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Review article

# Prevalence of antenatal and postnatal anxiety: systematic review and meta-analysis

Cindy-Lee Dennis, Kobra Falah-Hassani and Rahman Shiri

**Background**
Maternal anxiety negatively influences child outcomes. Reliable estimates have not been established because of varying published prevalence rates.

**Aims**
To establish summary estimates for the prevalence of maternal anxiety in the antenatal and postnatal periods.

**Method**
We searched multiple databases including MEDLINE, Embase, and PsycINFO to identify studies published up to January 2016 with data on the prevalence of antenatal or postnatal anxiety. Data were extracted from published reports and any missing information was requested from investigators. Estimates were pooled using random-effects meta-analyses.

**Results**
We reviewed 23 468 abstracts, retrieved 783 articles and included 102 studies incorporating 221 974 women from 34 countries. The prevalence for self-reported anxiety symptoms was 18.2% (95% CI 13.6–22.8) in the first trimester, 19.1% (95% CI 15.9–22.4) in the second trimester and 24.6% (95% CI 21.2–28.0) in the third trimester. The overall prevalence for a clinical diagnosis of any anxiety disorder was 15.2% (95% CI 9.0–21.4) and 4.1% (95% CI 1.9–6.2) for a generalised anxiety disorder. Postnatally, the prevalence for anxiety symptoms overall at 1–24 weeks was 15.0% (95% CI 13.7–16.4). The prevalence for any anxiety disorder over the same period was 9.9% (95% CI 6.1–13.8), and 5.7% (95% CI 2.3–9.2) for a generalised anxiety disorder. Rates were higher in low- to middle-income countries.

**Conclusions**
Results suggest perinatal anxiety is highly prevalent and merits clinical attention. Research is warranted to develop evidence-based interventions.

**Declaration of interest**
None.



Perinatal mental health is a leading public health issue because of its negative effect on both maternal and child outcomes and its significant economic cost to society if left untreated.[1,2] A common mental health problem women experience during the perinatal (pregnancy and postpartum) period is anxiety[3] and despite it being a frequent comorbidity with depression,[4] it has received limited attention from researchers and health professionals. This is an important clinical omission given the ever-growing evidence indicating maternal anxiety both antenatally and postnatally may lead to serious negative outcomes. Maternal antenatal anxiety has been associated with increased childbirth fear,[5] a preference for Caesarean section delivery,[6] decreased effective coping strategies,[7] higher rates of eating disorders[8] and an increased risk for suicide.[9] It also has important neonatal implications as it has been linked to increased preterm birth rates,[10,11] lower Apgar scores[12] and decreased birth length.[13] Further, antenatal anxiety is a risk factor for poor child developmental trajectories.[14] In a study conducted in the Netherlands, antenatal anxiety early in pregnancy significantly increased the risk for cognitive disorders in children at 14 and 15 years of age.[15] In the same population, hierarchical multiple regression analyses showed that maternal anxiety at 12–22 weeks' gestation explained 22%, 15% and 9% of the variance in cross-situational attention-deficit hyperactivity disorder symptoms, externalising problems and self-reported anxiety, respectively, among Dutch children aged 8 and 9 years.[16] The link between antenatal anxiety and behavioural/emotional problems in children at 4 years of age after adjusting for covariates has also been reported in a UK study.[17] More recently, maternal antenatal anxiety was associated with an increased risk of child attention problems after accounting for confounders.[18] Similar adverse effects have been found for maternal postnatal anxiety, which has been associated with negative and disengaged parenting[19–21] and overcontrolling maternal behaviours that increase the likelihood of internalising and externalising difficulties in the child.[20,22,23] The emergent evidence highlights the need for early identification of maternal anxiety across the perinatal period and the provision of effective treatment. However, reliable estimates of maternal anxiety to guide clinical interventions are unknown because of widely varying published prevalence rates. The aim of this systematic review was to establish summary estimates for the prevalence of maternal anxiety in the antenatal and postnatal periods.

