxiety symptoms: Mean scores (M) and Standard Deviations (SD)	Anxiety symptoms: Prevalence % (n) and levels	Factors contributing to anxiety symptoms	Impact of Anxiety symptoms
Mahmoodi et al. (2017) Iran Cross sectional study	"To investigate the mother-father differences in Postnatal Psychological Distress (PPD) and its determinants among the parents with 8-weeks old children" (p.91)	124 fathers Age: 18-28 years (42.7%); 29-39 years (46.8%); > 39 years (10.5%) Relationship status: NR Employment status: Employed (49.6%); Unemployed (50.4%) Education level: Illiterate (9.3%); Elementary (48%); High school (13.7%); Diploma (21%); University (8.1%); Parity: 1st child (44.4%); 2nd child (43.1%); 3rd child (9.7%); > 3 children (2.8%) Recruited from a maternity ward **Note**: age, employment status, education level and parity were reported for participants and not separately for fathers	Iranian version of General Health Questionnaire (GHQ-28). The GHQ-28 encompasses four dimensions: somatic symptoms, anxiety, social dysfunction, and depression. Each dimension consists of 7 items. Likert-type scaling (0, 1, 2, and 3). Total scores range from 0 to 84. Higher score indicates more symptoms of psychological distress. A cut-off point of 23 was employed. Internal consistency: NR Data collection time point(s): 8 weeks postpartum	NA	21% (26)	Education level ($p < .001$), parity ($p < .01$) and monthly income ($p < .003$) predicted 37% of anxiety symptoms among fathers	NA

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Charandabi et al. (2017) **Iran** Randomized controlled trial	"To determine the impact of lifestyle-based training on paternal depression and anxiety (primary outcomes) during the prenatal and postnatal periods" (p.482)	126 fathers Age: (M) 31.9 (SD 5.3) Relationship status: NR Employment status: self-employed (85.7%) Education level: Secondary (6–8 year) (30.9%); High school (9–11 years) (10.3%); Diploma (12 years) (30.1%); University (13 years +) (28.5%) Parity: NR Recruited from health centres	The State-Trait Anxiety Inventory (STAI) is a self-report scale consisting of two subscales. The state anxiety and the trait anxiety subscales each contain 20 items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety represents a predisposition to react with anxiety in stressful situations. Internal consistency: α.91 Data collection time point(s): T (1) 24–28 weeks antenatal; T (2) 6 weeks postpartum	State anxiety subscale Intervention group: Baseline (M) 35.0 (SD 9.7) 8 weeks after Intervention (M) 30.1 (SD 7.7) 6 weeks postpartum (M) 31.0 (SD 10.1) Control group: Baseline (M) 33.9 (SD 9.3) 8 weeks after Intervention (M) 35.8 (SD 10.5) 6 weeks postpartum (M) 38.5 (SD 12.7) Trait anxiety subscale Intervention group: Baseline (M) 39.7 (SD 9.3) 8 weeks after Intervention (M) 30.7 (SD 7.6) 6 weeks postpartum (M) 30.5 (SD 10.0) Control group: Baseline (M) 37.0 (SD 9.1) 8 weeks after Intervention (M) 35.8 (SD 9.7) 6 weeks postpartum (M) 38.8 (SD 11.8)	NA	8 weeks after the intervention and 6 weeks postpartum there was a statistically significant difference of anxiety symptoms between the two groups ($p < 0.001$). The average score of state anxiety showed a significant decrease in the intervention group in comparison with the control group (−7.5; −11.6 to −3.4). 8 weeks after the intervention ($p = 0.001$) and 6 weeks postpartum ($p < 0.001$). The score of trait anxiety showed a significant decrease in the intervention group in comparison with the control group ($p < 0.01$)	NA
Zerach & Magal (2016, 2017)	"To examine rates of post traumatic stress disorder (PTSD)	171 fathers Age: (M) 27.77 (SD 4.17) Relationship status:	The State-Trait Anxiety Inventory (STAI-S). The 20-item anxiety state subscale	STAI-S scores T (1) (M) 32.44 (SD 10.52) T (2) (M) 31.05 (SD 9.23)	13.8% (23) of fathers exceeded the 40 cut-off score	Dyadic Adjustment- (T1) ($p < .001$); Partner's Resilience	NA

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Israel Longitudinal study	symptoms (PTSS) and anxiety symptoms among men following the birth of their first offspring" (p.1)	Married (100%) Employment status: Employed full-time (65.5%); Employed part-time (27.5%); unemployed (7%) Education level: Years of education (M) 13.72 (SD 2.51) Parity: 1st child (100%) Recruited from from birth-related Web sites and online communities	assesses how participants feel "at the moment" (e.g., "I feel concerned"). Scores range from 20 – 80. Higher scores indicate higher levels of anxiety. Previous studies have used cut-off points of 40 and 45 to indicate a level of clinically significant anxiety Internal consistency ranged from α.94 (antenatal); α.93 (postnatal) Data collection time point(s): T (1) 3rd trimester antenatal T (2) 1 month postpartum		6% (10) of fathers exceeded the 45 cut-off score	(T1) ($p < .01$); PTSD symptoms (T1) ($p < .01$) PTSD symptoms (T2) ($p < .001$); Anxiety symptoms (T1) ($p < .001$); Anxiety sensitivity (AS)-total (T1) ($p < .01$) Anxiety sensitivity (AS)- physical (T1) ($p < .01$); Anxiety sensitivity (AS)-cognitive (T1) ($p < .01$) Intolerance of uncertainty (IU)-total (T1) ($p < .01$) Intolerance of uncertainty (IU)-prospective (T1) ($p < .01$); Intolerance of uncertainty (IU)-inhibitory (T1) ($p < .01$). Subjective exposure to stress during birth predicted anxiety in T2, above and beyond other negative life events and anxiety in T1 ($p < .001$). The sum of negative life events was negatively related to anxiety symptoms after birth. The more first-time fathers have	

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						experienced negative life events, the less they suffer from anxiety symptoms following birth.	
Vismara et al. (2016) **Italy** Longitudinal study	"To examine whether there are any differences and relationships between fathers' and mothers' levels of parenting stress, anxiety, and depression symptoms and to evaluate their evolution from three to 6 months after their child's birth. To explore, through a path model, whether the persistence of PND could be a response to the parent's own parenting stress and anxiety levels and the anxiety levels and depressive symptoms of his/her partner" (p.2).	181 fathers Age: (M) 37.9 years (SD 5.6) Relationship status: Married (70%); Cohabiting (30%); Employment status: NR Education level: elementary school qualification (12%); high-school qualification (45%); college degree (38%); PhD (5%) Parity: 1st child (100%) Recruited from NR	The State-Trait Anxiety Inventory (STAI) is a self-report scale comprised by two subscales, the state anxiety and the trait anxiety, each containing 20 items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) that measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety represents a predisposition to react with anxiety in stressful situations. Internal consistency T (1) α.94; T (2) α.95 Data collection time point(s): T (1) 3 months postpartum; T (2) 6 months postpartum	STAI–State T (1) (M) 34.9 (SD 9.4) T (2) (M) 33.6 (SD 9.3) STAI–Trait T (1) (M) 35.1 (SD 9.4) T (2) (M) 32.9 (SD 8.4) The mean STAI-Trait score decreased from T (1) to T (2) (t (180) =3.21 and p= 0.002)	STAI–State Normal (<40) T (1) 74.6% (135) T (2) 76.8% (139) Anxious (>40) T (1) 25.4% (46) T (2) 23.2% (42) STAI–Trait Normal (<40) T (1) 74% (134) T (2) 80.1% (145) Anxious (>40) T (1) 26% (47) T (2) 19.9% (36)	NA	Paternal postnatal depression T (1) (p < .01); Paternal postnatal depression T2 (p < .01)
Prino et al. (2016) **Italy** Longitudinal study	"To examine whether mothers' and fathers' anxiety, depression, and dyadic adjustment, assessed at the sixth month of	29 fathers Age: (M) 38.2 (SD 4.4) Relationship status: Married (100%) Employment status: NR Education level:	The State-Trait Anxiety Inventory (STAI) is a self-report scale comprised by two subscales, the state anxiety and the trait anxiety, each containing 20	NR	STAI–State Anxious (> 40) T (1) 6.9% (2) T (2) 13.8% (4) STAI–Trait Anxious (> 40)	NR	Anxiety during pregnancy and after delivery, are correlated with stress: STAI–State T (1)

