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Stress in Fathers in the Perinatal Period: A Systematic Review

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Abstract

Background

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despite the evidence that fatherhood has a long-term positive and protective effect on men's health, there is also evidence that fatherhood in the perinatal period can be complex and demanding. Due to the potential increase in stressors in the perinatal period, there is reason to hypothesise that it is a time of increased stress for fathers. However, it is not clear how significant a problem stress is for fathers during this stage of life. This is in part, due to the fact that the available research has not been systematically reviewed.

Purpose

the purpose of this systematic review was to critically appraise the empirical evidence that examined stress in fathers in the perinatal period.

Design

systematic review

Methods

a systematic review protocol was developed and registered with PROSPERO (Reference number: CRD42016035821). The review was guided by the PRISMA reporting process. Electronic databases Medline, CINAHL, the Cochrane Library, PsycARTICLES, PsycINFO, Psychology and Behavioural Sciences Collections were searched to identify studies that met the inclusion criteria. Studies that researched fathers in the perinatal period were included if stress was the principal focus of the research, if stress was in the title and/or aim of the study or if stress was an outcome or dependent variable. Data were extracted and presented in narrative form including tables and figures.

Findings

eighteen studies met the inclusion criteria. The findings indicate that fathers experience stress in the perinatal period, particularly at the time of birth. Stress levels were found to increase from the antenatal period to the time of birth, with a decrease in stress levels from the time of birth to the later postnatal period. There are a number of factors that contribute to stress in fathers in the perinatal period and these included negative feelings about the pregnancy, role restrictions related to becoming a father, fear of childbirth and feelings of incompetence related to infant care. The review found that stress has a negative impact on fathers, with higher stress levels contributing to mental health issues such as anxiety, depression, psychological distress and fatigue.

Key conclusion

during the perinatal period fathers experience stress and face unique stressors that can impact negatively on their health and social relationships.

Key words: Fathers, Stress, Perinatal, Systematic review, Mental health, Men's Health

Introduction

The perinatal period, which covers the time when a man's partner becomes pregnant through to the first year after birth is marked by significant change and the absence of routine (Wilson, 2008; Leach et al., 2014). While most of these changes are expected and welcome, others can be unanticipated (Paulson and Bazemore, 2010). Fatherhood, even when it is desirable and planned, can be complex and demanding and can have a negative impact on men's mental health, resulting in stress, anxiety and increased risk of depression (Pollock et al., 2005; Kim and Swain, 2007; Veskrna, 2010; Leach et al., 2016).

Over the last three decades, researchers have investigated the mental health of fathers in the perinatal period, with the majority of studies focusing on depression. 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%. These rates of depression are above those seen in the general male adult population which are estimated at 4.7% (National Institute of Mental Health, 2015). Stress has been identified as a critical risk factor for the development of depression (Cohen and Janicki-Deverts, 2012) and there is evidence that the onset and duration of depression is strongly linked to stress (Cohen et al., 2007).

Stress is associated with the development of anxiety (Wee et al., 2015) which is more common than depression in the general population (Wittchen et al., 2011; Bandelow and Michaelis, 2015) and among fathers in the perinatal period (Leach et al., 2016). A systematic review by Leach et al. (2016) indicated that between 4% and 16% of fathers experience anxiety during the prenatal period, while between 2% and 18% experiencing anxiety during the postnatal period. Perinatal anxiety is associated with negative outcomes such as fear of childbirth (Hall et al., 2009), low levels of self-confidence (Reck et al., 2012), increased fatigue (Taylor and Johnson, 2013) and impaired paternal/infant interactions (Bögels and Phares, 2008).

Stress has been identified as a very broad term (Darabi et al., 2016). Lazarus and Folkman (1984) in their classic stress model distinguished between predecessors of stress and consequences of stress. They defined stress as “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus and Folkman, 1984, p.19). This model refers to stress as a transaction between an individual (father) and the environment (stressors e.g. lack of sleep, work-family conflict), in which stress is seen as an

adaptive response to an event (fatherhood) that may have positive or negative implications for well-being (Cronin and Becher, 2015).

Due to the potential increase in stressors in the perinatal period, it can be hypothesised that this period is a time of increased stress for fathers. However, it is currently not known how common a problem stress is for fathers during this life stage. Up to this point there has been no attempt to systematically review studies that have examined stress in fathers in the perinatal period. A systematic review will give a better understanding of stress in fathers during this life stage. Analysing factors that contribute to stress will help identify risk populations of fathers, inform service planning and lead to more targeted interventions to support fathers during the perinatal period. It will also provide researchers with an opportunity to identify areas where future research is needed. Given the lack of clarity around the current knowledge and the potential impact of stress, a systematic review is both timely and warranted.

The aim of this review was to systematically review evidence from studies that explored stress in fathers in the perinatal period. The objectives for this review were to identify: a) how stress was measured; b) the levels of stress among fathers in the perinatal period; c) the factors contributing to stress; d) interventions and strategies used to manage stress; and g) the impact of stress on fathers in relation to their health and social relationships.

Methods

A systematic review was conducted. The PRISMA statement was used to guide the reporting of this review (Moher et al., 2009).

Search strategy

A systematic review protocol was developed and registered with PROSPERO (Reference number: CRD42016035821). Electronic databases Medline, CINAHL, the Cochrane Library, PsycARTICLES, PsycINFO, Psychology and Behavioural Sciences Collections were searched to identify studies potentially eligible for inclusion based on pre-determined criteria. The reference lists of all papers that met the inclusion criteria were scanned to identify further relevant studies. The search strategy included the Boolean terms "OR"/ "AND," Medical Subject Headings (MeSH), CINAHL headings and truncation "*". 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 (stress* OR distress). Studies for inclusion were quantitative designs of any type, published in English from May 2001 to May 2016. Studies that researched fathers' during the perinatal period were included, if stress was the principal focus of the research, with reference to stress in the title and/or aim of the study, or if stress was an outcome or dependent variable. Studies that reported stress in couples were included provided that the data specific to men and women were reported separately. Exclusion criteria were studies reporting psychological distress expressed as depression, anxiety, posttraumatic stress disorder or pathological mental health disorders. Other studies excluded were those 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. The reason for excluding these studies was that fathers may experience may experience additional stressors in these circumstances. Studies were excluded if the method of conception was by assisted reproductive technology (ART) because most births are

associated with naturally conceived pregnancies (Zhu et al., 2016) and ART is associated with additional stressors beyond normal pregnancy (An et al., 2013).

Study selection

The electronic search strategy yielded a total of 4487 records. These records were exported to EndNoteX7 and duplicates were deleted. The authors paired to independently screen the titles and abstracts of papers from the Medline, and CINAHL database and Cochrane library searches (LP & ES), and from the PsycARTICLES, PsycINFO, and Psychology and Behavioural Sciences Collections databases searches (PL-W & SF). In total, 3,450 papers were excluded, leaving 62 papers for full text review. The full text papers were divided in two and allocated to paired authors (PL-W & SF; LP & ES). The authors in each pair independently read the full text papers. Eighteen papers were identified to include for review, and a further 4 papers were identified from screening the reference lists of included papers. Therefore, the final search output was 22 papers which reported on 18 studies. The selection process and output is presented in Fig 1.

Data extraction and analysis

An extraction table was developed and piloted before the final version was adopted. One author (LP) extracted the relevant data from the 18 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), stress scores, measurement tools and time points, factors contributing to stress, and the impact of stress on fathers. Data extraction was independently cross-checked by two co-authors (ES, SF). Discrepancies were resolved by consensus. Data extraction is presented in Table 1

Risk of bias assessment

All observational studies (i.e. cross-sectional, longitudinal) were assessed for risk of bias using criteria based on guidelines for 'STrengthening the Reporting of OBservational Epidemiological' (STROBE) studies which Sanderson et al. (2007) reported 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). The assessment of both observational and RCT studies involved a judgement of low, high, or unclear risk of bias. This assessment was completed independently by 2 authors (LP, SF) and all were cross-checked by ES (see Tables 2 & 3). Discrepancies were resolved through consensus between these 3 authors.