## Method

### Search strategy and study eligibility

The protocol and reporting of the results of this systematic review and meta-analysis were based on PRISMA guidelines.[24] Comprehensive literature searches were conducted in MEDLINE, Embase, PsycINFO, Cumulative Index to Nursing and Allied Health Literature, Web of Science, Scopus, ResearchGate and Google Scholar from 1950 until 13 January 2016 using predefined key terms (online Table DS1) such as (postpartum OR puerperium OR pregnancy OR gestation OR postbirth OR post-birth OR antenatal OR prenatal OR postnatal) AND (mood disorders OR depressive disorder OR depression OR depressive symptoms OR anxiety disorders OR anxiety). We used MeSH terms and key words in MEDLINE and Emtree terms and key words in Embase. The titles and abstracts of all identified citations were screened for relevance and the full text of potentially relevant articles were obtained and assessed for eligibility. In addition, the reference lists of relevant articles were hand searched.

Studies were eligible for inclusion if they: (a) included women who were 16 years or older; (b) assessed for antenatal or postnatal anxiety using a validated diagnostic or self-report instrument;



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(c) reported the results of peer-reviewed research based on cross-sectional or cohort studies; and (d) provided data in order to estimate the prevalence of anxiety. Studies were excluded if they: (a) were conducted among self-selected volunteers; (b) recruited high-risk women; (c) reported results for only a subsample of a study population; (d) reported duplicate data from a single database; (e) reported only mean data; (e) reported combined prevalence for depression and anxiety; or (f) did not report a cut-off point for anxiety. We contacted over 70 authors for additional information, particularly those who reported only mean data, no cut-off data or had missing information, with approximately a third providing us with additional results. For studies with duplicate data from a single database, we selected the study with the larger sample size.

### Data extraction and quality assessment

We extracted individual details of the included studies such as year of publication, study population, recruitment method, sample size used in the analysis, measure of anxiety, cut-off points, timing of assessments and prevalence of anxiety variously defined. The risk of bias in the included studies was independently rated by two reviewers (K.F.-H. and R.S.) using criteria adapted from the Effective Public Health Practice Project Quality Assessment Tool for observational studies.[25] Three domains were assessed: selection bias, detection bias and attrition bias. Selection bias was classified as: (a) low: likely to be representative of the target population or subgroup of the target population (i.e. specific age group or geographic area) and response rate was 80% or higher; (b) moderate: likely to be somewhat representative of the target population or a restricted subgroup of the target population and response rate was 60–79%; or (c) high: target population was self-referred/volunteers, or response rate was less than 60%. Detection bias was classified as follows: (a) low: the outcome was defined by clinical diagnosis; (b) moderate: the outcome was assessed by a validated questionnaire; or (c) high: the outcome was self-reported. Finally, attrition bias was classified as follows: (a) low: follow-up participation rate was more than 80% or missing data was less than 20%; (b) moderate: follow-up participation rate was 60–79% or missing data was 20–40%; or (c) high: follow-up participation rate was less than 60% or missing data was more than 40%. Any disagreements in quality ratings were resolved by discussion (K.F.-H., R.S.), and if necessary with the involvement of another author (C.-L.D.).

### Data synthesis and analysis

Many studies reported an estimate for the prevalence of antenatal or postnatal anxiety for more than one time point for the same participants. In order to include each study with multiple time-points only once in a specific meta-analysis, an overall prevalence of antenatal or postnatal anxiety was estimated using an average sample size and an average number of events (for example estimate for the 1–24 weeks' postnatal anxiety symptoms). The prospective cohort studies included in the current meta-analysis determined the prevalence of anxiety rather than the incidence of anxiety. We therefore combined both cross-sectional and cohort studies in a single analysis. Anxiety was assessed using diverse measures, cut-off scores and perinatal time periods. We performed meta-analyses based on the following anxiety categories: (a) self-reported state anxiety symptoms, (b) self-reported trait anxiety, (c) clinical diagnosis of any anxiety disorder, and (d) clinical diagnosis of generalised anxiety disorder. We further performed analyses according to pregnancy trimester and postpartum time period. We used a random-effects meta-analysis to combine the estimates of different studies.[26] The presence of heterogeneity across the studies was assessed using the $I^2$-statistic.[27] An $I^2$-statistic less than 25% indicates small inconsistency and more than 50% indicates large inconsistency.[27] We used meta-regression to assess the differences between subgroups.[26] We performed subgroup analyses according to year of publication ($\geqslant$2009 *v.* $\leqslant$2010), income of study country based on World Bank categories (low to middle income *v.* high income), selection bias and attrition bias. Stata (version 13) was used for the meta-analyses.

