Journal of Affective Disorders 191 (2016) 62–77

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Review article

Identifying the women at risk of antenatal anxiety and depression: A systematic review

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ARTICLE INFO

Article history:
Received 14 May 2015
Received in revised form
19 October 2015
Accepted 11 November 2015
Available online 18 November 2015

Keywords:
Antenatal depression
Antenatal anxiety
Risk factors
Antenatal mental health

ABSTRACT

Background: Pregnancy is a time of increased vulnerability for the development of anxiety and depression. This systematic review aims to identify the main risk factors involved in the onset of antenatal anxiety and depression.

Methods: A systematic literature analysis was conducted, using PubMed, PsychINFO, and the Cochrane Library. Original papers were included if they were written in English and published between 1st January 2003 and 31st August 2015, while literature reviews and meta-analyses were consulted regardless of publication date. A final number of 97 papers were selected.

Results: The most relevant factors associated with antenatal depression or anxiety were: lack of partner or of social support; history of abuse or of domestic violence; personal history of mental illness; unplanned or unwanted pregnancy; adverse events in life and high perceived stress; present/past pregnancy complications; and pregnancy loss.

Limitations: The review does not include a meta-analysis, which may have added additional information about the differential impact of each risk factor. Moreover, it does not specifically examine factors that may influence different types of anxiety disorders, or the recurrence or persistence of depression or anxiety from pregnancy to the postpartum period.

Conclusions: The results show the complex aetiology of antenatal depression and anxiety. The administration of a screening tool to identify women at risk of anxiety and depression during pregnancy should be universal practice in order to promote the long-term wellbeing of mothers and babies, and the knowledge of specific risk factors may help creating such screening tool targeting women at higher risk.

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http://dx.doi.org/10.1016/j.jad.2015.11.014

1. Introduction

Pregnancy and the postpartum can be times of joy and positive expectations but also of stress and difficulties. Pregnancy and delivery bring many physiological and psychosocial changes, and both mothers and fathers are required to face several new challenges during this period. Consequently, pregnancy and the post partum are times of increased vulnerability for the onset or relapse of a mental illness (Smith et al., 2011). Depression and anxiety are the most common psychiatric disorders during pregnancy and the post partum (Alipour et al., 2012) and the symptoms can range from mild to severe. However, we still do not know why some women are more "at risk" of developing depression or anxiety symptoms while others remain resilient even in the face of adversity.

The estimated prevalence of perinatal anxiety and depression varies between studies. The prevalence of antenatal depression is estimated to be between 7% and 20% in high- income countries (Andersson et al., 2003; Evans et al., 2001; Gavin et al., 2005; Lee et al., 2007; Marcus et al., 2003; Melville et al., 2010), while rates of 20% or more have been reported in low- and middle-income countries, although less research has been conducted in these areas (Faisal-Cury et al., 2009; Golbasi et al., 2010; Husain et al., 2012, 2011). Gavin et al. found that the prevalence of antenatal depression in the first trimester is 11.0%, then drops to 8.5% in the second and third trimesters (Gavin et al., 2005). In contrast, Bennett et al. found an opposite trend, with a prevalence of 7.4% during the first, 12.8% during the second, and 12% during the third trimester (Bennett et al., 2004). Postpartum depression prevalence is estimated to be between 7% and 30% across low-, middle- and high-income countries (Beck, 2001; Csatordai et al., 2007;Parsons et al., 2012). Indeed, a recent review showed that, in 22 of 28 low- and middle-income countries, postnatal depression prevalence was higher than in high-income countries, with the highest values in Vietnam (33%), Zimbabwe (33%) and Guyana (50%), and lowest in Uganda (7.1%) and Nepal (4.9%) (Parsons et al., 2012). Prevalence of postnatal depression in high-income countries begins to rise after delivery and reaches the highest value in the third month postpartum (12.9%), and then declines to 10.6% at month 7 and to 6.5% after month 7 (Gavin et al., 2005). The prevalence of both classes of disorders tends to be higher when symptoms, rather than disorders, are investigated, or when depression or anxiety is assessed by a self-report rating scale rather than a structured interview, or when operational criteria are not used for the diagnosis (Bennett et al., 2004). In general, the postpartum period has historically been the focus of far greater research attention than the antenatal period, despite the fact that some studies have shown a decrease, rather than an increase, in depression and anxiety after childbirth (Heron et al., 2004). A recent review (Norhayati et al., 2015) has shown that antenatal depression and anxiety are significant risk factors for postnatal depression in both developed and developing countries, together with a previous history of psychiatric illness, poor marital relationship, stressful life events, a negative attitude towards the pregnancy, and lack of social support. The present systematic review will focus on the risk factors for antenatal depression and anxiety.

There are a number of reasons why mental health problems in the antenatal period have received much less attention than in the postpartum. For example, there is the misconception that women are "hormonally protected" from psychological disturbance during pregnancy (Bennett et al., 2004). Moreover, women can themselves be reluctant to share symptoms of sadness and irritability owing to the stigma associated with depression and to the discrepancy between women's expectation of happiness during pregnancy (and the postpartum period) and their own experience (Marcus, 2009). Furthermore, there is a tendency to focus on (maternal and foetal) physical health during pregnancy, rather than mental health, and to misattribute emotional complaints to the physical and hormonal changes that occur during pregnancy (Bowen and Muhajarine, 2006a). Indeed, these women often present with atypical symptoms of depression and unspecified somatic complaints (Posternak and Zimmerman, 2001), such as fatigue, loss of energy, appetite and sleep changes, rather than depressed mood. Therefore, it can be difficult to distinguish between "normal" pregnancy symptoms, which are common during pregnancy, and atypical somatic complaints, which may be related to depression or anxiety (Lee et al., 2007; Marchesi et al., 2009). This obviously makes it more complicated to diagnose depression and anxiety without a standardized assessment (Andersson et al., 2006). For this reason, the most validated and widely used self-report screening tool for depression during the perinatal period, the Edinburgh Postnatal Depression Scale (EPDS), does not include questions about somatic complaints, fatigue and changes in appetite, as these complaints would not help to distinguish depressed from non-depressed women (Murray and Cox, 1990). Therefore, somatic complaints may lead to the overdiagnosis of depression during the perinatal period. However, it has also been argued that not considering somatic complaints may interfere with the measure of the severity of the illness (Yonkers et al., 2009). Indeed, most of the women with higher EPDS scores also present a greater number of somatic complaints (Apter et al., 2013; Zelkowitz et al., 2004). Therefore, there is a risk that clinicians and patients may attribute somatic symptoms to the normal course of the pregnancy and the postpartum period rather than to a depressive disorder (Klein and Essex, 1994).

Diagnosing antenatal depression can also be difficult if women are only screened once throughout pregnancy. In fact, multiple evaluations during pregnancy can show differences in the rates of depression and anxiety. To this end, some studies (Bunevicius et al., 2009; Lee et al., 2007; Marchesi et al., 2009; Yanikkerem et al., 2013) have shown that depressive episodes occur more frequently during the first and third trimester of pregnancy, compared with the second, possibly because the most vulnerable women are more likely to experience stress when they are coping with the new event of becoming mothers, and when they are about to deliver and start a new life (Marchesi et al., 2009). The fact that many women present anxiety or depressive symptoms at one or two time points implies that only one screening is not enough during pregnancy. These circumstances make antenatal depression among the most under-recognized and under-treated conditions (Marcus, 2009).

This lack of recognition has serious implications, as it is now widely recognized that maternal depression, anxiety and stress during pregnancy have powerful long-term effects on both mother and baby (Dunkel Schetter and Tanner, 2012; Glover, 2015). The underlying biological mechanisms have not been fully understood but it has been suggested that a decrease in blood flow to the foetus and/or an increased exposure of the foetus to cortisol may

be some of the possible mediating factors. Maternal increased levels of cortisol that have been associated with depression, anxiety and stress, can cross the placenta and be transferred to the foetal environment and affect the developing foetus (Glover, 2014). Antenatal depression and anxiety have also been associated with inadequate nutrition and weight gain, increased alcohol consumption, substance abuse and smoking (Marcus, 2009); moreover, mothers with antenatal anxiety and depression are more likely to access perinatal services late, to attend antenatal appointments less frequently, and to fail to have regular scans (Kim et al., 2006; Redshaw and Henderson, 2013). Some studies have found that these women have more visits to the obstetrician, mainly related to the fear of childbirth, and show a preference for an elective caesarean section (Andersson et al., 2004; Rubertsson et al., 2014). Moreover, depression and anxiety have been linked to stillbirth, premature birth, low birth weight, low Apgar scores, smaller head circumference and major congenital anomalies (Marcus, 2009; Raisanen et al., 2014) as well as altered developmental trajectories as shown by a reduced score on the Brazelton Neonatal Behavioural Assessment Scale, a more difficult temperament, and an increased risk of emotional problems (especially anxiety and depression), impaired cognitive development, and symptoms of attention deficit hyperactivity disorder and conduct disorder during childhood (Glover, 2014; O'Connor et al., 2002; Previti et al., 2014). These children are also at increased risk of impulsivity and cognitive disorders at 14 and 15 years old (Van den Bergh et al., 2005), and at increased risk of encountering adverse life events and of developing depression in adolescence and adulthood (Pariante, 2014; Pawlby et al., 2011; Plant et al., 2015; Stein et al., 2014). Antenatal depression has also been recognized as the strongest predictor of postnatal depression, and postnatal depression is the strongest predictor of parenting stress and difficulties in the mother–infant relationship (Leigh and Milgrom, 2008). Taken together, these numerous lines of evidence point to the importance of focusing on the antenatal period in order to develop preventive and therapeutic interventions.