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	pregnancy and at 3 months postpartum are associated with the infants' negative affectivity (NA) and with parenting stress (Time 2)" (p.3)	elementary school qualification (10%); high-school qualification (35%); college degree (48%); PhD (7%) Parity: 1st child (100%) Recruited from NR	items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) that measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety represents a predisposition to react with anxiety in stressful situations. Internal consistency for STAI–State T (1) α.94; T (2) α.87 STAI–Trait T (1) α.94; T (2) Data collection time point(s): T (1): 24-26weeks of pregnancy; T (2): 3 months postpartum		T (1) 3.4% (1) T (2) 13.8% (4)		(p < .05); T (2) (p < .01) STAI–Trait T (1) (p < .05); T2 (p < .01)
Pinto et al. (2016) Portugal Longitudinal study	"To analyse fathers' parenting self-efficacy developmental path and the effects of anxious and depressive symptoms and co-parenting support on fathers' parenting self-efficacy developmental path, from the first trimester of pregnancy to 6 months postpartum"	86 fathers Age: 20–29 years (35.2%) 30–39 years (62.6%) 40–45 years (2.2%) Relationship status: Married (63.7%) Cohabitation (28.6%) Single (7.7%) Employment status: Employed (89.0%) Unemployed (8.8%) Household or student (2.2%)	The State-Trait Anxiety Inventory (STAI) is a self-report scale comprised by two subscales, the state anxiety and the trait anxiety, each containing 20 items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) that measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety represents a	T (1) (M) 31.91 (SD 7.07) T (2) (M) 35.37 (SD 7.51) T (3) (M) 30.42 (SD 8.14) T (4) (M) 31.79 (SD 7.14)	NR	Depressive symptoms T (1) (p < .001) T (2) (p < .001) T (3) (p < .001) T (4) (p < .001) Co-parenting support T (1) (p < .01) T (2) (p < .01) T (3) (p < .01) T (4) (p < .01)	At the 1st trimester, fathers with higher anxious symptoms showed lower levels of parenting self-efficacy (p < .001) and a lower increase of parenting self-efficacy from the 1st trimester to 6

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	(p.345)	Education level: < 9 years (9.9%); 9–12 years (52.7%); > 12 years (37.4%) Parity: 1st child (100%) Recruited from two health services	predisposition to react with anxiety in stressful situations. Internal consistency α.87 Data collection time point(s): T (1) 1st trimester; T (2) 3rd trimester; T (3) 1 month postpartum; T (4) 6 months postpartum				months postpartum (*b* = −0.01, *p* = .027, effect size *r* = .139)
Kannenberg et al. (2016) Germany Cross sectional study	"To assess the fears of expectant parents in the setting of antenatal and obstetric care according to their sex, age, parity and education" (p.809)	183 fathers Age: NR Relationship status: NR Employment status: NR Education level: NR Parity: NR Recruited from UKSH Women's hospital	The State-Trait Anxiety Inventory (STAI) is a self-report scale comprised by two subscales, the state anxiety and the trait anxiety, each containing 20 items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) that measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety represents a predisposition to react with anxiety in stressful situations. Internal consistency α.87 Data collection time point(s): Antenatal	STAI–State (M) 39.37 STAI–Trait (M) 34.59	NA	State anxiety fell significantly with increasing number of children (p = 0.005); there was a significant increase in trait anxiety (p = 0.044) and state anxiety (p = 0.016) as pregnancy progressed; anxiety surrounding the birth decreased with increasing age (p = 0.008)	NA
Labrague & McEnroe-Petitte (2016) Philippines Prospective quasi-	"Is there a significant difference on the anxiety levels of the music and non-musical group after exposure to music?	98 fathers Age: (M) 25.1 (SD 3.62) control group; (M) 24.31 (SD 3.89) experimental groups Relationship status:	The 20 items state subscale of the State Trait Anxiety Inventory (STAI-S). Scores can range from 20 to 80 with higher scores indicating a higher level of	Experiment group (T1) (M) 40. 30 (SD 1.74) (T2) (M) 36.82 (SD 2.09) Control group (T1) (M) 40.43 (SD 2.20) (T2) (M) 43.12 (SD 1.73)	NA	Statistically, significant differences in the STAI scores in the experimental group (music) (*t* = 93.90, *p* < 0.05) and control	NA

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experimental design	Is there a significant difference on the level of satisfaction with the childbirth experience of the music and non-music group after exposure to music" (p.122)	Married (66%) control group; (72.9%) experimental groups; Single (345) control group; (27.1) experimental group Employment status: NR Education level: Primary (8%) control group (10.4%) experimental group; Secondary (34%) control group; (39.9%) experimental group; Tertiary (58%) control group; (50%) Parity: 1st child (100%) Recruited from a government hospital	anxiety Internal consistency α.92 Data collection time point(s): during labor			group (no music) (t = −52.36, p < 0.05) were noted.	
Alibekova et al. (2016) Taiwan Longitudinal study	"To investigate whether the paternal smoking status is longitudinally associated with maternal and paternal depression and anxiety from early pregnancy until 6 months postpartum" (p.19)	533 fathers Age: < 30 years 30 (5.9%); 30-35 years 236 (46.5%); > 35 years 242 (47.6%) Relationship status: 495 (96.7%); Other 17(3.3%) **note**: reported for mothers not fathers Employment status: Full-time 484 (96.6%) Part-time/unemployed 17 (3.4%) Education level: < 12	The 20 items state subscale of the State Trait Anxiety Inventory (STAI-S). Scores can range from 20 to 80 with higher scores indicating a higher level of anxiety Internal consistency α.90 Data collection time point(s): T(1) early pregnancy; T(2) mid-pregnancy; T(3) late pregnancy; T(4) 1 month postpartum; T(5) 6 months	Non smoker T (1) (M) 34.0 T (2) (M) 34.8 T (3) (M) 34.6 T (4) (M) 34.8 T (5) (M) 35.2 Smoking but not in the mother's presence T (1) (M) 35.5 T (2) (M) 35.4 T (3) (M) 36.8 T (4) (M) 35.8 T (5) (M) 35.4	NA	Paternal smoking in the mother's presence was consistently and independently related to paternal anxiety in all 3 perinatal periods (3.0, 95% CI 1.2 – 4.7, p < 0.001) for the antenatal period; (2.3, 95% CI 0.2–4.5, p < 0.05) during pregnancy; (3.2, 95% CI 0.7–5.6, p < 0.01) in the postpartum	NA

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		years 48 (9.4%); 12–16 years 305 (59.8%); > 16 years 157 (30.8%) Parity: 1st child 319 (62.3%); 2+ 193 (37.7%) **note**: reported for mothers not fathers Recruited from 5 outpatient clinics of hospitals in Taipei	postpartum	Smoking in the mother's presence T (1) (M) 36.7 T (2) (M) 35.2 T (3) (M) 36.5 T (4) (M) 39.0 T (5) (M) 38.8		period). Smoking outside the mother's presence was significantly associated with paternal anxiety throughout the perinatal period, especially in the postpartum period (regression coefficient 2.7, 95% CI 0.7–4.7, p < 0.01), compared with a non-smoking status. Frequent paternal alcohol use was significantly associated with increased anxiety (regression coefficient 2.1, 95% CI 0.7–3.5) symptom during the perinatal period when compared with non-frequent paternal drinking status	
Skjothaug et al. (2015) Norway Longitudinal study	"To examine the association between fathers' adverse childhood experiences and pregnancy-related anxiety and depression during pregnancy; and to investigate if this	981 fathers Age: (M) 32.3 (SD 5.9) Relationship status: Married (35%); co habiting (62%); single (3%) Employment status: NR Education level: high-school or lower (33%); university (77%)	The Pregnancy-Related Anxiety Questionnaire-Revised (PRAQ-R) consists of 10-items to assess ongoing anxiety related to pregnancy toward birth. When the scale is used for fathers, it is reduced by 3 items to make it more suitable to assess fathers'	PRAQ-R T (2) (M) 15.6 (SD 5.4) T (3) (M) 14.1 (SD 5.6) T (4) (M) 14.7 (SD 5.6) T (5) (M) 14.8 (SD 5.6)	NA	There was a significant association between adverse childhood experiences at baseline and the PRAQ-R at T (2) (p = 0.01) to T (4) (p = 0.001). Age at T (1) (p < 0.001);	NA