Findings

Study Characteristics

The 18 studies reviewed were conducted across a number of countries including 5 in Australia (Johnson, 2002; Johnson and Baker, 2004; Halford et al., 2010; Wee et al., 2015; Seah and Morawska, 2016), 3 in China (Gao et al., 2009; Mao et al., 2011; Lu et al., 2012), 2 in Sweden (Bergstrom et al., 2009; Hildingsson et al., 2014), 2 in Taiwan (Lu, 2006; Wang and Chen, 2006), and 1 each from Hong Kong (Ngai and Ngu 2014 a,b, 2015), Canada (Loutzenhiser et al., 2015), Iran (Kamalifard et al., 2014), Portugal (Gameiro et al., 2010, 2011), Norway (Skari et al., 2002), and the United States (Yu et al., 2011). Sample sizes ranged from 31 to 1064. Studies included first time fathers only in 6 studies (Gao et al., 2009; Gameiro et al., 2010, 2011; Mao et al., 2011; Lu et al., 2012; Ngai and Ngu 2014 a,b,

2015; Loutzenhiser et al., 2015), a mixed sample of both first time fathers and fathers with 1 or more child in 7 studies (Johnson, 2002; Johnson and Baker, 2004; Lu, 2006; Wang and Chen, 2006; Bergstrom et al., 2009; Hildingsson et al., 2014; Wee et al., 2015), and 5 studies made no reference to the status of fathers (Skari et al., 2002; Halford et al., 2010; Yu et al., 2011; Kamalifard et al., 2014; Seah and Morawska, 2016). Fathers were mostly recruited at hospitals or antenatal clinics. Fathers recruited from the community, outside a hospital, clinic or healthcare setting were included in 3 studies (Loutzenhiser et al., 2015; Wee et al., 2015; Seah and Morawska, 2016). Research designs were: cross-sectional in 7 studies (Wang and Chen, 2006; Gao et al., 2009; Mao et al., 2011; Yu et al., 2011; Lu et al., 2012; Kamalifard et al., 2014; Seah and Morawska, 2016), longitudinal in 9 studies (Skari et al.,2002; Johnson, 2002; Johnson and Baker, 2004; Lu, 2006; Gameiro et al., 2010, 2011; Hildingsson et al., 2014; Loutzenhiser et al., 2015; Ngai and Ngu, 2014 a,b, 2015; Wee et al., 2015) or randomized clinical/control trials in 2 studies (Bergstrom et al., 2009; Halford et al., 2010).

Measurement tools used and assessment time points

An objective of this review was to identify how stress was measured in fathers in the perinatal period. This included the scales used and the time points of assessment. All 18 studies reviewed used a self-report measure to assess stress levels in fathers during the perinatal period. The most commonly used measure was the Perceived Stress Scale (PSS), found in 7 of the 18 studies reviewed. The versions of the PSS varied across studies. These were the 10 itemed English (Wang and Chen, 2006; Mao et al., 2011; Kamalifard et al., 2014) or Chinese version (Gao et al., 2009), or the 14 itemed English (Loutzenhiser et al., 2015) or Chinese version (Lu, 2006; Lu et al., 2012). The Parenting Stress Index (PSI) was used in 3 studies comprising of the 120 itemed version (Gameiro et al., 2010, 2011); and the 36

itemed version (Halford et al., 2010; Seah and Morawska, 2016). Other measures included the Swedish Parental Stress Questionnaire (SPSQ) (Bergstrom et al., 2009; Hildingsson et al., 2014); the Impact of Event Scale (IES) (Skari et al., 2002; Johnson, 2002; Johnson and Baker, 2004), the Social Readjustment Rating Scale (SRRS) (Ngai and Ngu, 2014 a, b, 2015), the Depression, Anxiety and Stress Scales (DASS) (Wee et al., 2015) and the Prenatal Psychosocial Profile (PPP) (Yu et al., 2011).

The time points of assessment of stress varied across studies. Prenatal stress was reported in 3 studies, 2 of which did not specify the time point of measurement (Yu et al., 2011; Loutzenhiser et al., 2015), the remaining study measured stress at 3 time points: 18, 25 and 33 weeks' gestation (Wee et al., 2015). Postnatal stress was reported in 11 studies (Skari et al., 2002; Wang and Chen, 2006; Gao et al., 2009; Bergstrom et al., 2009; Halford et al., 2010; Gameiro et al., 2010; Mao et al., 2011; Lu et al., 2012; Hildingsson et al., 2014; Kamalifard et al., 2014; Seah and Morawska, 2016). The assessment time points for these studies ranged from 4 days (Skari et al., 2002) to 12 months (Halford et al., 2010; Hildingsson et al., 2014). The most frequently reported time-point for assessment in the postnatal period was 6-8 weeks, evident in 4 studies (Lu, 2006; Gao et al., 2009; Mao et al., 2011; Lu et al., 2012). Stress was reported longitudinally in 4 studies including the ante and postnatal period. For these 4 studies, the time point of antenatal and follow up assessment varied from: 6 weeks antenatal and 6 weeks postnatal (Lu, 2006); during pregnancy, birth and 6 weeks postnatal (Johnson, 2002); pregnancy to 48 hours and 12 months postnatal (Johnson and Baker, 2004); and antenatal, 6 weeks and 6 months postnatal (Ngai and Ngu, 2014 a, b, 2015).

Stress Levels in Fathers

The majority of studies (n=17) reported stress as a mean score with just 1 study reporting the prevalence of stress (Wee et al., 2015). Normal stress levels among fathers were reported in 7 studies (Bergstrom et al., 2009; Halford et al., 2010; Gameiro et al., 2010, 2011; Yu et al., 2011; Hildingsson et al., 2014; Seah and Morawska, 2016). Mild stress levels among fathers were reported in 3 studies (Skari et al., 2002; Johnson, 2002; Kamalifard et al., 2014). Moderate stress levels were reported in 8 studies (Johnson and Baker, 2004; Lu, 2006; Wang and Chen, 2006; Gao et al., 2009; Mao et al., 2011; Lu et al., 2012; Ngai and Ngu, 2014 a,b, 2015; Loutzenhiser et al., 2015). No study reported fathers as having high stress levels. The prevalence of stress among fathers, as reported in 1 study (Wee et al., 2015) was between 6% and 8.7% across the antenatal period.

Studies that assessed stress across the perinatal period reported changes in stress levels (Johnson, 2002; Johnson and Baker, 2004; Ngai and Ngu, 2014 a ,b, 2015). Fathers' stress levels were found to have significantly increased from the antenatal period to the time of birth (Johnson, 2002), 48 hours postpartum (Johnson and Baker, 2004) and at 6 weeks postpartum (Ngai and Ngu, 2014 a,b, 2015). In later postnatal time points, stress levels had significantly decreased at 6 months (Ngai and Ngu, 2014 a, b, 2015) and at 12 months (Johnson and Baker, 2004). In Johnson's (2002) study, although there was a postnatal decrease in stress levels from birth to 6 weeks, this was not statistically significant. Ngai and Ngu (2014 a, b, 2015) reported an increase in stress from the antenatal period to 6 weeks postnatal, but an overall decrease in stress at 6 months postnatal was evident. Johnson and Baker (2004) reported an increase in stress levels between the antenatal period and the early postnatal period, with a reduction in stress levels between the antenatal period and 1 year postnatal. There was also a reduction in stress from the early postnatal period to 1 year postnatal (Johnson and Baker 2004). Similarly, Johnson (2002)

reported an increase in stress levels at the time of birth when compared to the antenatal period, with a decrease in stress levels at 6 weeks when compared to the time of birth.