A psychosocial assessment, in the sense of a comprehensive and multidimensional evaluation of a woman's psychosocial circumstances (e.g., sources of support, quality of her relationships, recent life stressors, past or current physical or sexual abuse) should be common practice for all women during the antenatal period. In fact, this assessment would help health professionals to identify women with a high-risk profile but not currently symptomatic and, therefore, to offer them preventive interventions (Austin, 2014; Milgrom and Gemmill, 2014). Unfortunately, this assessment is not always conducted, and therefore many women are not identified as being at risk for, or as currently suffering from, antenatal anxiety and depression (Andersson et al., 2003; Marcus et al., 2003). However, in the perinatal period both parents are often highly motivated to seek help for their babies' wellbeing and for the potential reduction in intergenerational family dysfunction, and hence this is a unique opportunity to provide preventive interventions for the mental health of the whole family (Austin, 2014).

A recent systematic review on this topic by Lancaster et al. (2010) was focused on the identification of risk factors for antenatal depression that could be assessed during routine obstetric care. In fact, because most women use obstetric services during the course of their pregnancy, this is a great opportunity to identify women at risk, and eventually to treat them and to follow them up (Lancaster et al., 2010). This review identified 57 studies published between January 1980 and March 2008 in the United States, Canada, Europe, Australia and New Zealand and found that the main risk factors associated with depressive symptoms during pregnancy are maternal anxiety, life stress, a history of depression, lack of support, domestic violence and unintended pregnancy.

The purpose of our systematic review is to describe the main psycho-social, obstetric and environmental risk factors involved in the development of antenatal anxiety and depression, including a wider range of low-, middle- and high-income countries compared with those considered by Lancaster et al. (2010).

2. Methods

A systematic literature analysis was performed with the aim of identifying the main psycho-social and environmental risk factors involved in the onset of antenatal anxiety and depression. We used databases for psychological and medical research (PubMed, PsychINFO and the Cochrane Library), to select relevant studies and reviews, with the following key words, as single terms or in combination: antenatal depression; antenatal anxiety; risk factors for antenatal mental health; risk factors for depression/anxiety during pregnancy, risk factors for prenatal depression/anxiety; antenatal depression/anxiety risk factors; prenatal depression/anxiety risk factors; screening; assessments; evaluations. Relevant papers cited in the references of selected articles were further considered for inclusion in the review. Original papers were included if they were written in English and published between 1st January 2003 and 31st August 2015. In addition, the following sources of grey literature were consulted: NICE guidelines, reports from related charities (for example, Tommy's) and scientific organizations (for example, Marcé Society) and information on relevant websites (Austin, 2014; NICE, 2014; Tommy's, 2013). Twelve literature reviews and meta-analyses regarding perinatal mental illness and relevant risk factors were consulted regardless of publication date (Beck, 2001; Bennett et al., 2004; Gavin et al., 2005; Howard et al., 2013; Lancaster et al., 2010; Norhayati et al., 2015; O'hara and Swain, 1996; Parsons et al., 2012; Paulson and Bazemore, 2010; Previti et al., 2014; Robertson et al., 2004; Siegel and Brandon, 2014). After cross-referencing the different sources and excluding duplicates and irrelevant papers, 97 papers were selected (see Table 1). Studies conducted on particular and high-risk populations, such as women exposed to major environmental catastrophes like earthquakes or tsunamis, women with pre-existing health conditions such as HIV or obesity, women with health conditions associated with pregnancy such as diabetes, with high risk pregnancies or with babies with congenital anomalies, were all excluded. Moreover, we have not included risk factors related to physical health. Studies conducted with the aim of investigating risk factors for persistent and recurrent depressive episodes during pregnancy have been included, but studies describing risk factors for persistency of depression and anxiety from pregnancy into the postpartum period have been excluded. Moreover, studies were excluded if the measures used, the risk factors investigated, the times of the assessments and the statistical analysis were not clearly described, or if they had explored risk factors for depression and/or anxiety in the perinatal period (either pregnancy or postpartum) and it was not possible to determine if the risk factors were unequivocally related to the antenatal period.

An additional 46 papers regarding the epidemiology of perinatal anxiety and depression, the bio-psycho-social mechanisms involved, child development outcomes, and preventive interventions, have been included in this review, either in the introduction and/or in the results. These papers have been identified either in the databases consulted or from the references of the studies included in the review.

3. Results

3.1. Psychological and psychiatric risk factors

Depression and anxiety are highly comorbid during the antenatal period, and indeed high anxiety during pregnancy is one of

Table 1
Studies included in this review, in alphabetical order.

Authors	Year of publication	Country	Sample size
Abuidhail, J., Abujilban, S.	2014	Jordania	218
Abujilban, S.K., et al.	2013	Jordan	218
Adewuya, A.O., et al.	2007	Nigeria	180
Agostini, F., et al.	2015	Italy	404
Ajinkya, S., et al.	2013	India	185
Akcal, X.A.P., et al.	2014	Turkey	463
Ali, N.S., et al.	2012	Pakistan	165
Armstrong, D.S.	2004	USA	40
Balestrieri, M., et al.	2012	Italy	1608
Bayrampour, H., et al.	2015	Canada	3021
Bergner, A., et al.	2008	Germany	177
Bicking Kinsey, C., et al.	2015	USA	3006
Bilszta, J.L., et al.	2008	Australia	1578
Bodecs, T., et al.	2013	Hungary	503
Bottomley, K.L., Lancaster, S.J.	2008	Australia	94
Bowen, A., et al.	2009	Canada	402
Bowen, A., Muhajarine, N.	2006	Canada	39
Brittain, K., et al.	2015	South Africa	726
Bunevicius, R., et al.	2009	Lithuania	230
Canady, R.B., et al.	2008	USA	2731
Chojenta, C., et al.	2014	Australia	584
Cooklin, A.R., et al.	2007	Australia	165
Dibaba, Y., et al.	2013	Ethiopia	627
Dmitrovic, B.K., et al.	2014	Serbia	212
Edge, D.	2007	UK	301
Edwards, B., et al.	2008	Australia	421
Elsenbruch, S., et al.	2007	Germany	896
Faisal-Cury, A., Rossi Menezes, P.	2007	Brazil	432
Faisal-Cury, A., et al.	2009	Brazil	831
Fellenzer, J.L., Cibula, D. A.	2014	USA	19.219
Figueiredo, B., et al.	2007	Portugal	108
Fisher, J., et al.	2010	Vietnam	364
Fisher, J., et al.	2013	Vietnam	419
Fonseca-Machado Mde, O., et al.	2015	Brazil	358
Gavin, A.R., et al.	2011	USA	1997
Giardinelli, L., et al.	2012	Italy	590
Ginsburg, G.S., et al.	2008	USA	53
Glazier, R.H., et al.	2004	USA	2052
Golbasi, Z., et al.	2010	Turkey	258
Gong, X., et al.	2013	China	18.665
Grant, K.A., et al.	2012	Australia	149
Groves, A.K., et al.	2012	South Africa	1500
Hartley, M., et al.	2011	South Africa	1062
Holzman, C., et al.	2006	USA	1321
Husain, N., et al.	2012	UK	714
Husain, N., et al.	2011	Pakistan	1357
Jeong, H.G., et al.	2013	Korea	1262
Jesse, D.E., et al.	2005	USA	130
Karmaliani, R., et al.	2009	Pakistan	1369
Lanzi, R.G., et al.	2009	USA	660
Lee, A.M., et al.	2007	China (Hong Kong)	357
Leigh, B., Milgrom, J.	2008	Australia	367
Luke, S., et al.	2009	USA	546
Lydsdottir, L.B., et al.	2014	Icel&	2411
Mahenge, B., et al.	2013	Tanzania	1180
Manikkam, L., Burns, J. K.	2012	South Africa	387
Marchesi, C., et al.	2014	Italy	277
Marchesi, C., et al.	2009	Italy	154
Marcus, S.M., et al.	2003	USA	3472
Martin, S.L., et al.	2006	USA	95
Martini, J., et al.	2015	Germany	306
Melville, J.L., et al	2010	USA	1888
Mezey, G., et al.	2005	UK	200
Miszkurka, M., et al.	2012	Canada	5321
Mohammad, K.I., et al.	2011	Jordan	353
Mohamad Yusuff, A.S., et al.	2015	Malaysia	2072
Nasreen, H.E., et al.	2011	Bangladesh	720
Plant, D.T., et al.	2013	UK	125
Prady, S.L., et al.	2013	UK	8454
Qiao, Y.X., et al.	2009	China	527
Raisanen, S., et al.	2014	Finland	511.938
Ratcliff, B.G., et al.	2015	Switzerland	93
Records, K., Rice, M.	2007	USA	139
Redshaw, M., Henderson, J.	2013	UK	5332
Rich-Edwards, J.W., et al.	2006	USA	1662
Rich-Edwards, J.W., et al.	2011	USA	3637
Robertson-Blackmore, E., et al.	2013	USA	374
Rodriguez, M.A., et al.	2008	USA	210
Rubertsson, C., et al.	2003	Sweden	3001
Rubertsson, C., et al.	2014	Sweden	916
Seng, J.S., et al.	2014	USA	1581
Shakeel, N., et al.	2015	Norway	749
Shen, J.J., et al.	2010	USA	877,579
Simpson, J.A., et al.	2003	USA	106
Smedberg, J., et al.	2015	Europe (15 European countries)	4295
Sockol, L.E., et al.	2014	USA	211
Srinivasan, N., et al.	2015	India	100
Stewart, R.C., et al.	2014	Malawi	583
Verreault, N., et al.	2014	Canada	364
Waqas, A., et al.	2015	Pakistan	500
Weobong, B., et al.	2014	Ghana	20,920
Westdahl, C., et al.	2007	USA	1047
Woods, S.M.	2010	USA	1522
Yanikkerem, E., et al.	2013	Turkey	651
Zayas, L.H., et al.	2003	USA	106
Zelkowitz, P., et al.	2004	Canada	119
Zeng, Y., et al.	2015	China	292