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	association varies during the course of pregnancy" (p.107)	Parity: 1st child (56%), 2nd child (33%); 3rd + (11%) Recruited from well-baby clinics	possible anxiety-related stress. Items related to pain in the process of delivery, change in body perception after birth, and fear for gaining weight are removed. It assesses three subscales of anxiety specific to pregnancy: fear of giving birth, fear of bearing a handicapped child, and pregnancy-related concerns about one's appearance (not for fathers). Internal consistency α.83 Data collection time point(s): T (1) Weeks 8–34 T (2) Weeks 20–25 T (3) Weeks 26–31 T (4) Weeks 32–34 T (5) Week 36			Parity at T (1) ($p < 0.001$); T (2) ($p < 0.001$); T (3) ($p < 0.001$); T (4) ($p < 0.001$); T (5) ($p < 0.001$) EPDS T (1) at T (1) ($p < 0.001$); T (2) ($p < 0.05$); T (3) ($p < 0.001$); T (4) ($p < 0.001$); T (5) ($p < 0.001$) EPDS T (2) at T (1) ($p < 0.001$); T (2) ($p < 0.001$); T (3) ($p < 0.001$); T (5) ($p < 0.001$) EPDS T (3) at T (1) ($p < 0.001$); T (3) ($p < 0.001$); T (4) ($p < 0.001$); T (5) ($p < 0.001$) EPDS T (4) at T (1) ($p < 0.001$); T (3) ($p < 0.001$); T (4) ($p < 0.001$); T (5) ($p < 0.001$) EPDS T (5) at T (1) ($p < 0.001$); T (3) ($p < 0.001$); T (4) ($p < 0.001$); T (5) ($p < 0.001$) PRAQ-R T (1) at T (2) ($p < 0.001$); T (3) ($p < 0.001$); T (4) ($p < 0.001$); T (5) ($p < 0.001$ PRAQ-R T (2) at T (3)	

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						(p < 0.001); T (4) (p < 0.001); T (5) (p < 0.001); PRAQ-R T (3) at T (4) (p < 0.001); T (5) (p < 0.001); PRAQ-R T (4) at T (5) (p < 0.001);	
Leach et al. (2015) Australia Longitudinal study	"To investigate whether becoming a first-time expectant (partner pregnant) and/or new father (child 51 year) is associated with increases in depression and anxiety" (p.471)	196 fathers Age: New fathers (i.e. had a child aged less than 1 year) (M) 22.7 (SD 1.5) Expectant fathers (M) 22.7 (SD 1.4) Relationship status: New fathers Married (11.1%); De facto (23.1%); Separated/divorced (0%); Never married (65.7%) Expectant fathers Married (11.4%); De facto (18.2%); Separated/divorced (0%); Never married (70.5%) Employment status: New fathers Employed (90.7%); Unemployed (2.8%); Not in labour force (6.5%) Expectant fathers Employed (89.8%); Unemployed (3.4%);	Goldberg Depression and Anxiety Scales. Each scale contains nine binary items (yes, 1; no, 0) summed to yield scale scores ranging from 0 to 9. Internal consistency NR Data collection time point(s): NR	New fathers (M) 2.8 (SD 2.6) Expectant fathers (M) 2.7 (SD 2.6)	NA	NA	NA

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		Not in labour force (6.8%) Education level: Years in education New fathers (M) 14.6 (SD 1.5) Expectant fathers (M) 14.7 (SD 1.6) Parity: 1st child (100%); Recruited from the Canberra and Queanbeyan electoral rolls					
Koh et al. (2015) **Hong Kong** Longitudinal study	"Determining the prevalence of paternal perinatal anxiety and identifying its risk factors among the fathers" (p.1)	622 fathers Age: (M) 34.19; < 25 years (3.1 %); 26 to 34 years (51.3 %); > 35 years old (45.5 %) Relationship status: Married or cohabiting (98.9 %); divorced (1.1 %) Employment status: NR Education level: tertiary (58.1%); secondary school (41 %); primary (0.9%) Parity: 1st child (67.7 %); Previous children (32.3 %) Recruited from two regional hospitals	The Anxiety Subscale of Hospital Anxiety and Depression Scale (HADS). 7 items relate to anxiety. The recommended cut-off of 7/8 was used to identify a probable case of anxiety. Internal consistency α.77 Data collection time point(s): T (1) 12 weeks gestation; T (2) 36 weeks gestation; T (3) 6 weeks postpartum	NA	Mild anxiety T (1) 11.6 % T (2) 13.4 % T (3) 14.2 % Moderate anxiety T (1) 1.9 % T (2) 2.6 % T (3) 3.4 %	At 6 weeks postnatal, family income level was found to be a significant predictor of anxiety (p < .05); Marital distress at T (1), T (2) and T (3) (p = <.001) Lower self-esteem T (2) and T (3) (p = <.001) Perceived lower social support at T (1), T (2) and T (3) (p = <.001) Higher work-family conflict at T (1), T (2) and T (3) (p = <.001) Partners' anxiety at T (1), T (2) and T (3) (p = <.001) Partners' depression at T (1), T (2) and T (3)	NA

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						(p <.001) Young age T (2) (p <.05)	
Wee et al. (2015) Australia Longitudinal study	"To examine whether depressive symptoms predict anxiety and stress or whether anxiety and stress precede depressive; examine the stability of depressive, anxiety and stress symptoms in men during their partner's pregnancy; compare findings for men and their partners; and finally to compare findings for first-time fathers and non-first-time fathers given the differences in antenatal mood symptoms between first-time and non-first-time fathers has yet to be explored " (p.359)	150 fathers Age: (M) 34 (SD 5.73) Relationship status NR Employment status: Employed (90.7%); Home-Based Paid Work (1.9%); Unemployed (3.7%) Education level: University/Postgraduate Degree (89%); High School or Less (11%) Parity: NR Recruited from advertisements in community media, magazines, websites, and posters in schools and clinics.	Anxiety scale as part of 21 itemed self-reported Depression, Anxiety and Stress Scales (DASS). Anxiety scores range from: Normal stress 0-7; Mild stress 8-9; Moderate stress 10-14; Severe stress 15-19; Very severe 20+ Internal consistency α 0.88 Data collection time point(s): Antenatally: T (1) 18 weeks T (2) 25 weeks T (3) 33 weeks	NA	T (1) Normal:95.3% (n=143) Mild: 2% (n=3) Moderate: 2%(n=3) Severe: 0.7% (n=1) T (2) Normal: 94% (n=141) Mild: 3.3% (n=5) Moderate: 2% (n=3) Severe: 0.7% (n=1) Very severe: 0.7% (n=1) T (3) Normal: 96% (n=144) Mild: 2% (n=3) Moderate: 0.7% (n=1) Severe: 1.3% (n=2) A significant time effect was found for anxiety. LSD post-hoc tests revealed that fathers reported significantly more anxiety (< .05) at T (2) than at T (1)	Higher stress scores at 25 weeks' gestation T (2) were associated positively with anxiety scores at 33 weeks' gestation T (3) (p < 0.1).	Higher paternal anxiety scores at T (1) were associated positively with depression and stress scores at T (2) (p < .001) and higher paternal stress scores at T (2) were associated positively with depression and anxiety scores at T (3) (p < .001)
Arnal-Remón et al. (2015) Spain Cross sectional study	"To evaluate symptoms of depression and anxiety and psychological well-being in men and	25 fathers Age: (M) 34.48 (SD 3.08) Relationship status: Married (100%) Employment status: NR Education level: NR	The State-Trait Anxiety Inventory (STAI) is a self-report scale comprised by two subscales, the state anxiety and the trait anxiety, each containing 20	State-Anxiety (STAI-S) (M) 12.32 (SD 8.66) Trait-Anxiety (STAI-T) (M) 12.76 (SD 5.15)	NA	NR	NA