Factors contributing to stress

Factors that contribute to paternal stress in the perinatal period was reported in 11 studies. The findings revealed that stress can relate to father, social relationship, child and environmental factors. Father characteristics that contribute to stress was reported in 6 studies. These included: role restriction (Hildingsson et al., 2014); prenatal negative feelings about the pregnancy, the upcoming birth, and the first weeks with a new-born baby (Hildingsson and Thomas, 2014); lower levels of self-efficacy and responsiveness (Seah and Morawska, 2016); feelings of incompetence (Hildingsson et al., 2014); lower behavioural coping strategies (Johnson and Baker, 2004); being a younger father (Lu, 2006); and a first time father (Hildingsson et al., 2014). However, Wee et al. (2015) reported no significant differences in stress between first-time and non-first time fathers, while Gameiro et al. (2010, 2011) reported no significant relationship between age and stress. A history of a psychological diagnosis (Seah and Morawska, 2016) and fear of childbirth (Hildingsson et al., 2014) also contributed to increased stress.

Social relationship factors that contributed to stress was reported in 7 studies. These included social isolation (Hildingsson et al., 2014); having a partner with high stress levels (Ngai and Ngu, 2014b); lower levels of social support (Gao et al., 2009) from family, friends and special persons (Kamalifard et al., 2014); and problems and concerns related to family members (problems not specified) (Yu et al., 2011). Gameiro et al. (2011) found that support from extended family increased stress, while Johnson (2002) reported that feelings of not supporting a partner during labour (Johnson, 2002) contributed to stress. Child related factors that contribute to stress with reference to child difficulties (difficulties not

specified), child care issues and problems related to the pregnancy (not specified) (Yu et al., 2011) were reported in 1 study. Environmental factors that contribute to stress was reported in 3 studies. These included financial pressures (Seah and Morawska, 2016); money worries related to food, shelter, health care, transportation and bills (Yu et al., 2011); work problems /concerns relating to being laid off (Yu et al., 2011); and been present at the birth (Johnson, 2002).

Impact of stress

The impact of stress on fathers in the perinatal period was reported in 11 studies. From the findings of this review, it is evident that stress can impact on fathers' mental health, physical health and social relationships. Higher stress levels contributing to mental health issues was reported in 8 studies. These included anxiety (Wee et al., 2015), psychological distress (Skari et al., 2002), antenatal stress (Johnson, 2002), depression (Johnson and Baker, 2004; Gao et al., 2009; Mao et al., 2011; Kamalifard et al., 2014; Wee et al., 2015). In 1 study mental health issues were not specified (Lu, 2006). The impact that stress has on physical health was reported in 1 study (Loutzenhiser et al., 2015). The researchers of this Canadian study found that higher levels of antenatal stress contributed to postnatal fatigue. For fathers, stress was associated with fatigue when their infants were 6 months of age which may reflect an increase in work–family conflict as their partner returns to work after maternity leave and as the infant gets older (Loutzenhiser et al., 2015). The impact that stress has on fathers' relationships in the perinatal period was reported in 2 studies. Lu (2006) found that increased stress levels contributed to decreased marital satisfaction, while Kamalifard et al. (2014) reported a negative correlation between social support and stress.

Interventions to reduce stress

Bergstrom et al. (2009) investigated the effects of antenatal education focussing on natural childbirth preparation with psychoprophylactic training versus standard antenatal education on the use of epidural analgesia. As part of their study they measured stress levels and reported no difference between the two groups. Halford et al. (2010) investigated the effects of a couple relationship education programme (Couple Care for Parents, CCP) versus a maternal parenting education program (Becoming a Parent, BAP) in preventing deteriorating couple adjustment across the transition to parenthood. They found no difference between CCP and BAP on parenting stress levels.

Risk of bias assessment

For the observation studies, risk of selection bias was high in 14 studies (Skari et al., 2002; Johnson 2002; Johnson and Baker, 2004; Lu 2006; Wang and Chen, 2006; Gao et al., 2009; Mao et al., 2011; Yu et al., 2011; Lu et al., 2012; Hildingsson et al., 2014; Loutzenhiser et al., 2015; Ngai and Ngu, 2014 a, b, 2015; Wee et al., 2015; Seah and Morawska, 2016). Selection bias was related to convenience sampling and/or self-selection. Risk of bias regarding the use of appropriate measures was low in 13 studies because instruments were reported as valid or psychometrically robust (Skari et al., 2002; Johnson, 2002; Lu, 2006; Wang and Chen, 2006; Gao et al., 2009; Gameiro et al., 2010, 2011; Lu et al., 2012; Hildingsson et al., 2014; Kamalifard et al., 2014; Loutzenhiser et al., 2015; Ngai and Ngu, 2014 a, b, 2015; Wee et al., 2015; Seah and Morawska, 2016). Low risk for design specific sources of bias with evidence of reporting attrition rates and/or recall bias was identified in 6 studies (Lu, 2006; Gameiro et al., 2010, 2011; Kamalifard et al., 2014; Loutzenhiser et al., 2015; Ngai and Ngu, 2014 a, b, 2015; Seah and Morawska, 2016). Three studies were high risk for reasons such as inappropriate methods to deal with performance bias or attrition rates, or inconsistency in blinding for outcome assessment (Johnson and Baker, 2004; Hildingsson et al., 2014; Wee et

al., 2015). Risk of bias in relation to control of confounders was high in 4 studies (Wang and Chen, 2006; Gao et al., 2009; Mao et al., 2011; Hildingsson and Thomas, 2014) and unclear in 9 studies (Skari et al., 2002; Johnson, 2002; Johnson and Baker, 2004; Yu et al., 2011; Lu et al., 2012; Kamalifard et al., 2014; Loutzenhiser et al., 2015; Ngai and Ngu, 2014 a, b, 2015; Wee et al., 2015). All studies except for 1 were found to have appropriate use of statistics for primary analysis of effect and therefore assessed as low risk of bias. Conflict of interest was low in 7 studies with explicit statements (Mao et al., 2011; Yu et al., 2011; Hildingsson et al., 2014; Kamalifard et al., 2014; Loutzenhiser et al., 2015; Ngai and Ngu, 2014 a, b, 2015; Wee et al., 2015), whereas 9 studies were assessed as unclear as there was no reference to conflict of interest (Skari et al., 2002; Johnson, 2002; Johnson and Baker, 2004; Lu, 2006; Wang and Chen, 2006; Gao et al., 2009; Gameiro et al., 2010, 2011; Lu et al., 2012; Seah and Morawska, 2016) (see Table 2)

Both RCTs (Bergstrom et al., 2009; Halford et al., 2010) were unclear in terms of selection bias as there was a lack of information on generation of randomised sequencing and allocation concealment. Performance bias was high in 1 study (Bergstrom et al., 2009), while attrition bias was low in both studies as loss to follow-up was reported (see Table 3).

Discussion

The aim of this systematic review was to examine stress in fathers in the perinatal period. The included studies were heterogeneous, specifically in relation to the measurement tools used and assessment time points, therefore, the findings should be interpreted with caution. Overall, the findings from the systematic review indicate that fathers experience stress in the perinatal period, particularly at the time of birth. Stress levels based on mean scores were found to increase from the antenatal period to the time of birth, with a

decrease in stress levels from the time of birth to the later postnatal period. There is a paucity of evidence in relation to the prevalence of stress among fathers during the perinatal period. Only 1 study assessed the prevalence of stress and that was found to be between 6 and 8.7% across the antenatal period (Wee et al., 2015). There is a need for further research to investigate the prevalence of stress in fathers across the perinatal period.

There are a number of factors that contribute to stress in fathers in the perinatal period. Many of the stressors that were identified could be experienced by men in the general population who are not fathers and these include financial pressure and money worries (Yu et al., 2011; Seah and Morawska, 2016), work problems (Yu et al., 2011), lower levels of social support (Gao et al., 2009; Kamalifard et al., 2014) and social isolation (Hildingson et al., 2014). However, it has been suggested that fathers in the perinatal period are more susceptible to these stressors (Genesoni and Tallandini, 2009). For example, stress with regard to money and financial issues may be heightened in the perinatal period due to the extensive cost associated with having a baby, and this stress may be further compounded if a father's image of a 'good father' is that of a provider (Darwin et al., 2017).