the strongest risk factors for depression (Lancaster et al., 2010; Verreault et al., 2014). Women with feelings of anxiety are at increased risk of suffering from depression during pregnancy (Edwards et al., 2008); for example, a recent study (Mohamad Yusuff et al., 2015) has found that women who had experienced antenatal anxiety were about three times more likely to suffer from depression during pregnancy.

A previous history of mental illness, in particular a history of anxiety and depression and a history of psychiatric treatment during a previous pregnancy or at any time during the lifetime, is also a well-established risk factor in the development of antenatal anxiety and depression (Akcal et al., 2014; Balestrieri et al., 2012; Bayrampour et al., 2015; Bowen et al., 2009; Bunevicius et al., 2009; Edwards et al., 2008; Faisal-Cury et al., 2009; Giardinelli et al., 2012; Jeong et al., 2013; Lydsdottir et al., 2014; Manikkam and Burns, 2012; Marchesi et al., 2014, 2009; Marcus et al., 2003; Martini et al., 2015; Nasreen et al., 2011; Redshaw and Henderson, 2013; Rich-Edwards et al., 2006; Rubertsson et al., 2014; Shakeel et al., 2015; Verreault et al., 2014). Many of these studies found that a history of previous anxiety or depression is the strongest risk factor for a new onset during the antenatal period. For example, one study (Marcus et al., 2003) found that almost half of the women depressed during pregnancy had a past history of major depressive disorder. In addition, another study (Andersson et al., 2006) found that absence of a previous psychiatric disorder was associated with a greater likelihood of recovery from antenatal anxiety and depression after the birth of the child. Nevertheless Raisanen et al. (2014) found that, despite a previous history of depression being the strongest risk factor for a new episode during pregnancy, half of the women depressed during

pregnancy had never been depressed before. This suggests that it is not uncommon for the first episode of depression to occur during pregnancy.

Some studies have also found a significant correlation between antenatal anxiety and depression and past (Lee et al., 2007) or current (Marcus et al., 2003) use of alcohol. Studies have also shown that smoking before or during pregnancy predicts anxiety and depression during pregnancy, even if it is not always clear whether smoking increases the risk of depression or if it is depression that is associated with less healthy behaviours, such as smoking (Abuidhail and Abujilban, 2014; Bottomley and Lancaster, 2008; Bowen et al., 2009; Lydsdottir et al., 2014; Marcus et al., 2003; Raisanen et al., 2014; Rubertsson et al., 2014). One recent research (Smedberg et al., 2015) found that women who continued to smoke during pregnancy were more likely to suffer from antenatal depression compared to the ones who quit smoking during pregnancy, with twice the prevalence of continuing smoking during pregnancy in women with depression than in healthy women. However, another study (Jeong et al., 2013) found that cigarette smoking increased the risk of antenatal depression even if women abstained from cigarette smoking during pregnancy. One study (Fellenzer and Cibula, 2014) found not only that smoking during pregnancy was associated with depression but also that a greater number of cigarettes per day was associated with higher levels of depression. Similarly, another study (Bottomley and Lancaster, 2008) found that there was a significant correlation between the number of cigarettes smoked during the 1st and 2nd trimesters and the depressive score on the EPDS in the 3rd trimester. However, one research found that smoking during pregnancy was not associated with antenatal depression (Luke et al., 2009). Substance use during pregnancy has also been found to be strongly associated with antenatal depression (Fellenzer and Cibula, 2014; Holzman et al., 2006).

The quality of attachment and a woman's relationship with her own parents is another important risk factor. For example, childhood abuse has been recognized as a clear risk factor for depression and anxiety specifically during pregnancy (Plant et al., 2013; Robertson-Blackmore et al., 2013), over and above the increased life-time risk for psychiatric disorders that childhood maltreatment carries (See section 3.4). However, despite considerable anecdotal clinical evidence, only a few studies have investigated the quality of parenting and attachment style in relation to depression and anxiety during the perinatal period. A study (Grant et al., 2012) found that the women reporting a style of parenting characterized by both low care and high control were six times more likely to have anxiety during pregnancy, and seven times more likely to have postnatal depression. Moreover, another study (Simpson et al., 2003) found that “highly ambivalent women”, who also perceived their husband as less supportive and angrier, were more likely to experience depressive symptoms in the perinatal period.

The absence of a good caregiving experience makes it more challenging for the mother to cope with distressing feelings and difficult situations related to parenthood. We know from the literature that pregnant women go through a mental reorganization that allows the development of maternal identity. This process involves the elaboration and integration of mental representations of the unborn baby, of the woman as a mother, of non-maternal self-features and of other significant relationships (Ammaniti and Trentini, 2009). The nature and quality of these maternal representations are influenced by many factors, such as childhood experiences of being parented, actual relationship with the partner and the family, psychological state, and environmental risk factors (Lara-Carrasco et al., 2013). Among these factors, the quality of the childhood experiences of being parented, and especially the relationship with the mother figure, influences the nature of these representations during pregnancy (Ammaniti and Trentini, 2009). In fact, many researchers have shown that, at the time of the transition to parenthood, unresolved and unprocessed issues are reactivated, and fantasies and revitalized memories related to the past are transferred to the new situation, potentially leading to distorted responses towards the baby after the birth (Raphael-Leff, 2010). To this end, one study (Jeong et al., 2013) found that past experience of insufficient emotional support from the mother (but not from the father) was an independent predictor of antenatal depression. This suggests that positive internalized experiences with her own mother may help the pregnant women in managing negative emotions during pregnancy and in building a healthy mother–baby relationship (Jeong et al., 2013). This evidence highlights the importance of assessing the quality of childhood parenting experiences and the presence of a history of abuse, because these factors both increase the likelihood that mothers may experience difficulties in developing optimal relationships with their babies.

A family history of psychiatric illness during the lifespan has been observed as another important risk factor for antenatal depression (Jeong et al., 2013; Lydsdottir et al., 2014). Nevertheless, this may sometimes be difficult to evaluate, because the woman may not be aware of mental problems that have affected relatives, or may be not willing to disclose this information (Robertson et al., 2004).

3.2. Social support and marital relationship risk factors

Lack of social support is another factor strongly associated with an increased risk of antenatal anxiety and depression. Social support is a multidimensional concept and includes informational support (information and advice), instrumental support (practical help) and emotional support (expression of caring and holding in esteem). The objective evaluation of the social support received may be challenging, because it has been noticed that depressed women tend to feel less supported than they objectively are (Robertson et al., 2004).

Many studies report perceived lack of partner support and of social support as important risk factors for antenatal anxiety and depression (Adewuya et al., 2007; Agostini et al., 2015; Bayrampour et al., 2015; Bowen and Muhajarine, 2006b; Bowen et al., 2009; Dibaba et al., 2013; Elsenbruch et al., 2007; Faisal-Cury et al., 2009; Ginsburg et al., 2008; Golbasi et al., 2010; Groves et al., 2012; Hartley et al., 2011; Jeong et al., 2013; Jesse et al., 2005; Leigh and Milgrom, 2008; Lydsdottir et al., 2014; Marchesi et al., 2014; Martini et al., 2015; Nasreen et al., 2011; Ratcliff et al., 2015; Records and Rice, 2007; Rich-Edwards et al., 2006; Rubertsson et al., 2003; Srinivasan et al., 2015; Stewart et al., 2014; Waqas et al., 2015; Westdahl et al., 2007; Yanikkerem et al., 2013; Zelkowitz et al., 2004) as well as social conflict (Westdahl et al., 2007). A study conducted with immigrants in Canada (Zelkowitz et al., 2004) demonstrated that women with scores of 12 or more on the EPDS reported less satisfaction with, and greater need for, social support. Also, they had fewer women, fewer relatives and fewer people from their own ethnic group in their networks.