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	women in their third trimester of pregnancy, and to compare them with two control groups of men and non pregnant women, both with children and without children" (p.128)	Parity: 1st child (100%) Recruited from a local community health centre **note**: age, reported for participants and not separately for fathers	items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) that measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety (STAI-T) represents a predisposition to react with anxiety in stressful situations. Internal consistency α.90 for the anxiety-trait and α.94 for the anxiety-state Data collection time point(s): 3rd trimester of pregnancy				
Vreeswijk et al. (2014) Netherlands Longitudinal study	"To systematically explore fathers' experiences of the unborn child during pregnancy" (p. 131)	301 fathers Age: (M) 34.01 (SD 4.59) Relationship status: Employment status: employed (96.6%) Education level: college degree (64.2%) Parity: 1st child (54.7%) Recruited from four midwifery practices	The State-Trait Anxiety Inventory (STAI) is a self-report scale comprised by two subscales, the state anxiety and the trait anxiety, each containing 20 items scored on a 4-point Likert-type scale. The State Anxiety Inventory (STAI-S) that measures the temporary condition of "state anxiety" (anxiety in a specific situation). Trait anxiety represents a predisposition to react with anxiety in stressful situations. Internal consistency α.95 Data collection time	State-Anxiety (STAI-S) (M) 31.35 (SD 7.66) Trait-Anxiety (STAI-T) (M) 31.11 (SD 6.89)	NA	Prenatal attachment score ($p < 0.1$); Prenatal quality of attachment ($p < 0.1$); Depressive symptoms ($p < 0.1$); State anxiety ($p < 0.1$)	NA

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			point(s): 26 weeks gestation				
Parfitt & Ayers (2014); Parfitt et al. (2013,2014) United Kingdom Longitudinal study	"To examine the transition to parenthood and mental health in first-time parents in detail and explore any differences in this transition in the context of parental gender and postpartum mental health" (p.263) and "To examine the effect of fathers' and mothers' pre and postnatal mental health on mother–infant and father–infant interactions" (p.599)	40 fathers Age: (M) 33.58, (SD 7.33) Relationship status: Married (64%) Employment status: NR Education level: university education (74%). Parity: 1st child 100% Recruited from the Sussex Journey to Parenthood Study	The Birmingham Interview for Maternal Mental Health (BIMMH) is divided into eight sections, covering the social, psychological, and psychiatric course of pregnancy, birth, and months after the birth. Parents were assessed on their degree of pre- and postpartum anxiety and depression on a scale 0 (none) to 3 (severe). A cut-off of ≥2 (moderate or severe disorder) was used to identify those with mental health issues. Internal consistency: NR The 14 item Hospital Anxiety and Depression Scale (HADS) consists of 7 items for depressive symptoms and 7 for anxiety symptoms, rated on a continuous 4-point scale, with ranges of 0–21 for each sub-scales. High scores indicate more pathological responses. Internal consistency T (1) α .77; T (2) α .85; T (3) NR Data collection time point(s): T (1) late pregnancy	T (1) (M) 6.41 (SD 3.41) T (2) (M) 4.47 (SD 3.29)	T (1) 25.% (10) T (3) 7.5% (3)	At T (1) all fathers with depression had comorbid anxiety. At T (3) 33.3% of fathers had comorbid depression and anxiety.	Prenatal anxiety associated with low paternal control ($p < 05$) and high paternal unresponsiveness ($p < 05$)

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			T (2) 3 months postpartum T (3) 5 months postpartum				
Gawlik et al. (2014) Germany Longitudinal study	"To confirm the hypothesis that prenatal symptoms predict postnatal symptoms" (p.50)	102 fathers Age: (M) 35.82 (SD 5.95) Relationship status: Widowed (2.9%) Single (16.7%) Married (75.5%) Divorced (4.9%) Employment status: NR Education level: NR Parity: 1st child (54.5%) other children 45.5%) Recruited from a obstetrics department	The 20 items state subscale of the State Trait Anxiety Inventory (STAI-S). Scores can range from 20 to 80 with higher scores indicating a higher level of anxiety Internal consistency α .83 Data collection time point(s): 6 weeks postpartum	(M) 49.61 (SD 11.19)	NA	Paternal Postnatal Depression ($p < .05$)	NA
Don et al. (2014) United States Longitudinal study	"To examine whether new parents experience different patterns of change in symptoms of anxiety over the early transition to parenthood (from pregnancy to nine-month postpartum" (p.635)	104 fathers Age: (M) 29.99 (SD 4.77) Relationship status: married (91%) Employment status: NR Education level: college (75%) Parity: 1st child (100%) Recruited from local birthing classes and online message boards	The Symptom Checklist-90-Rm (SCL-90r) anxiety subscale. Participants answered 10 items assessing their anxiety over the past week. Responses range from 0 = none/rarely (<1 day) to 3 = most (5–7 days), a mean score is created by averaging the items. Internal consistency T (1) α .82; T (2) α .82; T (3) α .85; T (4) α .82 Data collection time point(s): T (1) 3rd trimester T (2) 1 postpartum T (3) 4 months postpartum T (4) 9 months postpartum	T (1) (M) 0.43 (SD 0.42) T (2) (M) 0.34 (SD 0.37) T (3) (M) 0.26 (SD 0.39) T (4) (M) 0.32 (SD 0.40)	10.6% moderate anxiety	NA	Anxiety T (1): Anxiety T (2) ($P < .01$); Anxiety T (3) ($P < .01$); Anxiety T (4) ($P < .01$); Prenatal depression ($P < .01$); Prenatal self-esteem ($P < .01$); Expected parenting efficacy ($P < .01$); Anxiety T (2): Anxiety T (3) ($P < .01$); Anxiety T (4) ($P < .01$); Prenatal depression ($P < .01$); Prenatal

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							self-esteem (P < .01); Expected parenting efficacy (P < .01); Anxiety T (3): Anxiety T (4) (P < .01); Prenatal depression (P < .01); Prenatal self-esteem (P < .01); Expected parenting efficacy (P < .01); Prenatal spousal support (P < .01); Anxiety T (4): Anxiety T (1) (P < .01); Anxiety T (2) (P < .01); Anxiety T (3) (P < .01); Prenatal depression (P < .01); Prenatal self-esteem (P < .01); Expected parenting efficacy (P < .05);
Thome & Arnardottir (2013) Iceland Before and after, quasi-experimental study	"To evaluate the clinical effects of an antenatal family nursing intervention for distressed women and their partners on depressive symptoms, anxiety, self esteem,	39 fathers Age: (M) 30 (SD 5.6) Relationship status: NR Employment status: NR Education level: NR Parity: NR Recruited from family nursing home-visiting	State and Trait Anxiety Inventory (STAI) distinguishes anxiety as either situational or personality related. The State Anxiety Scale is used to assess anxiety as a situation-specific response,	STAI-trait (M) 21.58 post intervention STAI-state (M) 17.60 post intervention	Scores on the combined STAI scales post intervention remained high for 19%	Living with a partner who maintained high scores on either one or both anxiety subscales	NA

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	and dyadic adjustment" (p.808).	service in a primary care setting	whereas the Trait Anxiety Scale assesses personality-related anxiety. Each scale consist of 20 items that asses the intensity of anxiety symptoms. Scores for each scale can vary from a minimum of 20 to a maximum of 80, and scores ≥ 40 on either scale indicate severe anxiety. Internal consistency for state anxiety pre-test α .87, post-test α .89; trait anxiety pre-test α .97, post-test α .95 Data collection time point(s): (T) 1 second or third trimester; T (2) near to the due date.				
Tohotoa et al. (2012) Australia Randomised controlled trial	"To identify the impact of a father inclusive intervention on perinatal anxiety and depression" (p.1)	533 fathers Age: Control group (M) 29.4; Intervention group (M) 29.5; Relationship status: Control group Single (7%); Intervention group (8%); Control group Married (49%); Control group (55%); Control group Defacto (41%); Intervention group (32%) Employment status: Full	The14 item Hospital Anxiety and Depression Scale (HADS) is a self-report survey to identify anxiety and depression. Seven questions reflect anxiety with seven reflecting depression: HADS-A and HADS-D. Each item is answered on a four point (0–3) response category, possible scores range from 0 to 21 for anxiety and 0 to 21 for depression. 0 to 7 is within normal range; 8 to	NA	T (1) moderate to severe anxiety: intervention group 7% (24); control group 4% (13) T (2) intervention group 2.6% (8); control group 2.4% (6)	The change towards lower anxiety levels from baseline to six weeks were significant (p = 0.012) in the intervention group but were not significant in the control group (p = 0.410) Intervention group (p=0.012); unchanged anxiety 241(83%) reduced anxiety 36(12.4%) (p=0.015); increased anxiety	NA