The review also revealed stressors that were specific and unique to fathers in the perinatal period. These included prenatal negative feelings about the pregnancy, the upcoming birth and the first weeks with a new-born baby (Hildingson and Thomas, 2014). These findings suggest that negative perceptions about the pregnancy and subsequent birth result in greater stress. Other stressors included childbirth related fear (Hildingson et al., 2014), perceived pressure to be present at the birth, as well as actually being physically present at the birth (Johnson, 2002). Darwin et al. (2017) identified the potential impact of these

stressors especially on fathers who previously experienced their partner's birth as difficult or traumatic. In this qualitative UK study 1 fathers stated "at the back of my mind I was thinking, oh, we're going to go through this labour again, which was hell last time. As we approached due date, I was getting less sleep due to worrying about it" (p.8).

There was insufficient evidence in relation to two stressors, namely being a first-time fathers and a being a younger father. Wee et al. (2015) reported no differences in stress between first-time and fathers who previously had children, while Hildingson et al. (2014) found that being a first-time father was a factor contributing to stress. While first-time fathers may experience stress as they face more pronounced role changes and lifestyle adjustments, fathers who have previous children have the added stress of caring for more than 1 child. Furthermore, while first-time fathers may be at risk of stress due to a lack of experience and unrealistic expectations about their new role, fathers who have previous children may have increased risk of stress related to concerns based on previous traumatic or difficult birth experiences (Darwin et al., 2017).

Gameiro et al. (2010) found that a father's age did not contribute to stress levels, while Lu (2006) reported that being a younger father was a factor contributing to stress. The findings should be interpreted with caution as Lu (2006) did not define a younger/older father and the sample size was small in Gameiro et als. (2010) study. Furthermore, the variations in the findings in relation to first-time fathers and paternal age may also be explained by the fact that the studies used different assessment tools and undertook their assessments at different time points in the perinatal period. Further research is needed to confirm if

paternal age and being a first-time father has an influence on stress levels during this life stage, as the evidence from the review is inconclusive.

Based largely on observational, correlational studies, the review found that stress has a negative impact on fathers in the perinatal period. Higher stress levels were associated with mental health issues including anxiety, depression and psychological distress (Skari et al., 2002; Johnson, 2002; Johnson and Baker, 2004; Lu, 2006; Gao et al., 2009; Mao et al., 2011; Kamalifard et al., 2014; Wee et al., 2015). These findings echo evidence from research within the general population, where it is increasingly recognised that stress is a risk factor for developing mental health problems (Schönfeld et al., 2015). Research has shown that higher stress levels lead to elevated hormones such as cortisol, and reduced hormones such as serotonin, both of which have a clear link to mental health issues such as depression (Knuth et al., 2016).

Higher stress levels also contributed to fatigue (Loutzenhiser et al., 2015), and impacted negatively on social relationships (Lu 2006; Kamalifard et al., 2014). These findings are in line with the findings from a recent qualitative study. The fathers in Darwin et al's. (2017) study reported that increased stress led to fatigue through a lack of sleep and emotional exhaustion. In the study 1 father stated "I haven't slept well since you got pregnant … It could be worry, thinking about the future, about how it would pan out and how we would do things, and just like not being able to switch off properly" (p.6). In the same study stress impacted negatively on social relationships as couples spent less time together and received less emotional support from their partner (Darwin et al., 2017).

Strengths and Limitations

This is the first systematic review to investigate stress in fathers in the perinatal period. A rigorous approach following a standard systematic review protocol was used. However, the results of the review should be interpreted in light of its limitations. Only English language studies were included in the review, which may lead to publication bias. The vast number of assessments measurement tools used made it difficult to synthesis the findings and it was not feasible to combine the data for a meta-analysis. All of the studies relied on self-reporting of stress which has limitations, as it is suggested that men underreport mental health problems (Bergin et al., 2013). None

of the studies reported on the fathers stress history prior to the perinatal period which made it impossible to conclude whether the onset of stress was in the perinatal period. Convenience sampling which increases the risk of selection bias and yields a sample that is less representative of the target population was used in the majority of studies (Higgins et al., 2013). The majority of the fathers in the studies reviewed were married, employed, highly educated and lived in high income countries, thus hindering the generalisation of the findings to fathers from minority groups and to those living in low income countries.

Future Research

Longitudinal studies, using large cross-section samples are needed to build a more comprehensive picture of paternal perinatal stress and to detect changes in stress levels across the perinatal period. This research is important as a basis for developing interventions for fathers during the perinatal period. There is a paucity of evidence from the literature showing stress reducing interventions for fathers during this period. Therefore, research is needed to establish evidence based interventions that are effective in reducing stress for fathers during this life stage. The majority of the fathers in the studies reviewed were married, employed, highly educated and lived in high income countries. Research with

minority group fathers (gay, separated/divorced, unemployed, ethnic minorities) is needed as previous research has identified that these groups are at increased risk of mental health problems (Bostwick et al., 2010; Bostwick et al., 2014). Undertaking research with minority groups and comparing their stress levels and risk factors with fathers from majority groups will help establish if they are of greater risk of stress, and more susceptible to specific stressors at this life stage.

Clinical Implementation

The results of this review should alert healthcare professionals who engage with fathers in the perinatal to be vigilant for those who may present with stress. By including fathers in antenatal education, healthcare professionals can reduce stress through the provision of information about pregnancy, birth and postnatal care which is seen as key for helping fathers to feel confident in their own abilities (Shirani et al., 2009). However, fathers have indicated that they feel on the periphery during antenatal education as classes tend to focus on the expectant woman's needs and look at birth from the mother's point of view (Li et al., 2009; Longworth and Kingdon, 2011). Therefore, antenatal classes for fathers, which focus on their needs may be beneficial (Nash, 2017). Healthcare professionals are ideally placed to increase awareness among fathers about resources that are available in their local area and online, should they enquire or have a concern or problem in relation to stress. Healthcare professionals are also well-positioned to initiate assessments for fathers, as some fathers who have high levels of stress may require a referral to specialist perinatal mental health services, to ensure timely accurate diagnosis and treatment.

Conclusion

This is an important review and to the best of our knowledge this is the first systematic review on paternal stress in the perinatal period. The findings from the systematic review

indicate that fathers experience stress in the perinatal period, particularly at the time of birth. Stress levels based on mean scores were found to increase from the antenatal period to the time of birth, with a decrease in stress levels from the time of birth to the later postnatal period. There are a number of factors that contribute to stress in fathers in the perinatal period and while some of the stressors could be experienced by men in the general population who are not fathers, the review also revealed stressors that were specific and unique to fathers in the postnatal period. These included negative feelings about the pregnancy, role restrictions related to becoming a father, fear of childbirth and feelings of incompetence related to infant care. The review found that stress has a negative impact on fathers in the perinatal period with higher stress levels contributing to mental health issues such as anxiety, depression, psychological distress and fatigue. Further research is needed to establish evidence based interventions that are effective in reducing stress for fathers during this life stage.

Conflict of Interest Statement

The authors declare that there is no conflict of interest. No funding was received for this research.