## Results

### Study characteristics

The study selection process is presented in Fig. 1. The literature search yielded 23 468 unique references, of which 22 685 were excluded following title and abstract screening. Overall, 783 full papers were retrieved and assessed. Of these, 183 papers were relevant following full-text screening: 174 were identified from searches of electronic databases and 9 from hand searches of references. From these 183 studies, a further 81 were excluded primarily for only having mean anxiety scores ($n = 35$) and volunteer samples ($n = 18$). In total, 102 studies on antenatal or postnatal anxiety were included in the meta-analyses with assistance from 26 authors who were contacted and provided additional information to allow their studies to be incorporated (see Acknowledgements).

Characteristics of the included studies are provided in online Table DS2. In total, 70 studies provided data on the prevalence of antenatal anxiety and 57 studies provided data related to postnatal anxiety. The studies were conducted in 34 different countries spanning six continents and included 221 974 women.

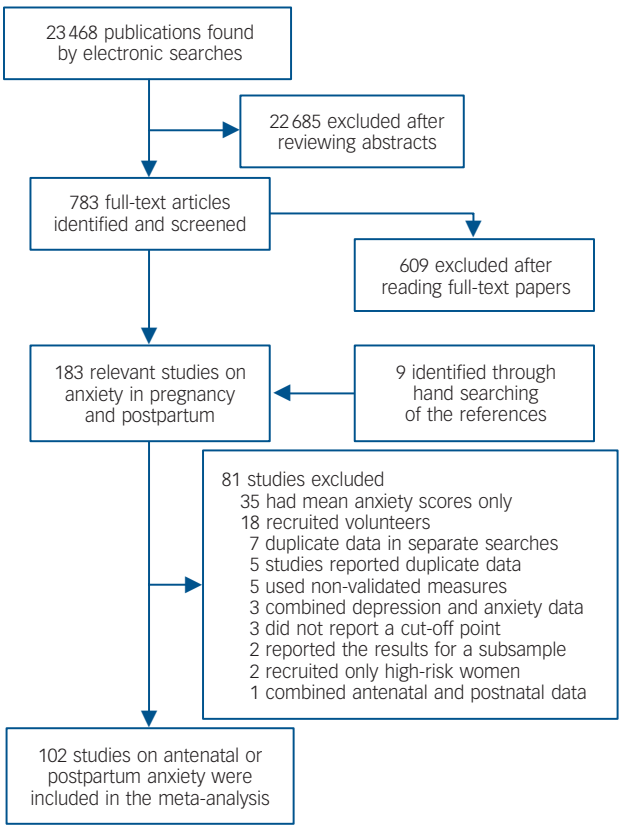


**Fig. 1** Flow diagram for identifying studies on the prevalence of antenatal and postnatal anxiety.



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The countries with the largest number of included studies comprised the USA ($n=19$), Australia ($n=11$), Brazil ($n=9$), Canada ($n=8$), France ($n=4$), Netherlands ($n=4$), Norway ($n=4$), UK ($n=4$), Germany ($n=3$) and Sweden ($n=3$). Ten countries from the Asian continent provided data (Bangladesh, China, Hong Kong, Israel, Japan, Jordan, Malaysia, Saudi Arabia, Singapore and Vietnam) as did four countries from Africa (Ghana, Nigeria, South Africa and Tanzania). In total, there were 24 countries classified as low to middle income using World Bank categories. The majority of studies used the self-report State-Trait Anxiety Inventory (STAI) to measure state anxiety symptoms ($n=51$) or trait anxiety ($n=24$). The most common diagnostic interviews to assess for any anxiety disorders or generalised anxiety disorder were the Mini-International Neuropsychiatric Interview ($n=6$), Composite International Diagnostic Interview ($n=5$) and Structural Clinical Interview for DSM ($n=5$). When evaluated by the modified Effective Public Health Practice Project Quality Assessment Tool, eight studies were rated as having low risk of selection bias, 69 as having moderate risk and 25 studies as having high risk (Table 2). In total, 17 studies were rated as having low risk of detection bias, 85 as having moderate risk, and none as having high risk. For attrition bias, 77 studies were rated as low risk, 17 as moderate risk and 8 as high risk.