Perceived support and marital satisfaction are protective factors against antenatal anxiety and depression (Lee et al., 2007; Zeng et al., 2015), while a problematic/conflictual or dissatisfied/poor relationship with partner have been identified as risk factors for the onset of anxiety and depression during pregnancy (Giardinelli et al., 2012; Marchesi et al., 2009; Martini et al., 2015; Nasreen et al., 2011; Records and Rice, 2007; Srinivasan et al., 2015; Zelkowitz et al., 2004). Good instrumental and emotional support, provided first of all by the partner but also by the family and the social environment, is crucial for the mother-to-be. The presence of a supportive partner acts as a buffer against the

difficulties experienced in the transition to parenthood, protecting maternal mental health (Bilszta et al., 2008). A problematic relationship with the partner, instead, causes an additional stress to the woman, making it harder for her to adjust to pregnancy and motherhood (Marchesi et al., 2009).

Other factors, such as marital status or length of relationship, may also influence the amount of support the new mother receives and could be considered to be risk factors for anxiety and depression during pregnancy. Some studies have identified that women experiencing depressive symptoms in the antenatal period are more likely to be not married, to be single or to have a partner not living in the same household (Adewuya et al., 2007; Brittain et al., 2015; Faisal-Cury and Rossi Menezes, 2007; Figueiredo et al., 2007; Jeong et al., 2013; Manikkam and Burns, 2012; Marcus et al., 2003; Melville et al., 2010; Mezey et al., 2005; Raisanen et al., 2014; Rich-Edwards et al., 2006; Rubertsson et al., 2003; Weobong et al., 2014). A study found higher level of depression in women living with friends or in a community compared to the ones cohabitating with a partner (Balestrieri et al., 2012). However, some researchers (Bilszta et al., 2008) have observed that the evidence that single mothers report higher levels of depressive symptoms during pregnancy than women with supportive partners may be explained by a previous history of depression, current emotional problems, previous abuse, level of daily hassles, maternal perception of the infant and income level. Interestingly, single mothers have lower levels of depressive symptoms compared to women with unsupportive partners (Bilszta et al., 2008). Likewise, a few studies did not find that marital status was always a significant predictor of antenatal depression and anxiety (Agostini et al., 2015; Glazier et al., 2004; Husain et al., 2012; Luke et al., 2009; Qiao et al., 2009). These findings highlight the importance of considering not only marital status but also the quality of the relationship. Given these results, we could conclude that being a single mother is in a way better than having a difficult and unsupportive relationship.

Surprisingly, no studies regarding the psychopathology of the partner as potential risk factor for antenatal depression and anxiety have been identified in this systematic review. Research has been conducted regarding the possible impact of partner psychopathology on maternal depressive symptoms in the first postpartum year (D'Anna-Hernandez et al., 2013), but no study has been found in relation to the antenatal period. One meta-analysis (Paulson and Bazemore, 2010) has found a positive and moderate in size correlation between maternal and paternal depression in the perinatal period (from the 1st trimester until the 1st year of the baby) but a direction of causal influence had not been reported in the studies included in the meta-analysis.

3.3. Socio-demographic and economic risk factors

Studies have examined many socio-demographic and economic risk factors in relation to antenatal anxiety and depression, but the results are equivocal.

Many studies have found a significant correlation between young age and depression/anxiety during pregnancy (Bodecs et al., 2013; Fellenzer and Cibula, 2014; Glazier et al., 2004; Hartley et al., 2011; Lee et al., 2007; Martini et al., 2015; Qiao et al., 2009; Rich-Edwards et al., 2006; Rubertsson et al., 2014, 2003). Perhaps unsurprisingly, adolescents are at increased risk of become depressed during pregnancy (Figueiredo et al., 2007; Lanzi et al., 2009; Raisanen et al., 2014). This confirms what has been found in a systematic review about adolescence and mental health during pregnancy (Siegel and Brandon, 2014). Nevertheless, some studies found that an older age was positively associated with depression scores during pregnancy (Ali et al., 2012; Faisal-Cury et al., 2009; Fisher et al., 2013; Gavin et al., 2011; Golbasi et al., 2010; Luke et al., 2009; Nasreen et al., 2011; Raisanen et al., 2014; Weobong et al., 2014; Yanikkerem et al., 2013) and other studies found that age was not associated with depression or anxiety during pregnancy (Abuidhail and Abujilban, 2014; Agostini et al., 2015; Balestrieri et al., 2012; Faisal-Cury and Rossi Menezes, 2007; Husain et al., 2012, 2011; Karmaliani et al., 2009; Marcus et al., 2003; Ratcliff et al., 2015; Srinivasan et al., 2015).

Antenatal depression and anxiety also seem more common in women with low educational achievements (Abuidhail and Abujilban, 2014; Abujilban et al., 2014; Bodecs et al., 2013; Bunevicius et al., 2009; Dmitrovic et al., 2014; Faisal-Cury and Rossi Menezes, 2007; Fellenzer and Cibula, 2014; Gavin et al., 2011; Glazier et al., 2004; Husain et al., 2011; Jeong et al., 2013; Lydsdottir et al., 2014; Marcus et al., 2003; Martini et al., 2015; Qiao et al., 2009; Yanikkerem et al., 2013). In particular, one study conducted in Bangladesh (Nasreen et al., 2011) found that antenatal anxiety was inversely associated with "literacy". Nevertheless, two studies conducted in Malawi (Stewart et al., 2014) and Pakistan (Karmaliani et al., 2009) found that women with "more years of schooling" were more likely to experiences symptoms of anxiety and depression. A few studies did not find education to be a significant predictor of antenatal depression (Agostini et al., 2015; Husain et al., 2012; Lanzi et al., 2009; Luke et al., 2009; Ratcliff et al., 2015; Srinivasan et al., 2015; Zelkowitz et al., 2004).

Antenatal anxiety and depression have also been found to be more prevalent in unemployed women (Bodecs et al., 2013; Dibaba et al., 2013; Faisal-Cury et al., 2009; Giardinelli et al., 2012; Lydsdottir et al., 2014; Marcus et al., 2003; Rubertsson et al., 2014, 2003) and housewives (Balestrieri et al., 2012; Marchesi et al., 2009; Yanikkerem et al., 2013), compared with employed women, even if a few studies did not find any significant association between employment and antenatal depression (Agostini et al., 2015; Glazier et al., 2004; Husain et al., 2011; Karmaliani et al., 2009; Lanzi et al., 2009; Zelkowitz et al., 2004). One study (Cooklin et al., 2007) analysed the role of workplace adversity on maternal wellbeing during pregnancy. It found that poor working conditions, in terms of discrimination and lack of key entitlements during pregnancy, are associated with higher levels of depression. Moreover, women whose partners were unemployed seem to be more likely to experience antenatal depression (Akcal et al., 2014; Husain et al., 2011; Karmaliani et al., 2009; Srinivasan et al., 2015).

Studies that have examined the association with low income and financial hardships have also reported contradictory results. While some studies (Bodecs et al., 2013; Faisal-Cury and Rossi Menezes, 2007; Fisher et al., 2013, 2010; Glazier et al., 2004; Hartley et al., 2011; Holzman et al., 2006; Husain et al., 2011; Jeong et al., 2013; Leigh and Milgrom, 2008; Lydsdottir et al., 2014; Prady et al., 2013; Rich-Edwards et al., 2006; Weobong et al., 2014; Zeng et al., 2015) found low income or financial difficulties to be relevant factors, others (Abuidhail and Abujilban, 2014; Josefsson et al., 2002; Srinivasan et al., 2015) did not find any significant correlation.

Ethnicity and, in particular, belonging to a minority ethnic group, are other potential risk factors highlighted by some studies, even if the results are also contradictory. The prevalence of antenatal depression seems higher in Black, Latina and Asian mothers compared to White mothers (Faisal-Cury and Rossi Menezes, 2007; Fellenzer and Cibula, 2014; Gavin et al., 2011; Melville et al., 2010; Redshaw and Henderson, 2013; Shakeel et al., 2015; Verreault et al., 2014), but other studies do not show any significant difference (Canady et al., 2008; Jesse et al., 2005; Marcus et al., 2003) and others show higher levels of depression among White mothers compared to Black and Hispanic mothers as well as women of other ethnicities (Shen et al., 2010). Belonging to a minority group could be a risk factor for antenatal depression because of the increased level of stress due to discrimination (Prady et al., 2013).