Ethical Statement

1. There is no conflict of interest

2. Ethical approval was not required for the review

3. There was no funding

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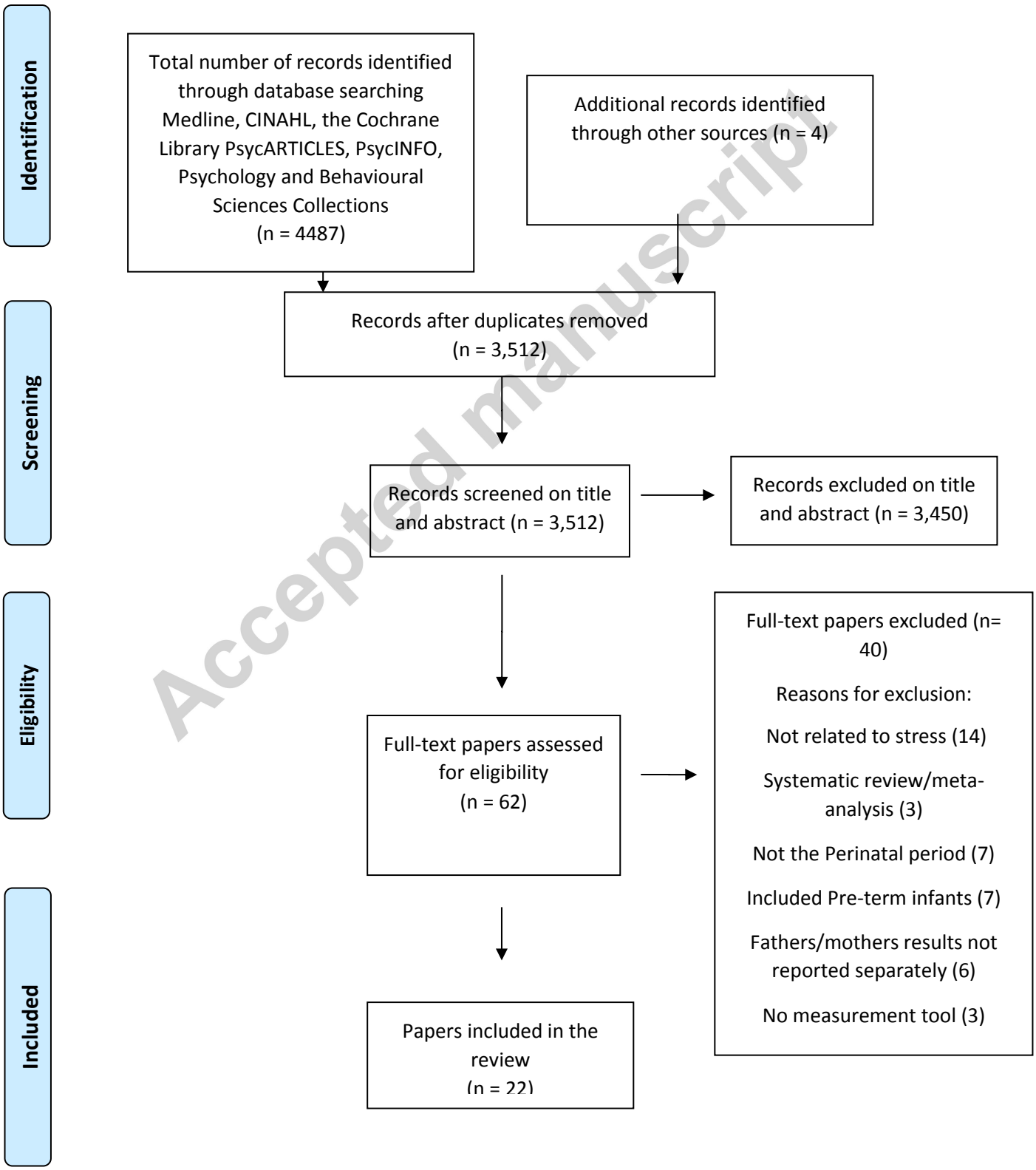

Fig 1: Study selection flow diagram (PRISMA 2009) Moher et al., 2009

Table 1: Data extraction table

Author(s), year, country Study design	Study Aim	Participants details and recruitment	Measures and time points	Stress: Mean scores (M) and Standard Deviations (SD)	Factors contributing to stress	Impact of stress
Seah and Morawska (2016) Australia Baseline cross-sectional study from a RCT examining the impact of a parenting intervention program.	"To examine predictors of paternal stress within the first 6 months of having a baby in a normative Australian sample, and to compare paternal and maternal stress" (p.45)	54 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 History of depression: 6% Recruited from advertisements in community media, magazines, websites, and posters in schools and clinics.	Parenting Stress Index (PSI) -Short Form (SF); 36 items, 3 subscales (a) Parental Distress, (b) Parent–Child Dysfunctional Interaction and (c) Difficult Child. The sum of the 3 subscales provides an overall parenting stress score. A score above 90 (or above the 85th percentile) indicates a clinically significant level of stress and it is the clinical range for a referral for professional consultation. Internal consistency for the total scale	(M) 65.28 (SD 15.25); 12.2% (n=6) of fathers scored above the 85th percentile.	Psychological diagnosis and financial pressure explained 13 - 14% of the variance in paternal stress (p = .008). Both responsiveness and efficacy were significant predictors of paternal stress (p < .05), having controlled for financial pressure and history of psychological diagnosis.	NA

			α .92; subscales α .84, .90, and .90 Data collection time point(s): 1 to 6 months postpartum: (M) 3.4 months (SD 1.63)			
Wee et al. (2015) Australia Prospective design	"To (i) examine whether depressive symptoms predict anxiety and stress or whether anxiety and stress precede depressive; (ii) examine the stability of depressive, anxiety and stress symptoms in men during their partner's pregnancy; (iii) compare findings for men and their partners; and finally (iv) 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 antenatallyAge: (M) 34.07 (SD 5.23). Relationship status: Married 72.7%; de facto relationships 21.3%* Employment status: NR Education level: Tertiary-educated 78.0%; others NR* Parity: 1st child 60.7%; 2nd child 15.3%; 3rd child 8.0%; 4th child 2%; 5th child 2%; 6th child 0%; 7th child 2%. *Note: reported for participants and not separately for fathers. Recruited from a pregnancy exercise programme obstetrician/ GP clinics / advertisements in local papers and university newsletters.	Stress scale as part of 21 itemed self-reported Depression, Anxiety and Stress Scales (DASS). Scores range from: Normal stress 0-14; Mild stress 15-18; Moderate stress 19-25; Severe stress 26-33; Extremely Severe >34 Internal consistency α 0.88 Data collection time point(s): Antenatally: T1: 18 weeks (n=150) T2: 25 weeks NR T3: 33 weeks (n=96)	T1: Normal:94% (n=141) Mild: 1.3% (n=2) Moderate: 4.7%(n=7) Severe: 0% (n=0) T2: Normal: 92.7% (n=139) Mild: 2.7% (n=4) Moderate: 3.3% (n=5) Severe: 1.3% (n=2) T3: Normal: 91.3% (n=137) Mild: 4.7% (n=7) Moderate: 2% (n=3) Severe: 2% (n=3) No significant changes in stress over time (F(1.89,282.30) = 2.67, p = 0.10)	No significant differences in distress symptoms between first-time and non-first-time fathers.	Higher stress scores at 25 weeks' gestation (T2) were associated positively with depression and anxiety scores at 33 weeks' gestation (T3) (p < 0.1).
Ngai &Ngu (2014 a,b, 2015) Hong Kong Cross sectional (2014a) & Longitudinal study (2014 b & 2015)	To examine (i) "the relationships between family sense of coherence, stress, family and marital functioning, and depressive symptoms among Chinese childbearing	224 fathers antenatally Age: (M) 34.5 (SD 4.7) Relationship status: NR Employment status: Employed 100% Education level: Primary education 0.4%; Secondary:	Social Readjustment Rating Scale (SRRS); 43 major stressful life events, with each assigned a value, higher values indicate a more stressful event.	T1: (M) 195.4 (SD 148.6) T2: (M) 212.0 (SD 140.5) T3: (M) 166.4 (SD 125.7) Increase in SRRS from	Significant correlation between mothers' and fathers' stress (r=0.36, p<0.006) at T1 (NR for T2, T3). No significant correlation between other	No significant correlation between prenatal stress and depressive symptoms, assessed only at T3. No