## Prevalence of antenatal anxiety

Meta-analytic pooling of the estimates yielded the prevalence of self-reported anxiety symptoms to be 18.2% (95% CI 13.6–22.8, 10 studies, $n=10\,577$)[6,12,28–35] for the first trimester, 19.1% (95% CI 15.9–22.4, 17 studies, $n=24\,499$)[10,12,29,31,32,34–45] for the second trimester and 24.6% (95% CI 21.2–28.0, 33 studies, $n=116\,720$)[3,5,7,12,13,29–32,34,35,37,40,43,44,46–63] for the third trimester (Table 1 and Fig. 2). The overall pooled prevalence for self-reported anxiety symptoms across the three trimesters was 22.9% (95% CI 20.5–25.2, 52 studies, $n=142\,833$). The prevalence for self-reported trait anxiety was 29.1% (95% CI 11.7–46.4, 4 studies, $n=2388$) for the first trimester, and 32.5% (95% CI 27.6–37.4, 12 studies, $n=5568$) for the third trimester. The prevalence for a clinical diagnosis of any anxiety disorder was 18.0% (95% CI 15.0–21.1, 2 studies, $n=615$) for the first trimester, 15.2% (95% CI 3.6–26.7, 4 studies, $n=3002$) for the second trimester and 15.4% (95% CI 5.1–25.6, 4 studies, $n=1603$) for the third trimester. The prevalence of a clinical diagnosis of a generalised anxiety disorder was 5.3% (95% CI 1.5–9.1, 3 studies, $n=3338$) for the first trimester, 0.3% (95 CI % 0.1–0.6, 2 studies, $n=1862$) and 4.1% (95% CI 1.0–7.2, 4 studies, $n=1455$) for the second and third trimester, respectively. Overall, the prevalence of any anxiety disorder across the three trimesters was 15.2% (95% CI 9.0–21.4, 9 studies, $n=4648$, Table 1 and online Fig. DS1) and that of a generalised anxiety disorder was 4.1% (95% CI 1.9–6.2, 10 studies, $n=6910$, Table 1 and online Fig. DS2).

## Prevalence of postnatal anxiety

The prevalence of self-reported anxiety symptoms was 17.8% (95% CI 14.2–21.4, 14 studies, $n=10\,928$) at 1–4 weeks postpartum, 14.9% (95% CI 12.3–17.5, 22 studies, $n=19\,158$) at 5–12 weeks postpartum, 15.0% (95% CI 13.7–16.4, 39 studies, $n=145\,293$) at 1–24 weeks postpartum, and 14.8% (95% CI 10.9–18.8, 7 studies, $n=11\,528$) at >24 weeks postpartum (Table 2 and online Fig. DS3). The prevalence of having a clinical diagnosis of any anxiety disorder was 9.6% (95% CI 3.4–15.9, 5 studies, $n=2712$) at 5–12 weeks postpartum, 9.9% (95% CI 6.1–13.8, 9 studies, $n=28\,495$) at 1–24 weeks postpartum and 9.3% (95% CI 5.5–13.1, 5 studies, $n=28\,244$) at >24 weeks postpartum (Table