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		time Control group (85%); Intervention group (88%); Unemployed Control group (8%) Intervention group (4%); Other Control group (6%); Intervention group (4%) Education level: ≤year 12 Control group (39%); Intervention group (39%); Trade/diploma Control group (38%); Intervention group (38%); Degree/higher Control group (21%); Intervention group (19%); Parity: NR Recruited from public maternity hospitals	10 is within mild range; 11–14 moderate range; > 15 and above indicating a severe level of anxiety or depression Internal consistency α .83 Data collection time point(s): T (1) pregnancy T (2) 6 weeks postpartum			12(4%) Control group (p=0.471); unchanged anxiety 198(81%); reduced anxiety 28(11.4%); increased anxiety 18(7%)	
Biehle & Mickelson (2011) United States Cross sectional study	"To examine if expectant mothers and fathers differ in the types of worries they report during pregnancy" (p.3)	104 fathers Age: (M) 29.99 (SD 4.77) Relationship status: married (91%); cohabiting (9%) Employment status: NR Education level: NR Parity: 1st child (100%) Recruited from local birthing classes and online message boards	The Symptom Checklist–90R. Participants were asked to report how they felt in the last week in regards to 10 different items (e.g., "felt nervous," "felt so restless you could not sit still"). Possible responses ranged from most (5–7 days) = 3, moderate (3–4 days) = 2, a little (1–2 days) =1, or none/ rarely (<1 day) = 0 that week. Higher scores	(M) 4.29 (SD 4.16) Moderate level of anxiety	NA	Fathers who worried about security issues reported higher levels of anxiety than fathers who worried about baby issues (security worries: M= 5.60, SD=4.97; baby worries: M=3.22, SD=3.04; p<.01, η 2=.08) Childbirth worries (p<.05) Relative worry	Depression (p<.001) Positive affect (p<.001)

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			indicating higher levels of anxiety Internal consistency α .83 Data collection time point(s): 3rd trimester of pregnancy			(p<.001)	
Figueiredo & Conde (2011a, b) Teixeira et al. (2009) Portugal Longitudinal study	"To investigate high-anxiety and depression throughout pregnancy (first, second, and third trimesters) and the first postpartum months (childbirth and 3-months postpartum), analyzing differences in rates between high anxiety and depression, women and men, and pregnancy and the postpartum period" (p.248)	102 fathers Age: ≤19 years (4.2%); 20–29 years (38.9%); 30–39 years (46.9%); ≥40 years (10%) Relationship status: married (55.1%); cohabiting (33.1%); single (11.4%); divorced (0.4%) Employment status: Employed (88.8%); Unemployed (9.2%); Household/student (2.0%) Education level: < 9 years (40%); 9–12 years (48.4%); >12 years (11.6%) Parity: 1st child (62.9%) Recruited from public hospital obstetrics out-patients	The 20 item STAI-S was used to measure anxiety. The STAI-S is a self-report scale for measuring the temporary condition of state-anxiety (anxiety in a specific situation). A score equal or higher than 45 (STAI-S ≥ 45) denotes high-anxiety states Internal consistency α .87 - α .93 Data collection time point(s): T (1) 1st trimester; T (2) 2nd trimester; T (3) 3rd trimester; T (4) Childbirth; T (5) 3 months postpartum	T (1) (M) 32.55 (SD 8.21) T (2) (M) 30.87 (SD 7.74) T (3) (M) 32.50 (SD 7.47) T (4) (M) 32.95 (SD 8.73) T (5) (M) 29.41 (SD 7.65) 1st time fathers T (1) (M) 32.28 (SD 8.52) T (2)(M) 29.57 (SD 7.29) T (3)(M) 30.72 (SD 6.96) T (4)(M) 32.11 (SD 9.14) T (5)(M) 27.87 (SD 7.14) 2nd time fathers (M) 32.93 (SD 7.80) (M)32.69 (SD 8.04)	T (1) 10.1% T (2) 8.0 % T (3) 7.8 % T (4) 8.5 % T (5) 4.4% Rates of STAI-S≥45 were lower at 3-months postpartum than in the first ($\chi2$=8.31,p=0.004), second ($\chi2$=12.12, p<0.001), third pregnancy trimesters ($\chi2$= 14.88,p<0.001) and childbirth ($\chi2$=16.68,p<0.001) High anxiety T (1) 11.1% T (2) 7.9%	A significant effect of insecure anxious attachment style on anxiety symptoms, (p =.03)	NA

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				(M) 34.97 (SD 7.50) (M) 34.11 (SD 8.04) 31.54 (7.86)			
Sapountzi-Krepia et al. (2010) Greece Cross-sectional study	"Exploring the feelings and the experience of fathers about their wife/partner's delivery" (p.48)	417 fathers Age: (M) 36.24 (SD 6.85) Relationship status: Married (95.2%); Cohabiting (2.6%); Unmarried 1.7%) Employment status: Employed (97.9%); Unemployed (0.7%); Other (1.4%) Education level: Primary school (6.5%); Secondary school (gymnasium) (16.4%); Secondary school (77.1%) Parity: 1st child (47.4%); 2nd child (37.4%); 3rd + child (15.2%) Recruited from the community	The Kuopio Instrument for Fathers (KIF) explores fathers' feelings and experiences related to their wife/partner's delivery. The KIF contains two scales. The first scale is a 35-item scale for eliciting information on the father's feelings related to his wife/partner's delivery. This scale is divided into four subscales: 13-items on father's own feelings, 7-items on father's feelings concerning his wife/partner, 5-items about the birth of his child, and 10-items about the hospital staff and environment. The second scale has 19-items related to their wife/partner's delivery. Internal consistency α .61 to α .90 Data collection time	NA	51% Anxiety	Presence during delivery (p=0.000), presence during past delivery (p=0.033), being frightened at preparatory visit to the obstetric hospital (p=0.009)	NA

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			point(s): Postnatal 1 week to 1 year				
Ekelin et al. (2009) Sweden Longitudinal Study	"To investigate parents' expectations, experiences and reactions, sense of coherence and anxiety before and after a second-trimester routine ultrasound examination, with normal findings" (p.952)	1,243 fathers Age: (M) 33 Relationship status: Married or cohabitant 97.5%); Partner but not living together' (2.0%); Single (0.4%); Other (0.1%) Employment status: Education level: Less than basic compulsory schooling, (in Sweden 9 years) (0.8%); Comprehensive school (2.9%); High school (32.1%); University/college (64.2%) Parity: 1st child (42.3%); Second child or more (57.7%) Recruited from university hospital	State and Trait Anxiety Inventory (STAI) with the full form of the trait scale (STAI-T) (20 items) and a six-item version of the STAI state scale (STAI-S). Internal consistency (STAI-T) α .90; (STAI-S). α .90 Data collection time point(s): 2nd trimester of pregnancy	STAI-S Before US (M) 28.8 (SD 8.7); After US (M) 29.4 (SD 8.6) STAI-T Before US (M) 31.2 (SD 7.5); After US (M) 30.9 (SD 7.6)	NA	NR	NA
Lachance-Grzela and Bouchard (2009) Canada Cross-sectional study	"To examine the moderational role of pregnancy planning in the relationship between marital status and future parents' wellbeing" (p.142)	154 fathers Age: 30.12 (3.55) Relationship status: Married (66%); Co-habiting (34%) Employment status: NR Education level: 15.85 years (SD 2.57) Parity: 1st child 100% Recruited from prenatal	The anxiety subscale of the Psychiatric Symptom Index. Each scale contains 7 items which are scored using a 4-point Likert-type scale (0 = never and 3 = very often). Scores, ranging from 0 to 21. Higher scores reflect more severe levels of anxiety.	Married fathers (M) 2.45 (SD 2.35) Cohabiting fathers (M) 3.00 (SD 2.30)	NA	dyadic adjustment was significant for anxiety ($p < .05$)	NA