	couples" (2014a p. 82); and (ii) the predictive role of family sense of coherence, social support and stress during pregnancy and their changes from pregnancy to postpartum on family and marital functioning at 6 weeks postpartum" (2014b, p.2588) and (iii) the predictive role of prenatal family sense of coherence, stress, social support, and family and marital functioning, the effect that any changes in these factors from pregnancy to postpartum; and partner's depressive symptoms on depressive symptoms at 6 months postpartum (2015, p. 156).	34%; Tertiary: 10.5%; University/above: 55.5% Parity: 1st child 100% Recruited from the antenatal clinic of a regional hospital.	Score range from low stress level ≤ 150; moderate stress level 150 – 299; high stress level ≥ 300 Internal consistencies ranged from α 0.72 to 0.82. Data collection time point(s) T1: Antenatally (n=224) T2 -6 weeks (n=202) T3: 6 months postpartum (n=200)	T1 to T2 (n=202) t = -3.0 (p < 0.01) & reduction in SRRS from T1 to T3 (n=200) = −15.5 (−8.5%).	variables and fathers' stress at T1, 2, 3.	significant correlation was found between prenatal stress and family / marital functioning at T2
Loutzenhiser et al. (2015) Canada Longitudinal study	"To assess fatigue in first-time mothers and fathers and to answer which psychological factors (stress and depressive symptoms) are associated with maternal and paternal fatigue during the first 6 months of the transition to parenthood?" (p.17)	118 fathers antenatally Age: (M)30.7 (SD 5.7) Relationship status: Married 80.6%; others NR Employment status: Employed 100% Education level: Post-secondary 76.4%; Others NR. Parity: 1st child 100% Recruited from prenatal education classes, a community baby shower, and local media.	Perceived Stress Scale (PSS); 14 items, higher scores indicate higher levels of perceived stress. Scores range from 0-56. Internal consistency α 0.85 Data collection time point(s): T1:3rd trimester (n=118). T2: 1 month post-partum (n=NR)	(M) 20.6 (SD 6.71)	Age was unrelated to stress (r=0.01).	Higher levels of prenatal stress were related to higher levels of post-partum fatigue at T4 (p = .01).

			T3: 3 months post-partum (n=NR) T4: 6 months post-partum (n=107) Note: Stress was measured at T1 only.			
Kamalifard et al. (2014) Iran Descriptive cross-sectional study	"To examine father's depression, explain its relationship with social support and perceived stress, in 6 to 12 weeks of postpartum" (p.58)	205 fathers Age: (M)32.63 (SD 5.00) Relationship status: NR Employment status: Employee 35.1%; Unemployed 1%; Private 43.4%; Worker 10.7%; Other 9.8% Education level: Primary 2.9%; Secondary 15.1%; High school 6.8%; Diploma 35.6%; University 39.5% Parity: NR Recruited from health centres, affiliated to the Shahid Beheshti University.	Perceived Stress Scale (PSS); 10 items, higher scores indicate higher levels of perceived stress. Total scores range from 0-40. Internal consistency α 0.83 Data collection time point(s): 6 - 12 weeks postpartum	(M) 12.21 (SD 6.55) Low stress: 17.6% Moderate stress: 68.8% High stress: 13.7%	Stress was negatively associated with perceived social support from family (r = -0.317, $p < 0.01$); from friends (r = 0.194, $p < 0.01$) and special persons (r = 0.264, $p < 0.01$)	Perceived stress was key predictor of paternal postpartum depression ($p < 0.001$). Significant negative correlation between perceived stress and perceived social support components ($p < 0.01$).
Hildingsson & Thomas (2014); Hildingsson et al. (2014) Sweden Longitudinal study	To compare (i) "prenatal feelings and parental stress in parents one year after birth" (p.41); and (ii) "self-rated health and perceived difficulties during pregnancy and to follow up antenatal attendance, birth experience and parental stress in fathers with and without childbirth related fear" (p.248)	1047 fathers antenatally Age (M) 32.4 (SD 5.28) Married/cohabiting: 98.4%; Others NR Employment status: NR Education level: Comprehensive school grade1–9 years; Elementary school/high school 58.1%; College/university 41.9% Parity: 1 child 46.2%; Previous children: 53.8% Recruited from antenatal routine ultrasound screening at three hospitals in the middle-northern part of Sweden.	Swedish Parental Stress Questionnaire (SPSQ); 34 items. Overall/ subscale score > 2.8 indicates high levels of stress. Higher scores indicate higher levels of stress. Internal consistency α 0.87 Data collection time point(s): T1:Late pregnancy (n=1047) T2: 2 months (n=813) T3: 1 year postpartum (777)	Total SPSQ Score(M) 2.37 (SD 0.45) Lower stress in fathers with No fear of childbirth (M) 2.35 (SD 0.44) compared to fathers with Fear of child birth (M) 2.51 (SD 0.45) (p 0.003). Note. Fear of childbirth (FOB) was assessed mid pregnancy. (M) 2.37 (SD 0.45) No fear of	Role Restriction: High level of stress (i.e. score of > 2.8) found for one subscale in both fathers with *FOB* (M) 3.25(SD 0.69) and without FOB (M) 3.08 (SD 0.69) FOB: Fathers with FOB had significantly higher stress levels compared to those with no FOB for role restriction (p =(p = 0.047); Incompetence subscale (p= 0.004); Role restriction subscale(p =	NA

			Note: the SPQS was administered at T3 only.	childbirth (M) 2.35 (SD 0.44) Fear of child birth (M) 2.51 (SD 0.45) (*p* 0.003).	0.047); Social isolation subscale (p= 0.019); Parent health subscale (p=0.004) Being a first time fathers (p < 0.01) Prenatal experiences & feelings: Less than positive (i) experience of expecting a baby (p < 0.001) and (ii) feelings when thinking about the upcoming birth (p < 0.001) and (iii) feelings when thinking about the first weeks with a new-born baby (p < 0.001) 0.52) (*p*= 0.004)	
Lu et al. (2012) China Cross-sectional study	"To explore new parents' views and experiences during their transition to parenthood" (p.222)	194 fathers Age: ≤ 23 (5.1%); 23-34 (76.3%); ≥ 35 (18.6%) Relationship status: Married: 100% Employment status: Employed 91.8%; Unemployed or part-time: 8.2% Education level: High school education or below 26.8%; University or above 73.2% Parity: 1st child 100% recruited from out-patient postpartum clinics in a teaching hospital in Beijing	Chinese Perceived Stress Scale; 14 items, higher scores indicate greater perceived stress. Total scores range from 0-56. Internal consistency α 0.82 Data collection time point(s): 6–8 weeks postpartum	(M) 21.7 (SD 5.3)	No statistically significant relationships between family adaptation and perceived stress for fathers (r= -0.020, *p*> 0.05).	42% of variance in father adaptation could be explained by a set of independent variables including perceived stress (R2= 0.417)
Yu et al. (2011) USA Cross-sectional study	"To examine the underlying factors of the Prenatal Psychosocial Profile as a composite measure of stress, support from partner, support	66 fathers Age: (M) 26.9 (SD 5.9) Relationship status: Married 51.5%; Not married 48.5% Employment status: Employed 83.3%; Not employed 16.7%	Prenatal Psychosocial Profile (PPP) with a stress subscale of 11 items. Scores range from 11–44. No cut off	(M) 21.52 (SD 4.7) Scores ranged from 12–34	Financial worries (p. < 0.001) concerning e.g. food, shelter, health care, transportation; bills, problems related to family (e.g. partner,	NA

	from others and self-esteem; and compares factor structures between pregnant women and men" (p. 1767).	Education level: <High school (HS) graduate 33.3%; HS graduate/equivalent 34.8%; > HS graduate 31.8% Parity: NR Recruited from Medicaid-managed care health plan or WIC (Women, Infants and Children) clinics	points available for stress in fathers. Prenatal Internal consistency for subscale NR Data collection time point(s): Antenatally		children, current pregnancy; work problems (e.g. being laid off). Depression associated financial (r=0.5, p<0.001) and emotional (0.25, p<0.05) stress.	
Mao et al. (2011) China Cross-sectional study	"To examine the differences in the prevalence of depression and related factors between new mothers and fathers during the postnatal period" (p.645)	376 fathers Age: (M) 27.09 (SD 4.46) Relationship status: Married 100% Employment status: Full-time or part-time work 91.2%; Unemployed 8.8% Education level: <12 years educated 19.2%; 12 years completed 32.7%; associate degree or above 48.1% Parity: 1st child 100% Recruited from outpatient postpartum clinics at two regional hospitals	Perceived Stress Scale (PSS); 10 items, higher scores indicate higher levels of perceived stress. Total scores range from 0-40 Internal consistency α 0.77 Data collection time point(s): 6-8 weeks postpartum	(M) 16.03 (SD 3.67)	NA	Perceived stress was a key predictor of a postnatal depression (p < 0.002)