**Table 1** Prevalence of antenatal anxiety

| Time period, measure and outcome | All studies | | | | Studies without high risk of selection/attrition bias | | | |
|---|---|---|---|---|---|---|---|---|
| | Studies, *n* | Sample | Prevalence, % (95% CI) | $I^2$, % | Studies, *n* | Sample | Prevalence, % (95% CI) | $I^2$, % |
| *First trimester* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 4 | 2388 | 29.1 (11.7–46.4) | 99.0 | 2 | 1532 | 38.4 (36.1–40.7) | 99.6 |
| Anxiety symptoms | 10 | 10577 | 18.2 (13.6–22.8) | 97.3 | 9 | 8974 | 19.1 (13.3–24.8) | 97.6 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 2 | 615 | 18.0 (15.0–21.1) | 99.7 | 2 | 615 | 18.0 (15.0–21.1) | 99.7 |
| Generalised anxiety disorder | 3 | 3338 | 5.3 (1.5–9.1) | 94.7 | 3 | 3338 | 5.3 (1.5–9.1) | 94.7 |
| *Second trimester* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 1 | – | – | – | 1 | – | – | – |
| Anxiety symptoms | 17 | 24499 | 19.1 (15.9–22.4) | 97.9 | 13 | 18430 | 19.4 (15.7–23.2) | 97.3 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 4 | 3002 | 15.2 (3.6–26.7) | 98.7 | 4 | 3002 | 15.2 (3.6–26.7) | 98.7 |
| Generalised anxiety disorder | 2 | 1862 | 0.3 (0.1–0.6) | 97.3 | 2 | 1862 | 0.3 (0.1–0.6) | 97.3 |
| *Third trimester* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 12 | 5568 | 32.5 (27.6–37.4) | 92.5 | 8 | 4168 | 31.4 (25.9–36.9) | 92.4 |
| Anxiety symptoms | 33 | 116720 | 24.6 (21.2–28.0) | 98.9 | 22 | 16120 | 23.4 (19.9–26.9) | 95.9 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 4 | 1603 | 15.4 (5.1–25.6) | 97.6 | 2 | 615 | 14.2 (11.5–16.9) | 99.6 |
| Generalised anxiety disorder | 4 | 1455 | 4.1 (1.0–7.2) | 92.5 | 3 | 958 | 2.3 (0.2–4.4) | 80.1 |
| *First, second or third trimester* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 18 | 8086 | 31.5 (26.3–36.7) | 96.3 | 11 | 5372 | 34.3 (28.5–40.1) | 94.9 |
| Anxiety symptoms | 52 | 142833 | 22.9 (20.5–25.2) | 99.0 | 35 | 35656 | 22.4 (19.6–25.1) | 97.8 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 9 | 4648 | 15.2 (9.0–21.4) | 97.7 | 6 | 3560 | 14.8 (6.4–23.3) | 98.0 |
| Generalised anxiety disorder | 10 | 6910 | 4.1 (1.9–6.2) | 97.3 | 9 | 6413 | 3.6 (1.4–5.7) | 97.3 |