However, research in the United Kingdom has shown that some minority groups may have lower levels of mental illness than the majority population (Edge, 2007). Specifically, in this study Black Caribbean mothers, despite belonging to a minority ethnic group, living in more deprived areas and being more likely to be lone mothers and to receive less support from their partners, did not show higher levels of depression during pregnancy and the postpartum period, and did not receive more treatment for perinatal depression, compared with White British mothers (Edge, 2007). It is possible that social risk factors may have a different impact on the mental health of Black Caribbean and White women, as the prolonged and repeated exposure to adversity might have provided the Black Caribbean women with greater resilience and skills to manage psychological distress (Edge, 2007; Williams and Healy, 2001; Williams et al., 1997). This may also be explained by the higher levels of resources (social support, spirituality and self-esteem) in Black mothers than in White mothers (Jesse et al., 2005). These resources may act as a buffer against potential sources of risk and reduce the incidence of depression (Jesse et al., 2005; Prady et al., 2013). Therefore, being part of a minority ethnic group may not be an independent factor in the relation to depressive symptoms, and the substantial risk in minority ethnic groups found in some studies may be the result of a higher prevalence of other risk factors. To this end, a study found that the higher prevalence of depression among Black and Hispanic mothers was mainly explained by lower income and financial hardship (Rich-Edwards et al., 2006). Another study found that financial concerns are significantly associated with mental health difficulties during pregnancy, rather than belonging to a specific ethnic group (Prady et al., 2013).

3.4. Adverse events in life and perceived stress

Many studies have shown that adverse events in life and high perceived stress during pregnancy play an important role in the onset of antenatal depression (Abujilban et al., 2014; Bayrampour et al., 2015; Bowen et al., 2009; Brittain et al., 2015; Bunevicius et al., 2009; Fisher et al., 2013;, 2010, Gavin et al., 2011; Glazier et al., 2004; Holzman et al., 2006; Husain et al., 2012; Jesse et al., 2005; Leigh and Milgrom, 2008; Melville et al., 2010; Ratcliff et al., 2015; Rubertsson et al., 2003; Shakeel et al., 2015; Verreault et al., 2014; Woods et al., 2010; Zayas et al., 2003; Zelkowitz et al., 2004). Stressful experiences may vary from mild to severe, also depending on stress perception and the ability to cope; nevertheless, highly stressful experiences, such as the death or illness of a relative, a relationship breakdown, losing a job, moving home, being assaulted or raped, can trigger depressive and anxiety symptoms or disorders in most individuals. Pregnancy is in itself a well-recognized time of stress because of the many obvious and potential changes and challenges. The occurrence of one or more stressful events can then lead to an increase in the probability that mothers and fathers experience psychological difficulties or mental health disorders. To this end, a study has highlighted the important role of social support in reducing the negative impact of adverse events in life: they have shown that women who experience stressful life events but have good social support are less likely to suffer from emotional distress compared with women without an available support network (Glazier et al., 2004). Therefore, the impact of adverse events in life on antenatal mental health may be mediated by social support. This sustains the “stress buffering hypothesis”, where supportive interactions among people protect them against the negative health consequences of stressful life events (Cobb, 1976; Cohen and Wills, 1985). Nevertheless, in one study (Groves et al., 2012) social support did not attenuate the effects of partner violence on woman's mental health during pregnancy.

Within adverse events in life, being exposed to intrusive life events, such as domestic violence or emotional, physical or sexual abuse, has a considerable impact on a mother's mental health in the perinatal period. A number of studies have found that having been exposed to domestic violence before or during pregnancy (particularly if perpetrated by the partner), having a history of abuse, or having experienced a sexual assault, are all risk factors for the development of antenatal anxiety, depression and post-traumatic stress symptoms (Akcal et al., 2014; Ali et al., 2012; Brittain et al., 2015; Dibaba et al., 2013; Edwards et al., 2008; Fisher et al., 2013, 2010; Fonseca-Machado Mde et al., 2015; Gavin et al., 2011; Groves et al., 2012; Hartley et al., 2011; Holzman et al., 2006; Jesse et al., 2005; Karmaliani et al., 2009; Leigh and Milgrom, 2008; Lydsdottir et al., 2014; Mahenge et al., 2013; Martini et al., 2015; Melville et al., 2010; Mezey et al., 2005; Miszkurka et al., 2012; Nasreen et al., 2011; Rich-Edwards et al., 2011; Rodriguez et al., 2008; Stewart et al., 2014; Verreault et al., 2014; Waqas et al., 2015). In particular, a study found that having been exposed to a traumatic sexual experience is associated with antenatal anxiety but not depression (Martini et al., 2015). Another study found that women who are exposed to physical assault or sexual coercion by their intimate partners before or during pregnancy have higher levels of depressive symptoms during pregnancy (Martin et al., 2006).

We know from the literature that women with a history of abuse often experience more than one traumatic event during their lives, and have higher life-time levels of depressive and post-traumatic symptoms than women who have only suffered a single trauma. Indeed, one study (Holzman et al., 2006) found a marked increase in depressive scores when adverse circumstances were present both in childhood and in adulthood. This is in line with the theory that accumulation of adversity is more damaging than single events (Holzman et al., 2006). As such, women who have been sexually abused as children are at significant risk of experiencing abuse as adults, including domestic violence (Mezey et al., 2005). In fact, childhood abuse has been identified as a particularly strong predictor of depression and anxiety during the antenatal period (Brittain et al., 2015; Fisher et al., 2013; Groves et al., 2012; Jeong et al., 2013; Mezey et al., 2005; Plant et al., 2013; Robertson-Blackmore et al., 2013; Seng et al., 2014), with women with a history of childhood sexual abuse being twice as likely to develop antenatal depression (Robertson-Blackmore et al., 2013). Moreover, the relationship between childhood maltreatment and antenatal depression remains true even when accounting for a woman's antisocial characteristics, personal history of psychiatric illness outside pregnancy, and the availability of partner support during pregnancy, all of which have been identified as salient factors associated with maternal psychopathology (Plant et al., 2013).

3.5. Obstetric and pregnancy-related risk factors

Many studies have found an increased risk of developing antenatal depression and anxiety in women with an unplanned or unwanted pregnancy (Ajinkya et al., 2013; Akcal et al., 2014; Bayrampour et al., 2015; Brittain et al., 2015; Bunevicius et al., 2009; Dibaba et al., 2013; Fellenzer and Cibula, 2014; Giardinelli et al., 2012; Golbasi et al., 2010; Jeong et al., 2013; Karmaliani et al., 2009; Lee et al., 2007; Manikkam and Burns, 2012; Marchesi et al., 2009; Martini et al., 2015; Mohamad Yusuff et al., 2015; Mohammad et al., 2011; Redshaw and Henderson, 2013; Rich-Edwards et al., 2006; Waqas et al., 2015; Weobong et al., 2014; Yanikkerem et al., 2013), although two studies did not find this (Groves et al., 2012; Hartley et al., 2011). Two studies (Lee et al., 2007; Marchesi et al., 2009) observed that an unwanted pregnancy was a significant predictor of depression only in the first trimester, with less importance over time. Some researchers (Lee et al., 2007) suggested that women initially find it more difficult to cope with

an unexpected and undesired event and, therefore, are more likely to become depressed; however, as the pregnancy progresses, the shock reduces, and the relationship with the foetus grows stronger, the pregnancy becomes more accepted and the depressive symptoms decrease. Of note is also that fear of childbirth and negative thoughts about the upcoming delivery have been associated with increased risk of antenatal anxiety and depression (Raisanen et al., 2014; Rubertsson et al., 2014); indeed, a study found that a negative experience of pregnancy was significantly associated with antenatal depression (Agostini et al., 2015).

The role of parity in increasing the risk of antenatal depression and anxiety is not clear. Multiparous women are at increased risk of developing antenatal anxiety and depression according to some studies (Abuidhail and Abujilban, 2014; Golbasi et al., 2010; Lanzi et al., 2009; Redshaw and Henderson, 2013; Yanikkerem et al., 2013) while other studies (Ali et al., 2012; Fisher et al., 2013; Raisanen et al., 2014) found nulliparous or primiparous women as more at risk than multiparous women, and others yet did not find any significant association between parity and antenatal mental health (Abujilban et al., 2014; Dibaba et al., 2013; Faisal-Cury and Rossi Menezes, 2007; Fisher et al., 2010; Glazier et al., 2004; Husain et al., 2011; Marcus et al., 2003; Ratcliff et al., 2015; Rubertsson et al., 2003; Zelkowitz et al., 2004). Greater number of previous pregnancies (multigravida) has been found to be a predictor of antenatal depression in a few studies (Ajinkya et al., 2013; Records and Rice, 2007) while another study found that women in their first pregnancy (primigravida) were more likely to suffer from depression (Karmaliani et al., 2009), and other studies (Fisher et al., 2010; Srinivasan et al., 2015) did not find gravidity to be associated with antenatal depression.