Gameiro et al. (2010, 2011) Portugal Longitudinal prospective study	To examine (i) " the role of perceived network support on parenting stress and investment in the child in parents who conceived spontaneously or through Assisted Reproductive Technologies (ART), during their transition to parenthood" (2010 p.170); and (ii)"to describe the psychosocial adjustment during the transition to parenthood of Portuguese couples who conceived via ART in comparison to couples conceiving spontaneously"(2011 p.209) Note: Data extracted on fathers in group conceiving spontaneously only.	31 fathers (in spontaneous group) Age (M) 28.90 (SD 4.72) Relationship status: NR Employment status: NR Education level: Primary 16.1%; Secondary junior 35.5%; Secondary senior 29%; University 19.4% Parity: 1st child 100% Recruited from an obstetrical consultation at University of Coimbra Hospitals.	Portuguese Parenting Stress Index (PSI); 120 items, 3 subscales (a) Parental Distress, (b) Parent–Child Dysfunctional Interaction and (c) Difficult Child. The PSI yields a total score, three domain scores and 15 subscale scores. Total stress scores range from 104 to 520. Scores within the range of 180-250 are considered normal. Scores ≥ 122 in the child domain are considered high. Scores ≥ 153 in the parent domain are considered high. Internal consistencies ranged from α .80 to .91. Data collection time point(s): 4 months postpartum	(M) 232.26 (SD 20.03) Child domain:(M) 115.29 (SD 9.47) Parent domain:(M) 117.37 (SD 14.32)	Emotional support: positive association for extended family (β =0 .334; p = .016) and negative association for friends (β = −.283; p = .026) with parenting stress, explaining 10% of its total variance. No relationship found between age or years in current relationship and stress.	NA
Halford et al. (2010) Australia Randomized Clinical Trial	To evaluate "the effects of couple relationship education (CRE) in preventing deteriorating couple adjustment across the transition to parenthood" (p.89)	71 fathers Age: (M) 31.4 (Range 19–60) (BAP group); (M) 31.5 (Range 18–62) (BAP group); 31.5 (18–62) (CCP group) Relationship status: Married 70%; Cohabiting 30% Employment status: Employed 94%; others NR Education level: 3rd level education 57%; others NR	Parenting Stress Index (PSI) -Short Form (SF): 36 items, Total parenting stress score = 36 to 180 Data collection time point(s): T1: 5 months postpartum (post-intervention) T2: 12 months	T1: (M)57.8 (SD 10.8) T2: 12 months postpartum (M) 53.4 (SD 10.9)	There was no significant difference between BAP, a maternal parenting education program; or CCP, a couple relationship and parenting education program BAP and CCP on parenting stress	NA

		Parity: NR Recruited from antenatal classes or waiting for routine antenatal clinics	postpartum Note: No baseline measure prior to intervention.			
Bergstrom et al. (2009) Sweden Randomised controlled trial	"To examine the effects of antenatal education focussing on natural childbirth preparation with psychoprophylactic training versus standard antenatal education on the use of epidural analgesia, experience of childbirth and parental stress in first-time mothers and fathers"(p. 1167)	1064 fathers Age: (M) 31.45 Relationship status: Married/ cohabiting 97.2%; others NR Employment status: NR Education status: Elementary school 5.5%: High school 55.7%; College or university 38.8% Parity: 1st child 90.2%; others NR Recruited from 15 antenatal clinics	Swedish Parental Stress Questionnaire (SPSQ); 34 items. Overall/ subscale score > 2.8 indicates high levels of stress. Higher scores indicate higher levels of stress. Internal consistency α 0.87. Data collection time point(s): T1:Baseline T2: 3 months postpartum	T2: Natural care group (M) 2.2 (SD 0.4) T2: Standard care group (M) 2.3 (SD 0.5) (p = 0.4).	Psychoprophylactic training did not reduce stress experienced in early parenthood. No differences in parental stress between groups (p= 0.4)	NA
Gao et al. (2009) China Cross-sectional study	"To compare the prevalence of depression in the postpartum period and its relationship with perceived stress and social support in first time mothers and fathers." (p.50)	130 fathers Age: (M) 31.92 (SD 3.15) Relationship status: Married 100% Employment status: Employed 93.8%; Unemployed or part-time 6.2% Education level: High school education or below 15.4%; University or above : 84.6% Parity: 1st child 100% Recruited at the outpatient postpartum clinics at two regional hospitals	Chinese Perceived Stress Scale (PSS); 10 items, higher scores indicate higher levels of perceived stress. Internal consistency α .75 Data collection time point(s): 6–8 weeks postpartum	(M) 16.91 (SD 3.67)	Greater social support, led to lower stress level (p < .01).	Higher perceived stress was a key predictor postnatal depression (p < .01).
Wang and Chen (2006) Taiwan Cross-sectional study (not stated)	"To compare the differences in stress, social support, self-esteem, and depression in fathers and mothers during the postpartum period" (p.303)	83 fathers Age: (M) 32.83 (SD 4.39) Relationship status: Married 100% Employment status: NR Education level: Education beyond college 45%; others NR Parity: 1st child 49%;	Perceived Stress Scale (PSS); 10 items, higher scores indicate higher levels of perceived stress. Total scores range from 0-40. Internal	First-time fathers (M) 15.46 (SD 4.96) Subsequent fathers (M) 16.90 (SD 4.47)	NA	NA

		Subsequent child 51% Note: reported for participants and not separately for fathers. Recruited from private medical centre in Kaohsiung, Taiwan	consistency α = 0.77 Data collection time point(s): 6 weeks postpartum			
Lu (2006) Taiwan Longitudinal Study	"To explore the parenthood transition in a Chinese cultural content" (p.471)	163 fathers antenatally Age: (M) 30.29 (SD 4.57)* Relationship status: Married 33.7%; others NR Employment status: Employed 95.7%; Unemployed 3.7%; Not answered 1.2% Education level: Primary school 13.0%; Junior high school 3.9%; High (vocational) school 34.3%; Junior college 34.0%; College/university 23.2%; Graduate school 4.4%; Not answered .54% Parity: First born 83.6%; not first-born 16.4%; not answered .85%* Note*: Age and demographics and parity not reported separately for fathers. Recruited from paediatricians' offices when attending a routine antenatal health check-up	Chinese Perceived Stress Scale (PSS); 14 items, higher scores indicate higher levels of perceived stress. Total scores range from 0-56. Internal consistency α .83. Data collection time point(s): T1: 6 weeks prenatal (n=163) T2: 6 weeks postpartum(n= 69)	T1: (M) 21.95 (SD 5.68) T2: (M) 21.64 (SD 6.34)	*At the postnatal stage older parents reported lower stress (r = –.19, $p < .01$). Note*: not reported separately for fathers.	After controlling for prenatal baseline levels, stress had adverse effects on mental health ($p < .0001$) and marital satisfaction ($p < .05$)
Johnson and Baker (2004) Australia Longitudinal study	"To examine if men's coping response during pregnancy, at childbirth, or miscarriage predict psychological outcomes at the	284 fathers antenatally ('normal' unassisted delivery) Age: (M) 32.1 (SD 7.3) Parity: 1st child 40.8%; 2nd child 30.3%; 3rd child	Impact of Event Scale (IES); 15 items, with two components 'intrusion' and 'avoidance' stress. Scores range from 0-75: 0– 8	IES Score: T1: (M) 27.71 (SD 9.28) T2: (M) 38.48 (SD 14.02) T3: (M) 19.37 (SD	Stress, behavioural approach and avoidance were associated with stress levels at T3 (R^2 change = 0.59, F (11, 277) = 35.27,	Stress (avoidance) at T2 (birth) was associated with depression scores at T3 (1 year