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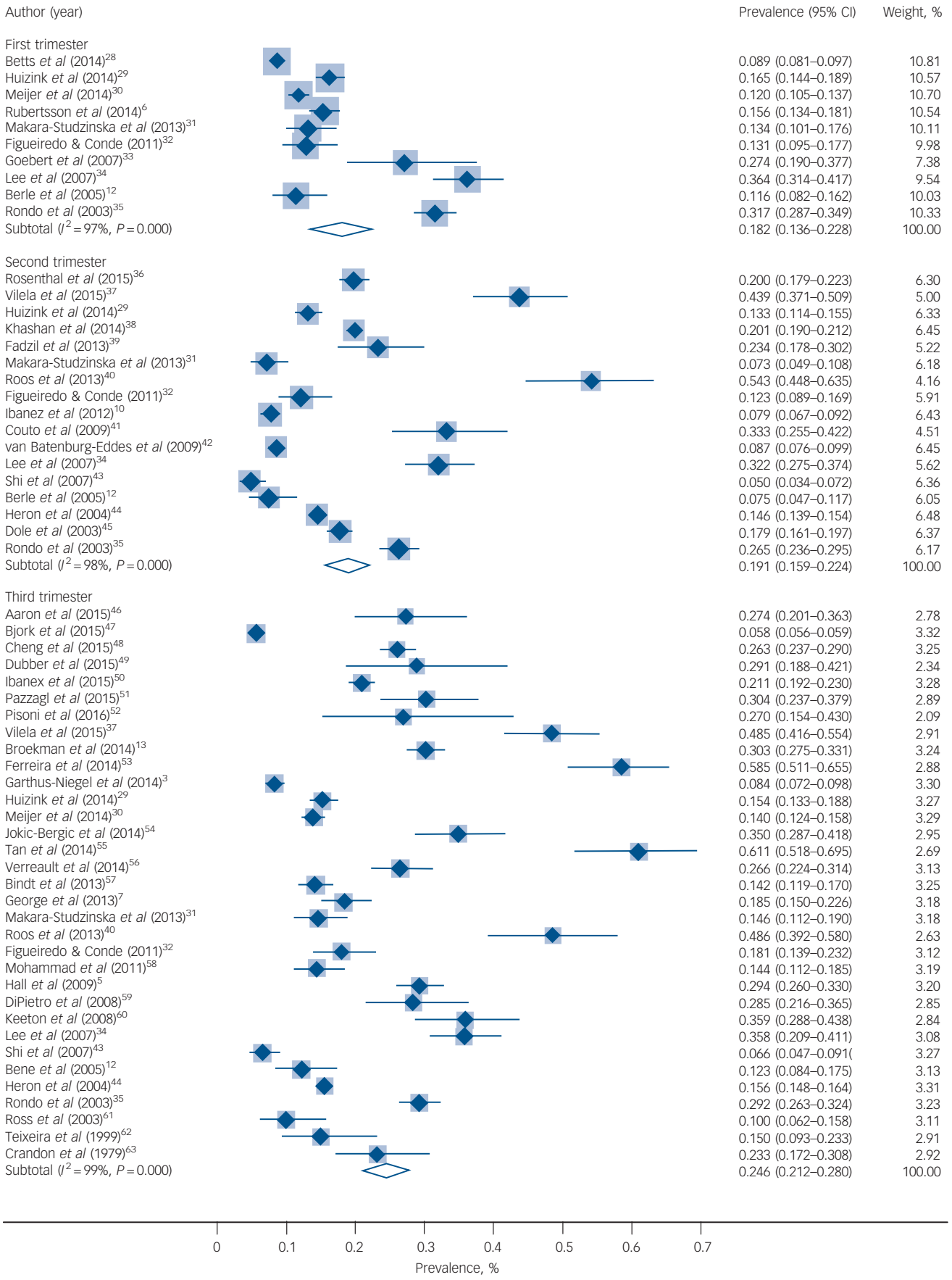


**Fig. 2** Prevalence of antenatal anxiety symptoms.



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2 and online Fig. DS1).The prevalence of a generalised anxiety disorder was 6.7% (95% CI 0.6–12.7, 4 studies, $n = 1979$) at 5–12 weeks postpartum, 5.7% (95% CI 2.3–9.2, 6 studies, $n = 2667$) at 1–24 weeks postpartum, and 4.2% (95% CI 1.5–6.9, 4 studies, $n = 1950$) at >24 weeks postpartum (Table 2 and online Fig. DS2).

### Sensitivity and subgroup analyses

Excluding studies with high risk of selection or attrition bias did not change markedly the estimates for the prevalence of antenatal and postnatal anxiety symptoms, any anxiety disorder or a generalised anxiety disorder (Tables 1 and 2). The prevalence of antenatal and postnatal anxiety symptoms as well as that of antenatal and postnatal anxiety disorder did not differ with regard to year of publication (>2010 *v.* <2009), selection bias and attrition bias (Table 3). However, the prevalence of antenatal anxiety symptoms across all trimesters was significantly higher in low- to middle-income countries (34.4%, 95% CI 25.0–43.8, 13 studies, $n = 5089$) in comparison with high-income countries (19.4% 95% CI 17.0–21.8, 39 studies, $n = 137\,744$). The prevalence of postnatal anxiety symptoms across the first 6 months postpartum was also significantly higher in low- to middle-income countries (25.9%, 95% CI 13.7–38.1, 5 studies, $n = 2159$) in comparison with high-income countries (13.7%, 95% CI 12.3–15.0, 34 studies, $n = 143\,134$) (Table 3). Studies with moderate or high risk of selection bias may have overestimated the prevalence of antenatal and postnatal anxiety symptoms.