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		classes	Internal consistency α .85 Data collection time point(s): 3rd trimester of pregnancy				
Li et al. (2009) Taiwan Randomized controlled trial	"To evaluate how an education program for expectant fathers who attended their partners' labour and birth affected their anxiety" (p. 289)	87 fathers Age: Experimental Group (M) 30.60 (SD 4.36); Control Group (M) 30.83 (SD 4.44); Relationship status: NR Employment status: NR Education level: High school or below Experimental Group (15.6%); Control Group (21.4%) Junior college Experimental Group (31.1%); Control Group (31.0); University Experimental Group (53.3%); Control Group (47.6) Parity: 1st child (100%) Recruited from hospital	The STAI assessed the state of anxiety and trait anxiety. Each of the subscales (state and trait) asked 20 questions about how the person currently feels (state anxiety) or how much anxiety the person usually feels (trait) about each statement. The STAI measures current anxiety and reflects current subjective feelings with respect to tension, apprehension, nervousness, and worry. Participants rated their feelings on a scale of 1 (not at all) to 4 (very much so). Possible scores for each scale are 20 to 80. A higher score indicated more anxiety. Internal consistency (STAI-T) α .73; (STAI-S). α .79 Data collection time point(s): T (1) 34 to 36 weeks' gestation; T(2) Two hours after birth	Trait anxiety before birth Experimental Group (M) 43.76 (SD 7.52) Control Group (M) 44.50 (SD 6.30) State anxiety after birth Experimental Group (M) 43.00 (SD 6.45) Control Group (M) 48.12 (SD 7.38)	NA	the childbirth program was significant for the postnatal level of anxiety (F = 3.38, p = 0.001)	NA
Armstrong et al. (2009) United States	"To evaluate the long-term influence of a previous perinatal loss	36 fathers Age: (M) 32.04 (SD 4.80) Relationship status:	The State Trait Anxiety Inventory (STAI) is a self-report questionnaire	STAI-S T (1) (M) 37.4 T (2) (M) 34.6	NA	Fathers' trait anxiety with posttraumatic stress (PTS) at	NA

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Longitudinal Study	on parents' psychological distress during a subsequent childbearing experience" (p.654)	(96.4%) Employment status: NR Education level: Primary (0%); High school (2.8%); Vocational (8.7%); College (30.6%); Masters (38.9%); Doctoral (16.7%); Professional (2.8%); Parity: NR Recruited from prenatal clinics, prenatal education classes, private obstetric practices, perinatal loss support groups, newsletters and Internet message boards focusing on perinatal loss	designed to measure two dimensions of anxiety: how the respondent feels right now (state) and how the individual generally feels (trait). The qualities measured by the State subscale (STAI-S) are current feelings of apprehension, tension, nervousness, and worry. Scores on this subscale increase in response to physical danger and immediate psychological stress. The Trait subscale (STAI-T) has been widely used for assessing clinical anxiety and screening for anxiety problems. Internal consistency α .92 for both the STAI-S and STAI-T subscale Data collection time point(s): T(1) 3rd trimester of pregnancy; T (2) 3 months postpartum; T (3) 8 months postpartum	T (3) (M) 30.6 STAI-T T (1) (M) 36.2 T (2) (M) 35.2 T (3) (M) 33.5 Anxiety scores for both STAI subscales scores significantly decreased over time(p <. 001)		assessment T (1) p=.001; T (2): p=.002	
Tzeng et al. (2009) Taiwan A prospective, repeated measures design	"To identify birth-related fatigue trajectories in expectant fathers with the progress of labour and the physiological,	108 fathers Age: (M) 31.8 (SD 4.2) Relationship status: Married (100%) Employment status: NR Education level: NR Parity: 1st child (78.7%)	Visual analogue scale anxiety (VAS-A) intensity. The scales consist of a 100 mm vertical line with the bottom of the scale representing 'no anxiety' and the top of the scale	NA	High anxiety: 42.6% (46)	NA	High anxiety was a strong risk factor for developing persistent high-fatigue trajectory pattern with

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	psychological and situational factors related to specific trajectory patterns" (p.1674)	Recruited from antenatal clinic of a medical centre	identified as 'the most serious anxiety imaginable.' The vertically-oriented VAS is considered more sensitive and easier to use than other instruments, especially for those under stress. Participants were instructed to indicate the intensity of anxiety they were experiencing by marking the appropriate place on the line. Possible scores ranged from 0–100. More severe anxiety was indicated by a higher score. Internal consistency NR Data collection time point(s): during labour				high anxiety was 93.4 times more likely to be in the persistent high-fatigue trajectory (OR,93.4;p < 0.0001)
Vilska et al. (2009) Finland Longitudinal study	"To evaluate the psychological well-being of ART and spontaneously conceiving parents of twins and singletons" (p.367)	379 fathers Age: Twins (M) 32.9 (SD 5.4); Singleton (M) 34.2 (SD 5.4) Relationship status: NR Employment status: NR Education level: NR Parity: not reported for fathers Recruited from the patient list for screening ultrasonographic scans at 16 – 18 weeks of gestation weeks at Helsinki University Central Hospital	General Health Questionnaire (GHQ-36), which gives an effective measure of psychiatric disorders in the general population was used to estimate how each of the 36 symptom descriptions matched his current state (1 = not at all, 4 = much more than usual). Averaged sum scores were created for symptoms of the 'anxiety' scale (11 items) Internal consistency α 0.88 – α 0.92 Data collection time	Twins T (1) (M) 1.46 (SD 0.09) T (2) (M) 1.53 (SD 0.11) T (3) (M) 1.59 (SD 0.013) Singletons T (1) (M) 1.44 (SD 0.02) T (2) (M) 1.39 (SD 0.02) T (3) (M) 1.36 (SD 0.03)	NA	Fathers of twins, had more anxiety symptoms than fathers of singletons (F=5.40,P < 0.05)	NA

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			point(s): T (1) 2nd trimester of pregnancy; T (2) 2 months postpartum; T (3) 1 year postpartum				
Skreden et al. (2008) Norway Longitudinal study	"To describe psychological health during a 5-year period in parents of preschool children and to explore differences between mother and fathers and identify predictors for increased psychological distress in parents" (p.462).	112 fathers Age: (M) 37 years Relationship status: NR Employment status: Unemployed (14%) Education level: > 10 years (89%) Parity: 1st child (51%) Recruited from a district general hospital	The 20 item State Trait Anxiety Inventory (STAI-S) enquiring to what extent the respondent is currently experiencing the symptom or sign: 'not at all', 'somewhat', 'moderately' or 'very much' and are rated on a four level scale (1-2-3-4) with a possible score range 20–80. Higher scores indicate more anxiety. Clinically important state anxiety was defined as a STAI score ≥40 Internal consistency NR Data collection time point(s): T (1) 0-4 days postpartum; T(2) 6 weeks postpartum; T (3) 6 months postpartum	T (1) (M) 29.5 T (2) (M) 30.1 T (3) (M) 30.2	NA	NR	NA
Keeton et al. (2008) United States Longitudinal study	"To explore how individuals' sense of control relates to psychological adjustment, namely anxiety and depressive symptoms, during the transition to	153 fathers Age: (M) 29.1 years Relationship status: Married (80%); Cohabiting (20%) Employment status: Employed (100%) Education level: high school or general	State Anxiety subscale of the State–Trait Anxiety Inventory. On a 4-point intensity scale, respondents rated the extent to which 20 statements (e.g., "I feel nervous and restless," "I make decisions easily")	T (1) (M) 32.45 (SD 7.69) T (2) (M) 31.58 (SD 7.60) T (3) (M) 32.60 (SD 8.45) T (4) (M) 33.18 (SD 10.03) T (5) (M) 31.66 (SD 8.14)	T (1) 16% T(2) 12% T (3) 16% T (4) 18% T (5) 14% Analyses revealed an ∩-shaped pattern such that fathers' anxiety, on average,	Greater family income ($p < .05$) and being married ($p < .05$) were significantly related to less anxiety. Higher levels of enduring control significantly predicted lower levels of anxiety at 6 months	NA