Women with current or past pregnancy/delivery complications, with a history of pregnancy loss, pregnancy terminations or stillbirth have been found to be more likely to experience antenatal depression, anxiety and pregnancy-specific anxieties (Adewuya et al., 2007; Ajinkya et al., 2013; Ali et al., 2012; Armstrong, 2004; Chojenta et al., 2014; Faisal-Cury et al., 2009; Faisal-Cury and Rossi Menezes, 2007; Fisher et al., 2013; Golbasi et al., 2010; Gong et al., 2013; Husain et al., 2011; Raisanen et al., 2014; Stewart et al., 2014; Waqas et al., 2015; Weobong et al., 2014; Zeng et al., 2015). In particular, one study (Bergner et al., 2008) found that women with a history of miscarriage suffer more from trait anxiety and pregnancy-specific anxieties, and those who have had recurrent miscarriages also have higher levels of anxiety. However, some studies (Bicking Kinsey et al., 2015; Fisher et al., 2010; Jeong et al., 2013; Qiao et al., 2009) did not find any significant association between previous obstetric history, including a history of either spontaneous or induced abortion, and antenatal anxiety or depression. A history of one or more episiotomies, caesarean section or a previous negative birth experience, have been found to be associated with a high incidence of antenatal anxiety and depression (Rubertsson et al., 2003; Waqas et al., 2015), but another study found no association between “mode of delivery” and antenatal depression (Ajinkya et al., 2013). In one study, women who had infertility treatments were more likely to suffer from antenatal anxiety (Bayrampour et al., 2015), but another study did not find this (Rubertsson et al., 2003).

An unexpected loss of pregnancy can be a traumatic event and can lead to high level of anxiety and depression that can persist into subsequent pregnancies. One study found previous miscarriage to be associated with antenatal depression but no significant association was found with stillbirth (Rubertsson et al., 2003). The interval between a pregnancy that did not result in a live birth and a new pregnancy seems to play a crucial role in whether the woman will or will not experience anxiety and depression during a new pregnancy: the World Health Organization recommends an interval of at least 6 months to allow women time to recover physically and mentally (WHO, 2005). To this end, Gong et al. found that women with a history of miscarriage and interpregnancy interval of less than 6 months are at increased risk of developing anxiety and depression during the first trimester of pregnancy (Gong et al., 2013).

3.6. Personality risk factors

Some studies have shown that some personality factors increase the risk of experiencing psychological difficulties in the antenatal period, and especially negative cognitive styles: pessimism, anger and rumination; a tendency to be nervous, worried or shy; low self-esteem and low self-efficacy; and high levels of neuroticism or psychoticism (Bayrampour et al., 2015; Bunevicius et al., 2009; Ginsburg et al., 2008; Jesse et al., 2005; Lee et al., 2007; Leigh and Milgrom, 2008; Martini et al., 2015; Mohammad et al., 2011; Zeng et al., 2015). On the contrary, active coping and high self-esteem/self-efficacy have been identified as protective factors (Edwards et al., 2008; Zeng et al., 2015).

While more research has been conducted regarding general cognitive biases in relation to depression and anxiety, some studies have also pointed out that specific types of cognitive biases have an impact in the perinatal period. A study (Sockol et al., 2014) has found that maternal attitudes regarding motherhood have incremental predictive validity for symptoms of depression and anxiety during the perinatal period over more general cognitive biases. Moreover, maternal attitudes towards motherhood continue to be strongly associated with anxiety and depression even after controlling for interpersonal factors. Examples of maladaptive beliefs about motherhood are: It is wrong to have mixed feelings about my baby; I should feel more devoted to my baby; it is wrong to feel disappointed by motherhood; if my baby is crying, people will think I cannot care for him/ her properly. As such, women with maladaptive beliefs about motherhood are at increased risk of experiencing feelings of sadness, guilt and worthlessness, and to develop anxiety and depression during pregnancy and in the postpartum period, when their feelings do not match their attitudes and expectations. This means that specific beliefs about motherhood could be most strongly activated by the particular stressors of parenting and, therefore, they could mediate the relationship between the specific stressors of becoming a parent and the emotional response to these events (Sockol et al., 2014).

4. Discussion

In this systematic review, psycho-social, environmental, obstetric and pregnancy-related risk factors for antenatal depression and anxiety have been investigated. Table 1 shows all the studies that have been included and discussed in this systematic review, while Table 2 shows all the main risk factors that have been found to be associated with antenatal depression and anxiety. Depression and anxiety have been found to be highly comorbid during the antenatal period, and indeed high anxiety during pregnancy is a risk factor for antenatal depression (Verreault et al., 2014); therefore, most of the risk factors identified here are relevant to both conditions.

The most relevant factors associated with antenatal depression or anxiety (ranked according to the number of studies that have found the factors to be significant predictors, and presenting also the number of studies who did not) are: lack of partner or of social support (29 vs. 0); history of abuse or of domestic violence (28 vs. 0); personal history of mental illness (23 vs. 0); unplanned or unwanted pregnancy (22 vs. 2); adverse events in life and high perceived stress (21 vs. 0); present/ past pregnancy complications or pregnancy loss (17 vs. 4); low education level (17 vs. 9); low

Table 2
Studies that found particular risk factors to be significant for anxiety and depression during pregnancy, in chronological order.

Psychological-psychiatric factors							
Personal history of mental illness/psychiatric treatment	Marcus et al. (2003)	Rich-Edwards et al. (2006)	Edwards et al. (2008)	Bowen et al. (2009)	Bunevicius et al. (2009)	Faisal-Cury et al. (2009)	Marchesi et al. (2009)
	Nasreen et al. (2011)	Balestrieri et al. (2012)	Giardinelli et al. (2012)	Manikkam and Burns (2012)	Jeong et al. (2013)	Redshaw and Henderson (2013)	Akcal et al. (2014)
	Marchesi et al. (2014)	Rubertsson et al. (2014)	Verreault et al. (2014)	Lydsdottir et al. (2014)	Raisanen et al. (2014)	Martini et al. (2015)	Shakeel et al. (2015)
	Bayrampour et al. (2015)						
Current/past alcohol use	Marcus et al. (2003)	Lee et al. (2007)					
Current/past smoking	Marcus et al. (2003)	Bottomley and Lancaster (2008)	Bowen et al. (2009)	Jeong et al. (2013)	Abuidhail and Abujilban (2014)	Raisanen et al. (2014)	Fellenzer and Cibula (2014)
	Rubertsson et al. (2014)	Lydsdottir et al. (2014)	Smedberg et al. (2015)				
Current substance use during pregnancy	Holzman et al. (2006)	Fellenzer and Cibula (2014)					
Childhood abuse	Mezey et al. (2005)	Groves et al. (2012)	Fisher et al. (2013)	Robertson-Blackmore et al. (2013)	Plant et al. (2013)	Jeong et al. (2013)	Seng et al. (2014)
	Brittain et al. (2015)						
Quality/style of parenting during childhood	Simpson et al. (2003)	Grant et al. (2012)	Jeong et al. (2013)				
Family history of psychiatric illness	Jeong et al. (2013)	Lydsdottir et al. (2014)					
Social support & marital relationship factors							
Lack of partner/social support	Rubertsson et al. (2003)	Zelkowitz et al. (2004)	Jesse et al. (2005)	Bowen and Muhajarine (2006a, 2006b)	Rich-Edwards et al. (2006)	Adewuya et al. (2007)	Elsenbruch et al. (2007)
	Records and Rice (2007)	Westdahl et al. (2007)	Ginsburg et al. (2008)	Leigh and Milgrom (2008)	Bowen et al. (2009)	Faisal-Cury et al. (2009)	Golbasi et al. (2010)
	Hartley et al. (2011)	Nasreen et al. (2011)	Groves et al. (2012)	Dibaba et al. (2013)	Jeong et al. (2013)	Yanikkerem et al. (2013)	Lydsdottir et al. (2014)
	Marchesi et al. (2014)	Stewart et al. (2014)	Agostini et al. (2015)	Bayrampour et al. (2015)	Martini et al. (2015)	Ratcliff et al. (2015)	Srinivasan et al. (2015)
	Waqas et al. (2015)						
Social conflict	Westdahl et al. (2007)						
Problematic/dissatisfied relationship	Zelkowitz et al. (2004)	Records and Rice (2007)	Marchesi et al. (2009)	Nasreen et al. (2011)	Giardinelli et al. (2012)	Martini et al. (2015)	Srinivasan et al. (2015)
History of abuse/domestic violence	Jesse et al. (2005)	Mezey et al. (2005)	Holzman et al. (2006)	Martin et al. (2006)	Edwards et al. (2008)	Leigh and Milgrom (2008)	Rodriguez et al. (2008)
	Karmaliani et al. (2009)	Fisher et al. (2010)	Melville et al. (2010)	Gavin et al. (2011)	Hartley et al. (2011)	Nasreen et al. (2011)	Rich-Edwards et al. (2011)
	Ali et al. (2012)	Groves et al. (2012)	Miszkurka et al. (2012)	Dibaba et al. (2013)	Fisher et al. (2013)	Mahenge et al. (2013)	Akcal et al. (2014)