## Discussion

### Main findings

This is the first systematic review and meta-analysis to estimate the prevalence of antenatal and postnatal anxiety. Included were 102 studies involving 221 974 women from 34 countries with 26 study authors providing additional information to promote the comprehensiveness and generalisability of the meta-analytic results. Overall, the prevalence rate for self-report anxiety symptoms in the first trimester was 18.2% increasing as the pregnancy progressed to 24.6% in the third trimester. The prevalence of anxiety symptoms across the three trimesters was 22.9%. Postnatally, 17.8% of women experienced significant anxiety symptoms in the first 4 weeks following childbirth but rates stabilised to approximately 15% thereafter. When diagnostic interviews were employed, the prevalence rate for any anxiety disorder during the first trimester was 18% decreasing marginally to approximately 15% in the final two trimesters of pregnancy. The prevalence of any anxiety disorder continued to decrease postnatally and ranged from 9.3 to 9.9% across the first year. As expected, rates for a generalised anxiety disorder were lower at 4% across the pregnancy and increased slightly to 4.2–5.7% postnatally. Overall, our findings demonstrate anxiety is a common mental health problem among pregnant and postpartum women internationally and that rates are significantly higher in this maternal population than in the general adult population.[64,65]

In interpreting the results, it is important to note that the majority of studies assessed anxiety using self-report instruments that measured anxiety symptoms rather than gold-standard diagnostic clinical interviews for various anxiety disorders. Although the sensitivity and specificity of these self-report instruments vary substantially, the most frequently used measure in this review was the STAI, a finding consistent with previous research.[66] Self-report measures do have limitations, such as potentially inflated prevalence estimates, but they also have high clinical utility in obstetric/midwifery, public health and primary care practices, where the majority of perinatal mental health

**Table 2** Prevalence of postnatal anxiety

| Time period, measure and outcome | All studies | | | | Studies without high risk of selection/attrition bias | | | |
|---|---|---|---|---|---|---|---|---|
| | Studies, *n* | Sample | Prevalence, % (95% CI) | $I^2$, % | Studies, *n* | Sample | Prevalence, % (95% CI) | $I^2$, % |
| *1–4 weeks postpartum* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 6 | 2724 | 23.1 (14.5–31.7) | 97.1 | 6 | 2724 | 23.1 (14.5–31.7) | 97.1 |
| Anxiety symptoms | 14 | 10928 | 17.8 (14.2–21.4) | 96.1 | 12 | 10065 | 17.8 (13.9–21.6) | 96.2 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 0 | – | – | – | – | – | – | – |
| Generalised anxiety disorder | 0 | – | – | – | – | – | – | – |
| *5–12 weeks postpartum* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 5 | 1260 | 23.4 (13.8–33.0) | 92.8 | 4 | 1140 | 23.1 (11.4–34.8) | 94.6 |
| Anxiety symptoms | 22 | 19158 | 14.9 (12.3–17.5) | 97.1 | 16 | 14024 | 15.2 (11.5–18.9) | 97.5 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 5 | 2712 | 9.6 (3.4–15.9) | 97.6 | 4 | 2413 | 11.3 (2.6–19.9) | 98.1 |
| Generalised anxiety disorder | 4 | 1979 | 6.7 (0.6–12.7) | 97.8 | 4 | 1979 | 6.7 (0.6–12.7) | 97.8 |
| *1–24 weeks postpartum* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 10 | 3533 | 23.2 (16.0–30.4) | 96.6 | 8 | 3313 | 22.8 (14.6–31.0) | 97.3 |
| Anxiety symptoms | 39 | 145293 | 15.0 (13.7–16.4) | 98.5 | 26 | 45104 | 17.2 (14.3–20.0) | 98.8 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 9 | 28495 | 9.9 (6.1–13.8) | 97.8 | 7 | 28096 | 9.9 (5.4–14.4) | 98.2 |
| Generalised anxiety disorder | 6 | 2667 | 5.7 (2.3–9.2) | 94.5 | 6 | 2667 | 5.7 (2.3–9.2) | 94.5 |
| *>24 weeks postpartum* | | | | | | | | |
| Self-report | | | | | | | | |
| Trait anxiety | 1 | | | | | | | |
| Anxiety symptoms | 7 | 11528 | 14.8 (10.9–18.8) | 95.9 | 5 | 9714 | 11.5 (8.2–14.8) | 89.2 |
| Clinical diagnosis | | | | | | | | |
| Any anxiety disorder | 5 | 28244 | 9.3 (5.5–13.1) | 98.0 | 5 | 28244 | 9.3 (5.5–13.1) | 98.0 |
| Generalised anxiety disorder | 4 | 1950 | 4.2 (1.5–6.9) | 89.3 | 4 | 1950 | 4.2 (1.5–6.9) | 89.3 |