	time of childbirth/ miscarriage or 1 year later, and to establish whether there are any changes in men's coping repertoire" (p. 87).	17.6%; 4th or more children 4.2% Recruited from several large general practice surgeries	subclinical range; 9 – 25 mild range; 26 – 43 moderate range; > 44 severe range. For a non-psychiatric male population the norm mean is 6.9 (SD 6.8), for a psychiatric population the norm mean is 35.3 (SD 22.6). Internal consistency α 0.78 (intrusion) and α 0.82 (avoidance) Data collection time point(s): T1 During pregnancy (n=284) T2 48 hours postpartum (n=278) T3 One year postpartum (n=278)	13.30) Significant increase in stress levels between T1 vs. T2 (p = 0.0001). Significant reduction in stress levels between T1 vs. T3 (p = 0.0001) and T2 vs. T3 (p = 0.0001)	p<0.001). The highest stress scores at T3 were for individuals reporting higher stress and lower behavioural approach coping strategies at the T2	postpartum) (p<0.001).
Johnson (2002) Australia Longitudinal study	"to examine the subjective stress experienced by men during their partner's pregnancy, at the time of the birth and six weeks postpartum" (p.173)	53 fathers Age: (M) 32.9 (SD 8.0) Relationship status: NR Employment status: NR Education level: NR Parity: 1st child 41.5%; 2nd child 28%; 3rd child 15%; 4th child 9%; 5th child 5.7% Recruited from General practitioners' surgeries	Impact of Event Scale (IES); 15 items, with two components 'intrusion' (seven items) and 'avoidance' (eight items) stress. Scores range from 0-75: 0– 8 subclinical range; 9 – 25 mild range; 26 – 43 moderate range; > 44 severe range. For a non-psychiatric male population the norm mean is 6.9 (SD 6.8), for a psychiatric population the	IES Score(s) T1: (M) 15.8 (SD 6.6) (p < 0.0001) T2: (M) 19.7 (SD 7.1) (p < 0.0001) T3: (M) 16.4 (SD 7.2) (p < 0.0001) Increased levels of stress were noted at T2 from T1 baseline (F (1, 52) = 162.8. p < 0.0001), but reduced at T3 (F (1, 52) = 45.2, p < 0.0001). IES level at T3 were higher	Although pregnancy stress was significantly related to stress at the time of the birth (F(1.50) = 8.4, p = 0.01, when stress level during the pregnancy was controlled for, been present at the birth resulted in significantly higher IES scores (F (1,50) = 20.7, p < 0.0001). Feelings of not supporting partner during labour (M) 21.6 (SD 6.2) vs feelings of	Stress at T1 had a significant effect on stress at T3 (p < 0.01).

			norm mean is 35.3 (SD 22.6). Internal consistency α 0.78 (intrusion) and α 0.82 (avoidance) Data collection time point(s): T1: During the pregnancy T2: Time of the birth T3: Six weeks postpartum	than in pregnancy, yet were not statistically significant (F (1, 52) = 2.6, p < 0.11)	having a supportive role (M) 16.8 (SD 6.4) (p < 0.05). Total IES score differences between men who perceived pressure to attend the birth compared to men who did not perceive pressure to attend the birth were significant (p < 0.0001)	
Skari et al. (2002) Norway A prospectiv e, longitudina l, population -based cohort study	"To compare maternal and paternal psychological responses following birth of a healthy baby; and to explore predictors of parental psychological distress" (p. 1154)	109 fathers Age: (M) 31.2 (SD NR) Relationship status: NR Employment status: NR Education level: NR Parity: NR Recruited from a Norwegian district general hospital	Impact of Event Scale (IES), with 15 items and two components, 'intrusion' and 'avoidance' stress. Scores in this study: 0–8 minor stress; 9–19 moderate stress; > 20 severe stress responses Internal consistency NR Data collection time point(s): T1: 4 days postpartum (n=109) T2: 6 weeks postpartum (n=98) T3: 6 months postpartum (n=81)	*Intrusive stress symptoms*: T1(M) 4.6 (SD NR) Minor 81.7% (n= 89) Moderate 16.5% (n= 18) Severe 1.8% (n= 2) T2(M) 2.4 (SD NR) Minor 93.9% (n= 92) Moderate 4.1% (n=4) Severe 2.0% (n= 2) T3(M)1.8 (SD NR) Minor 97.6% (n= 9) Severe2.4% (n= 2) *Avoidance stress symptoms* T1: (M) 3.0 (SD NR) Minor 91 % (n= 99) Moderate 7% (n= 8) Severe 2 % (n= 2) T2: (M) 1.2 (SD NR) Minor 96.9%	NA	Paternal psychologic al distress T1: (p= 0.005) T2: (p= 0.067) T3: (p= 0.045)

					(n= 95) Moderate 3.1% (n= 3) T3: (M) 1.4 (SD NR) Minor 98.8% (n= 80) Severe 1.2% (n= 1)	

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 2: Criteria for assessing and reporting quality (Adapted from Sanderson et al. 2007)

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**
Seah and Morawska (2016)	H	L	L	L	L	UC
Wee et al. (2015)	H	L	H	UC	L	L
Ngai & Ngu (2014 a,b, 2015)	H	L	L	UC	L	L
Loutzenhiser et al. (2015)	H	L	L	UC	L	L
Kamalifard et al. (2014)	UC	L	L	UC	L	L
Hildingsson & Thomas (2014); Hildingsson et al. (2014)	H	L	H	H	L	L

Lu et al. (2012)	H	L	UC	UC	L	UC
Yu et al. (2011)	H	H	UC	UC	L	L
Mao et al. (2011)	H	H	UC	H	L	L
Gameiro et al. (2010, 2011)	UC	L	L	L	L	UC
Gao et al. (2009)	H	L	UC	H	L	UC
Wang and Chen (2006)	H	L	UC	H	L	UC
Lu (2006)	H	L	L	L	L	UC
Johnson and Baker (2004)	H	H	H	UC	UC	UC
Johnson (2002)	H	L	UC	UC	L	UC
Skari et al. (2002)	H	L	UC	UC	L	UC

H= High, L= Low, UC= Unclear

Table 3: Cochrane Collaboration's tool for assessing risk of bias for RCTs (Higgins, J.P.T., Green,S. (Eds.) 2011)

Bias domain	Source of Bias	Support for Judgement	Judgement
Selection bias	Random sequence generation	Couples were randomly assigned to receive either the Couple Care for Parents (CCP) or Becoming a Parent (BAP) program.	UC
	Allocation concealment	Not reported	UC
Performance bias	Blinding of participants and personnel	Not reported for participants (couples). Not applicable since the educators are likely to know the specific focus. Insufficient detail on the interventions and the role that they played in delivering the interventions.	UC
Detection bias	Blinding of outcome assessment	Two research assistants who were blind to the couples' assigned condition rated the couple discussions	L
Attrition bias	Incomplete outcome data	Loss to follow-reported, with reasons stated	L
Reporting bias	Selective reporting	Reported on items set out to report on	L

Other bias	Anything else, ideally prespecified	None	N
Halford et al. (2010) Australia			
Selection bias	Random sequence generation	The educators were randomised individually to lead groups according to either model during the entire study period. The participating women and their partners were randomised into 207 groups. Participants with the lowest level of education were slightly underrepresented.	UC UC
	Allocation concealment	Not reported	
Performance bias	Blinding of participants and personnel	Blinding to group allocation was not possible as some women in the Standard care groups attended psychoprophylaxis classes outside of the trial or practised psychoprophylaxis at home	H
Detection bias	Blinding of outcome assessment	Blinding to group allocation was maintained during data entry but was not possible during the analyses.	H
Attrition bias	Incomplete outcome data	Loss to follow-up was reported for both groups, with reasons stated	L
Reporting bias	Selective reporting	Reported on items set out to report on	L
Other bias	Anything else, ideally prespecified	None	N
Bergstrom et al. (2009) Sweden			

H= High, L= Low, UC= Unclear

Highlights:

- Fathers experience stress in the perinatal period, particularly at the time of birth. Stress levels increase from the antenatal period to the time of birth, with a decrease in stress levels from the time of birth to the later postnatal period.

- Factors that contribute to stress in fathers in the perinatal period include negative feelings about the pregnancy, role restrictions related to becoming a father, fear of childbirth and feelings of incompetence related to infant care.

- Stress has a negative impact on fathers, with higher stress levels contributing to mental health issues such as anxiety, depression, psychological distress and fatigue.