	Lydsdottir et al. (2014)	Stewart et al. (2014)	Verreault et al. (2014)	Waqas et al. (2015)	Martini et al. (2015)	Brittain et al. (2015)	Fonseca-Machado Mde et al. (2015)
Single mother/partner non living in the house	Marcus et al. (2003)	Rubertsson et al. (2003)	Mezey et al. (2005)	Rich-Edwards et al. (2006)	Adewuya et al. (2007)	Faisal-Cury and Rossi Menezes (2007)	Figueiredo et al. (2007)
	Melville et al. (2010)	Balestrieri et al. (2012)	Manikkam and Burns (2012)	Jeong et al. (2013)	Raisanen et al. (2014)	Weobong et al. (2014)	Brittain et al. (2015)
Socio-demographic & economic factors							
Young age	Rubertsson et al. (2003)	Glazier et al. (2004)	Rich-Edwards et al. (2006)	Figueiredo et al. (2007)	Lee et al. (2007)	Lanzi et al. (2009)	Qiao et al. (2009)
	Hartley et al. (2011)	Bodecs et al. (2013)	Fellenzer and Cibula (2014)	Raisanen et al. (2014)	Rubertsson et al. (2014)	Martini et al. (2015)	
Older age	Faisal-Cury et al. (2009)	Luke et al. (2009)	Golbasi et al. (2010)	Gavin et al. (2011)	Nasreen et al. (2011)	Ali et al. (2012)	Fisher et al. (2013)
	Yanikkerem et al. (2013)	Raisanen et al. (2014)	Weobong et al. (2014)				
Low education level	Marcus et al. (2003)	Glazier et al. (2004)	Faisal-Cury and Rossi Menezes (2007)	Bunevicius et al. (2009)	Qiao et al. (2009)	Gavin et al. (2011)	Husain et al. (2011)
	Nasreen et al. (2011)	Bodecs et al. (2013)	Jeong et al. (2013)	Yanikkerem et al. (2013)	Abujilban et al. (2014)	Abuidhail and Abu-jilban (2014)	Dmitrovic et al. (2014)
	Fellenzer and Cibula (2014)	Lydsdottir et al. (2014)	Martini et al. (2015)				
Higher education level	Karmaliani et al. (2009)	Stewart et al. (2014)					
Unemployment	Marcus et al. (2003)	Rubertsson et al. (2003)	Faisal-Cury et al. (2009)	Giardinelli et al. (2012)	Bodecs et al. (2013)	Dibaba et al. (2013)	Lydsdottir et al. (2014)
	Rubertsson et al. (2014)						
Housewife status	Marchesi et al. (2009)	Balestrieri et al. (2012)	Yanikkerem et al. (2013)				
Workplace adversity	Cooklin et al. (2007)						
Partner unemployment	Karmaliani et al. (2009)	Husain et al. (2011)	Akcal et al. (2014)	Srinivasan et al. (2015)			
Black/Latina/Asian ethnic group	Faisal-Cury and Rossi Menezes (2007)	Melville et al. (2010)	Gavin et al. (2011)	Redshaw and Henderson (2013)	Fellenzer and Cibula (2014)	Verreault et al. (2014)	Shakeel et al. (2015)
Low income/financial hardships	Glazier et al. (2004)	Holzman et al. (2006)	Rich-Edwards et al. (2006)	Faisal-Cury and Rossi Menezes (2007)	Leigh and Milgrom (2008)	Fisher et al. (2010)	Hartley et al. (2011)
	Husain et al. (2011)	Bodecs et al. (2013)	Fisher et al. (2013)	Prady et al. (2013)	Jeong et al. (2013)	Lydsdottir et al. (2014)	Weobong et al. (2014)
	Zeng et al. (2015)						

Table 2 (*continued*)

Adverse events in life and perceived stress							
Adverse events in life and perceived stress	Rubertsson et al. (2003)	Zayas et al. (2003)	Glazier et al. (2004)	Zelkowitz et al. (2004)	Jesse et al. (2005)	Holzman et al. (2006)	Leigh and Milgrom (2008)
	Bowen et al. (2009)	Bunevicius et al. (2009)	Fisher et al. (2010)	Melville et al. (2010)	Woods et al. (2010)	Husain et al. (2012)	Fisher et al. (2013)
	Gavin et al. (2011)	Abujilban et al. (2014)	Verreault et al. (2014)	Bayrampour et al. (2015)	Brittain et al. (2015)	Ratcliff et al. (2015)	Shakeel et al. (2015)
Obstetric and pregnancy related factors							
Unplanned/unwanted pregnancy	Rich-Edwards et al. (2006)	Lee et al. (2007)	Bunevicius et al. (2009)	Marchesi et al. (2009)	Karmaliani et al. (2009)	Golbasi et al. (2010)	Mohammad et al. (2011)
	Manikkam and Burns (2012)	Giardinelli et al. (2012)	Ajinkya et al. (2013)	Dibaba et al. (2013)	Jeong et al. (2013)	Redshaw and Henderson (2013)	Yanikkerem et al. (2013)
	Fellenzer and Cibula (2014)	Akcal et al. (2014)	Weobong et al. (2014)	Waqas et al. (2015)	Martini et al. (2015)	Brittain et al (2015)	Mohamad Yusuff et al. (2015)
	Bayrampour et al. (2015)						
Multiparity	Lanzi et al. (2009)	Golbasi et al. (2010)	Yanikkerem et al. (2013)	Redshaw and Henderson (2013)	Abuidhail and Abujilban (2014)		
Primiparity/nulliparity	Ali et al. (2012)	Fisher et al. (2013)	Raisanen et al. (2014)				
Primigravida	Karmaliani et al. (2009)						
Multigravida	Records and Rice (2007)	Ajinkya et al. (2013)					
History/occurrence of pregnancy complications/ pregnancy loss	Rubertsson et al. (2003)	Armstrong (2004)	Adewuya et al. (2007)	Faisal-Cury and Rossi Menezes (2007)	Bergner et al. (2008)	Faisal-Cury et al. (2009)	Golbasi et al. (2010)
	Husain et al. (2011)	Ali et al. (2012)	Ajinkya et al. (2013)	Fisher et al. (2013)	Gong et al. (2013)	Chojenta et al. (2014)	Raisanen et al. (2014)
	Stewart et al. (2014)	Weobong et al. (2014)	Waqas et al. (2015)	Zeng et al. (2015)			
History of episiotomies/caesarean section/negative birth experience/infertility treatment	Rubertsson et al. (2003)	Waqas et al. (2015)	Agostini et al. (2015)	Bayrampour et al. (2015)			
Fear of childbirth	Raisanen et al. (2014)	Rubertsson et al. (2014)					
Personality factors							
Negative cognitive style/self-efficacy/self-esteem	Jesse et al. (2005)	Lee et al. (2007)	Ginsburg et al. (2008)	Leigh and Milgrom (2008)	Bunevicius et al. (2009)	Mohammad et al. (2011)	Sockol et al. (2014)
	Martini et al. (2015)	Bayrampour et al. (2015)	Zeng et al. (2015)				

income (15 vs. 3); single marital status (14 vs. 5); current or past smoking (11 vs. 1); negative cognitive style/low self-esteem and self-efficacy (10 vs. 0); problematic/dissatisfied relationship with partner (7 vs. 0); and childhood abuse (8 vs. 0). Inconsistent results have been found regarding unemployment (11 vs. 6) and Black, Asian and Latina ethnic group (7 vs. 4). Also, 13 papers found young age to be significant associated with antenatal depression and anxiety, while 10 studies found old age to be a significant risk factor, and 10 studies did not find any association with age. Moreover, 5 studies found multiparous women to be more at risk of antenatal depression/anxiety, 3 studies found nulliparous and primiparous to be more at risk, and 10 studies did not find any association with parity. Similar to parity, 2 papers have found women with multiple pregnancies to be more likely to suffer from depression or anxiety during pregnancy, 1 paper found women at their first pregnancy to be more at risk, and 2 papers did not find any association with gravidity. Studies included in this systematic review have also shown the following risk factors to be associated with antenatal anxiety and depression but further studies are needed as only little research has been conducted: current/past alcohol abuse (2 vs. 0), substance use (2 vs. 0), family history of mental illness (2 vs. 0), quality/style of parenting, (3 vs. 0), mode of delivery (2 vs. 1), partner unemployed (4 vs. 0).

Surprisingly, no studies regarding the psychopathology of the partner as potential risk factor for antenatal depression and anxiety have been identified in this systematic review. Only one meta-analysis (Paulson and Bazemore, 2010) has found a positive and moderate in size correlation between maternal and paternal depression in the perinatal period, including pregnancy. Clearly, more research is needed to explore the role of partner psychopathology in the onset of antenatal depression and anxiety. In fact, 29 studies have found lack of support, especially partner support, to be associated with antenatal depression and anxiety, with no studies reporting an absence of significant association. In turn, perceived support and marital satisfaction have been found to be protective factors for maternal mental health during pregnancy (Lee et al., 2007; Zeng et al., 2015) and to mediate the impact of adverse events in life on maternal wellbeing (Glazier et al., 2004). This is not surprising, since social support can help the woman to cope with negative emotions and stressors associated with pregnancy and to prepare positively for the birth and the postpartum period (Jeong et al., 2013).