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	parenthood" (p.4)	equivalency diploma (32.7%); additional schooling or vocational training after high school (52.3%); a 1/2-year associate's degree (15.0%) Parity: 1st child (100%) Recruited from hospital prenatal education classes	represented their current feelings. A high score on this measure indicates greater symptomatology. Internal consistency α .89 Data collection time point(s): T (1) 1 month antenatal; T(2) 1 month postpartum; T (3) 4 months postpartum T (4) 6 months postpartum; T (5) 12 months postpartum		increased during the transition to fatherhood but lowered over time (β= −.001, p< .05)	(p< .01)	
Hjelmsted & Collins (2008); Hjelmsted et al. (2007) Sweden Longitudinal study	"To compare IVF fathers and control fathers regarding personality traits, state anxiety, depressive symptoms and early father–infant attachment and to assess whether early father–infant relationship is explained by the father's prenatal relationship with the unborn infant, his personality traits, state anxiety and symptoms of depression" (p.72)	36 fathers Age: (M) 33.3 (SD = 2.7) Relationship status: NR Employment status: NR Education level: secondary education (16.7%); university degree (83.3%) Parity: NR Recruited from antenatal clinics	The State Anxiety Inventory consists of two scales: one measuring 'state' anxiety and the other 'trait' anxiety. Each of the scales consists of 20 items, which are rated on a four point Likert-scale where high values indicate high 'state' or 'trait' anxiety. The men answered the 'trait' scale in week 13 and the 'state' scale in week 26, week 36 and 2 months postpartum Internal consistency NR Data collection time point(s): T (1) 13 weeks gestation; T (2) 26 weeks gestation; T (3) 36 weeks gestation; T (4) 2 months postpartum	T (1) (M) 32.1 (SD 7.9) T (2) (M) 28.6 (SD 5.6) T (3) (M) 30.1 (SD 4.8) T (4) (M) 26.9 (SD 5.2)	NA	Prenatal attachment in gestational week 26 (P=0.000)	NA

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Castle et al. (2008) UK Longitudinal study	"To investigate whether perceived social support during a pregnancy is linked with postnatal distress and well-being, and whether attitudes to emotional expression are linked with perceived social support and postnatal distress in mothers and fathers" (p.183)	66 fathers Age: (M) 32.9 (SD 5.1) Relationship status: Married (75.8%) Employment status: (100%) Education level: NR Parity: 1st child (100%) Recruited from antenatal classes held at two hospitals	The14 item Hospital Anxiety and Depression Scale (HADS) is a self-report survey to identify anxiety and depression. Seven questions reflect anxiety with seven reflecting depression: HADS-A and HADS-D. Each item is answered on a four point (0–3) response category, possible scores range from 0 to 21 for anxiety and 0 to 21 for depression. 0 to 7 is within normal range; 8 to 10 is within mild range; 11–14 moderate range; > 15 and above indicating a severe level of anxiety or depression Internal consistency α .93 Data collection time point(s): T (1) 3rd trimester of pregnancy; T (2) 6 weeks postpartum	T (1) (M) 6.35 (SD 3.04) T (2) (M) 5.64 (SD 3.04) Fathers showed significantly lower anxiety scores 6 weeks after the birth ($p < 0.05$)	NA	Confidant (practical) social support did add significantly to predictive capacity for anxiety ($p < 0.001$)	NA
Feinburg & Kan (2008) United States Randomised Controlled Trial	"To investigate the ability of a theoretically driven, psychosocial prevention program implemented through childbirth education programs to enhance the co-parental relationship, parental mental health, the	169 fathers Age: 29.76 years (SD 5.58) Relationship status: Married 82% Employment status: NR Education level: educational attainment (M) 14.51 years (SD = 2.19) Parity: 1st child 100%	Anxiety was measured with the 20-item short form of the Taylor Manifest Anxiety Scale, which measures chronic anxiety Items (e.g., "I am a high-strung person") followed a dichotomous yes/no format. Internal consistency α .78 Data collection time	Pre-test Intervention group (M) 5.31 (SD 3.39) Control group (M) 6.05 (SD 3.70) Post-test Intervention group (M) 4.43 (SD 3.71) Control group (M) 5.22 (SD 4.00)	NA	Intervention status was significant for father report of co-parental support and for father report of parenting-based closeness ($p < .05$.)	NA

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	parent–child relationship, and infant emotional and physiological regulation" (p.1)	Recruited from childbirth education programs at two hospitals, from doctors' offices, health centres, newspaper ads, flyers, by word of mouth	point(s): T (1) 3rd trimester of pregnancy; T (2) 6 weeks postpartum				

NR = not reported, NA = not assessed, M = mean score, SD = standard deviation, P = prevalence, R = range, N = number, T = time-point, p = p-value,

Table 1: Data extraction table

Table 2: Risk of bias for all observational studies (i.e. cross-sectional, longitudinal) Adapted from Sanderson et al. (2007)

L= Low, H = High, UC = Unclear

Author, Year	**Selection bias** Sampling source and methods, with inclusion/exclusion criteria	**Measurement Bias** Exposure and/or Outcome measurement	**Design Specific Bias** Attrition Recall	**Confounding Bias**	**Statistical Method Bias** Primary analysis of effect	**Conflict of Interest or funding source**
Mahmoodi et al.	H	H	UC	L	L	L

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(2017)						
Zerach & Magal (2016, 2017)	H	L	UC	L	L	L
Vismara et al. (2016)	H	L	UC	L	L	L
Prino et al. (2016)	H	L	L	L	L	L
Pinto et al. (2016)	H	L	UC	H	H	L
Kannenberg et al. (2016)	H	H	L	H	L	L
Alibekova et al. (2016)	H	L	H	L	L	L
Skjothaug et al. (2015)	H	L	UC	L	L	H
Leach et al. (2015)	H	H	L	L	L	H
Koh et al. (2015)	H	L	L	L	L	L
Wee et al. (2015)	H	L	L	H	L	L
Arnal-Remón et al. (2015)	H	L	UC	H	L	H
Vreeswijk et al. (2014)	H	L	UC	L	L	H
Parfitt & Ayers (2014); Parfitt et al. (2013, 2014)	H	L	H	L	L	H
Gawlik et al. (2014)	H	L	L	H	L	L
Don et al. (2014)	H	L	L	H	L	H

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Biehle & Mickelson (2011)	H	L	UC	L	L	H
Figueiredo & Conde (2011a, b) Teixeira et al. (2009)	H	L	L	L	L	L
Sapountzi-Krepia et al. (2010)	H	L	UC	L	H	H
Ekelin et al. (2009)	H	L	L	H	L	H
Lachance-Grzela and Bouchard (2009)	H	L	L	L	L	H
Armstrong et al. (2009)	H	L	L	H	L	H
Tzeng et al. (2009)	H	H	UC	L	H	H
Vilska et al. (2009)	H	L	L	H	L	H
Skreden et al. (2008)	H	H	UC	L	L	H
Keeton et al. (2008)	H	L	L	L	L	H
Hjelmsted & Collins (2008); Hjelmsted et al. (2007)	H	L	L	L	L	H
Castle et al. (2008)	H	L	L	L	L	L

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Table 3: Cochrane Collaboration's tool for assessing risk of bias for RCTs (Higgins et al. 2011)

H= High, L= Low, UC= Unclear

Author	Selection bias	Performance bias	Detection bias	Attrition bias	Reporting bias	Other bias
Charandabi et al. (2017)	Low RoB	Low RoB	Unclear	Low RoB	Low RoB	Low RoB
Tohotoa et al. (2012)	Unclear	High RoB	Unclear	Low RoB	Low RoB	Low RoB
Li et al. (2009)	Low RoB	Unclear	Unclear	Low RoB	Low RoB	Low RoB
Feinberg and Kan 2008	Low RoB	Unclear	Unclear	Low RoB	Low RoB	Low RoB

Table 4: Cochrane Collaboration's ROBINS-I tool for assessing risk of bias in non-randomised studies of interventions (Sterne et al. 2016)

RoB = risk of bias

Author	Bias due to confounding	Bias in selection of	Bias in classification of	Bias due to deviating from	Bias due to missing data	Bias in measurement of	Bias in selection of the reported results	Overall RoB

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		participants into the study	interventions	intended interventions		outcomes		judgment
Labrague & McEnroe-Petitte (2016)	Serious RoB	Low RoB	Serious RoB	Low RoB	Low RoB	No information	Low RoB	Serious RoB
Thome and Arnardottir (2013)	Serious RoB	Low RoB	Serious RoB	Low RoB	Serious RoB	No information	Low RoB	Serious RoB

Table 5: Anxiety prevalence rates across the perinatal period

Antenatal Prevalence of Anxiety			
Author(s)	**Measurement tool**	**Data collection time point(s)**	**Prevalence (n)**

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Zerach and Magal (2016, 2017)	The State-Trait Anxiety Inventory (STAI-S)	3rd trimester antenatal	13.8%
Prino et al. (2016)	The State-Trait Anxiety Inventory (STAI)	24-26 weeks of pregnancy;	STAI–State 6.9% (2) STAI–Trait 3.4%
Koh et al. (2015)	Hospital Anxiety and Depression Scale (HADS)	12 weeks' gestation; 36 weeks' gestation;	11.6 % 13.4 %
Wee et al. (2015)	Depression, Anxiety and Stress Scales (DASS)	Antenatally T (1) 18 weeks T (2) 25 weeks T (3) 33 weeks	T (1) Mild: 2% (n=3) Moderate: 2%(n=3) Severe: 0.7% (n=1) T (2) Mild: 3.3% (n=5) Moderate: 2% (n=3) Severe: 0.7% (n=1) Very severe: 0.7% (n=1) T (3) Mild: 2% (n=3) Moderate: 0.7% (n=1) Severe: 1.3% (n=2)
Parfitt et al. (2013); Parfitt and Ayers (2014)	Hospital Anxiety and Depression Scale (HADS)	late pregnancy	25%
Don et al. (2014)	Symptom Checklist-90-Rm(SCL-90r)	3rd trimester	10.6 %
Thome and Arnardottir (2013)	The State-Trait Anxiety Inventory (STAI)	second or third trimester	19%
Tohotoa et al. (2012)	Hospital Anxiety and Depression Scale (HADS)	pregnancy;	Severe anxiety: intervention group 7%; control group 4%
Teixeira et al. (2009) Figueiredo and Conde (2011a, b)	The State-Trait Anxiety Inventory (STAI-S)	1st trimester 2nd trimester 3rd trimester;	10.1% 8.0 % 7.8 %
Intranatal Prevalence of Anxiety			
Teixeira et al. (2009) Figueiredo and Conde (2011a, b)	The State-Trait Anxiety Inventory (STAI-S)	Childbirth	8.5%
Tzeng et al. (2009)	Visual analogue scale anxiety (VAS-A) intensity.	During labour	42.6%
Postnatal Prevalence of Anxiety			
Mahmoodi et al. (2017) Iran	Iranian version of General Health Questionnaire (GHQ-28)	8 weeks postpartum	21% (26)
Zerach and Magal (2016, 2017)	The State-Trait Anxiety Inventory (STAI-S)	1 month postpartum	6%
Vismara et al. (2016)	The State-Trait Anxiety Inventory (STAI)	T (1) 3 months postpartum T (2) 6 months postpartum	STAI–State: T (1) 25.4%; T (2) 23.2%

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			STAI–Trait: T (1) 26%; T (2) 19.9%
Prino et al. (2016)	The State-Trait Anxiety Inventory (STAI)	3 months postpartum	STAI–State 13.8% STAI–Trait 13.8%
Koh et al. (2015)	Hospital Anxiety and Depression Scale (HADS)	6 weeks postpartum	14.2 %
Parfitt et al. (2013); Parfitt and Ayers (2014)	Hospital Anxiety and Depression Scale (HADS)	5 months postpartum	7.5%
Tohotoa et al. (2012)	Hospital Anxiety and Depression Scale (HADS)	6 weeks postpartum	Severe anxiety: intervention group 2.6%; control group 2.4%
Teixeira et al. (2009) Figueiredo and Conde (2011a, b)	The State-Trait Anxiety Inventory (STAI-S)	3 months postpartum	4.4%
Sapountzi-Krepia et al. (2010)	The Kuopio Instrument for Fathers (KIF)	1 week to 1 year	51%

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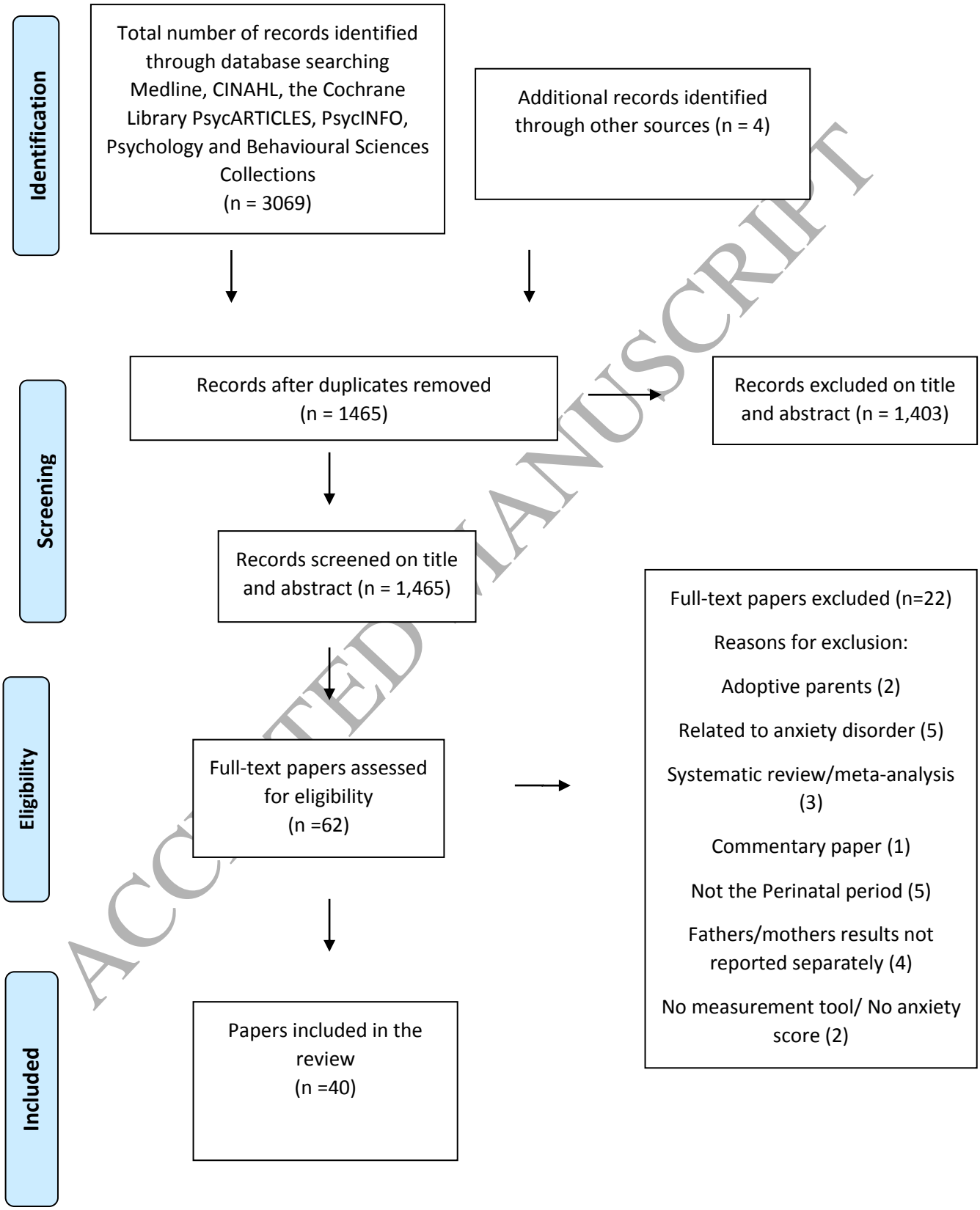
Fig. 1. Study selection flow diagram (PRISMA 2009) Moher et al., 2009.



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