On the contrary, domestic violence and history of abuse have been shown to be some of the strongest independent predictors of antenatal depression and anxiety (Dibaba et al., 2013; Lancaster et al., 2010; Melville et al., 2010). In fact, 28 studies have found domestic violence and history of abuse as significant risk factors for depression and anxiety, and 8 studies have specifically investigated the role of childhood abuse and all found it to be highly associated. These results confirm and extend what has been reported in a recent systematic review on domestic violence and perinatal mental disorders (Howard et al., 2013); they found that women with probable depression during pregnancy had a 3-to-5-fold increased risk of having experienced domestic violence over the adult lifetime, during the past year and during pregnancy. The results suggest a two-way association between domestic violence and antenatal depression: domestic violence is associated with depression during pregnancy while, at the same time, depressive symptoms can increase the probability that the woman may experience violence (Howard et al., 2013).

Several mechanisms have been proposed to explain this higher vulnerability conferred by stressful experiences. In fact, being exposed to a traumatic event leads to clear psychobiological changes that alter the ability to adjust and cope with subsequent stressful events. In particular, childhood maltreatment is a predisposing factor in the persistent activation of the two main biological systems involved in the stress response, the hypothalamic–pituitary–adrenal (HPA) axis and the inflammatory system (Baumeister et al., 2014; Pariante and Lightman, 2008). The hyperactivity of these two systems is also present in depression, and it is therefore considered to be part of its pathogenesis. As both systems are over-stimulated during normal pregnancy, this may make mothers more susceptible to depression in the context of previous exposure to childhood maltreatment (Danese et al., 2007; Heim et al., 2008; Pariante et al., 2014; Pariante and Lightman, 2008; Robertson-Blackmore et al., 2013). Psychological mechanisms, including reactivation of a previous sexual trauma during pregnancy, experiences and feelings of shame, and low self-esteem, are also very important (Mezey et al., 2005; Plant et al., 2013).

Together with partner/social support and satisfaction in the marital relationship, other potential protective factors that have been identified in this review are active coping, high self-esteem and high self-efficacy (Edwards et al., 2008; Zeng et al., 2015). In fact, these self-schema constructs are considered part of the phenomenology of depression and could possible mediate the relationship between adverse events in life and depression (Ginsburg et al., 2008). Education may also possibly function as a protective factor, via enhancing feelings of self-worth and reducing feelings of shame, which in turn may contribute to reduce depressive and anxiety symptoms (Nasreen et al., 2011).

A previous review investigating risk factors for antenatal depression was conducted by Lancaster et al. (2010). They found that maternal anxiety, life stress, history of depression, lack of support, domestic violence, unintended pregnancy, low income, lower education, single status, and poor relationship with partner were associated with depressive symptoms during pregnancy in bivariate analyses. Life stress, lack of social support and domestic violence continued to be associated with antenatal depression also in multivariate analyses. Inconsistent results were found for smoking, alcohol and drug use, parity, ethnic group and age, while no significant association was found with employment and obstetric history (Lancaster et al., 2010). Our review addressed a considerable limitation of this previous work, as they considered only studies performed in high-income countries. In fact, we have included studies conducted in low-, middle- and high- income countries, and this increases our power to generalize the results to a wider population. Similarly to Lancaster at al., our review has found that life-time adversities, history of depression, lack of support, domestic violence, unintended pregnancy, low education, lower income and poor relationship with partner are associated with antenatal depression and anxiety. Similar to Lancaster et al., we also found no or inconsistent evidence for alcohol, substance abuse, age and employment. Contrary to Lancaster et al., we have found that obstetric history is a strong predictor of depression and anxiety during pregnancy.

The results of this review confirm previous evidence that mood disorders during pregnancy and early parenthood have a complex and multi-factorial aetiology (Bilszta et al., 2008) where multiple factors are involved in the onset of depression and anxiety during pregnancy. Indeed, Leigh and Milgrom have proposed an interesting psychosocial model to help understand the diversity of these factors: they suggested that predisposing factors, antenatal stressors, and personal resources, all interact and concur in the development and maintenance of antenatal depression, and subsequently of postnatal depression and parenting stress (Leigh and Milgrom, 2008). According to this model, predisposing factors, such as a personal history of depression, a childhood history of abuse, low income, young age, and low education, make the woman vulnerable to the onset of antenatal depression. Poor personal resources, such as low self-esteem, negative cognitive style and low social support, make it more difficult for the mother-to-be to adjust positively to the changes in the transition to motherhood.

Antenatal stressors, such as antenatal anxiety and stressful life events, can also work negatively to increase the risk of antenatal depression. Other factors involved in this complex process are biological (e.g., changes in the level of hormones) and socio-cultural (e.g., unrealistic beliefs and representation of motherhood as an exclusive time of joy) (Milgrom et al., 1999).

The process whereby personal susceptibility is activated by stressful events and other kinds of current factors is also well described by the 'Earthquake Model' of Sichel and Driscoll, developed with the aim of conceptualizing women's mental health and its treatment. Sichel and Driscoll (1999) suggest that the genetic makeup of each woman, her hormonal and reproductive history, and experiences during her lifespan, all combine to predict her risk of an "earthquake" at critical times in life such as childbirth (Sichel and Driscoll, 1999).

5. Limitations

A few limitations of this review should be mentioned. We did not conduct a meta-analysis of the findings, which may have added additional information about the differential impact of each risk factor. Nevertheless, most of the risk factors described in this review have been independently replicated by a number of studies. Moreover, this review does not specifically examine factors that may influence the severity of episodes of depression or anxiety, or the onset of different types of anxiety disorders. Furthermore, it has not been possible to assess the cumulative effects of different factors; however, this limitation is mainly due to the lack of studies addressing these questions. This systematic review has also excluded studies based on high-risk populations, such as women exposed to major environmental catastrophes, like earthquakes or tsunamis, studies conducted on women with pre-existing health conditions, such as HIV or obesity, or with health conditions associated with pregnancy, such as diabetes, and women with babies with congenital anomalies. Therefore, the generalizability of the findings to these populations may be limited, as studies in these high-risk populations may have possibly led to different risk factors. Moreover, studies that have examined potential risk factors related to physical health have been excluded, as the main aim of this review was to investigate the psycho-social, environmental and obstetric risk factors involved in the onset of antenatal depression and anxiety in the wider, physically healthy population of women. Finally, papers not written in English have been excluded, and therefore some interesting studies may have not been considered.

6. Conclusions

Pregnancy is a time of increased vulnerability for the development of anxiety and mood disorders. Some women may experience their first depressive episode during pregnancy, while others are at risk of recurrence due to a previous history of depression and anxiety (Raisanen et al., 2014). Many studies have investigated the main risk factors involved in the onset of antenatal depression and anxiety and have highlighted a complex multi-factorial aetiology (Lancaster et al., 2010; Leigh and Milgrom, 2008). Different sources of psychosocial, environmental, obstetric and pregnancy related risk factors have been highlighted in this review. Correctly identifying the women at risk of suffering from antenatal anxiety and depression would give us the opportunity to target those women who would benefit from preventive and supportive interventions. Also, identifying the women at risk would allow us to follow them up during the course of their pregnancy and recognize earlier symptoms of depression and anxiety as they develop, and therefore implement therapeutic interventions if needed. This is now even more relevant, since most recent studies have shown a reassuring safety profile for antidepressant treatment in pregnancy (reviewed in Pariante, 2015) and have identified effective non-pharmacological treatments (Bowen et al., 2014; Su et al., 2008; Thomas et al., 2014), although more research is still need to be done regarding the effectiveness of non-pharmacological interventions during pregnancy.

Funding sources

The National Society for the Prevention of Cruelty to Children (NSPCC) funded this review.

Professor Pariante is also funded by the UK National Institute for Health Research (NIHR) Biomedical Research Centre for Mental Health at the South London and Maudsley NHS Trust and King's College London.

Professor Pariante's research is supported by grants MR/J002739/1 and MR/L014815/1 from the Medical Research Council (UK).

Contributions

The corresponding author managed the literature searches and wrote the first draft of the manuscript. The other authors reviewed the first draft and finalized the paper.

All authors contributed to and have approved the final manuscript.

Acknowledgements

The authors would like to thank the National Society for the Prevention of Cruelty to Children (NSPCC) who funded this review. The review has been commissioned in order to guide the implementation of preventive interventions to promote parental mental health during the perinatal period. The authors would also like to thank the South London and Maudsley NHS Trust, King's College London and the Medical Research Council United Kingdom, who funded Professor Carmine Pariante.

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