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**Table 3** Prevalence of anxiety symptoms and any anxiety disorder according to year of publication, country income and methodological quality

| | Anxiety symptoms | | | | Any anxiety disorder | | | |
|---|---|---|---|---|---|---|---|---|
| | Studies, *n* | Sample | Prevalence, % (95% CI) | *P* | Studies, *n* | Sample | Prevalence, % (95% CI) | *P* |
| *Antenatal (first, second or third trimesters)* | | | | | | | | |
| Publication year | | | | 0.99 | | | | 0.15 |
| ⩽2009 | 20 | 19 193 | 23.2 (18.9–27.5) | | 5 | 3 437 | 19.5 (8.3–30.8) | |
| ⩾2010 | 32 | 123 640 | 22.6 (19.8–25.4) | | 4 | 1 211 | 10.0 (3.7–16.2) | |
| Country income | | | | 0.001 | | | | 0.53 |
| Low to middle | 13 | 5 089 | 34.4 (25.0–43.8) | | 3 | 1 245 | 18.2 (1.7–34.8) | |
| High | 39 | 137 744 | 19.4 (17.0–21.8) | | 6 | 3 403 | 13.4 (8.2–18.7) | |
| Selection bias | | | | 0.11 | | | | 0.55 |
| Low | 4 | 13 034 | 15.3 (11.2–19.3) | | 2 | 1 284 | 22.8 (20.6–25.1) | |
| Moderate | 34 | 28 376 | 22.1 (19.0–25.1) | | 4 | 2 276 | 10.5 (5.5–15.6) | |
| High | 14 | 101 423 | 27.5 (21.9–33.1) | | 3 | 1 088 | 16.2 (1.1–31.4) | |
| Attrition bias | | | | 0.23 | | | | – |
| Low | 41 | 122 748 | 24.4 (21.1–27.7) | | 8 | 4 548 | 14.6 (8.1–21.2) | |
| Moderate or high | 11 | 20 085 | 16.3 (13.3–19.2) | | 1 | – | – | |
| *Postnatal (0–24 weeks)* | | | | | | | | |
| Publication year | | | | 0.92 | | | | 0.78 |
| ⩽2009 | 16 | 15 832 | 15.6 (12.8–18.3) | | 4 | 26 657 | 8.1 (3.9–12.3) | |
| ⩾2010 | 23 | 129 461 | 14.9 (13.3–16.6) | | 5 | 1 838 | 10.8 (4.3–17.3) | |
| Country income | | | | 0.04 | | | | – |
| Low to middle | 5 | 2 159 | 25.9 (13.7–38.1) | | 1 | 871 | – | |
| High | 34 | 143 134 | 13.7 (12.3–15.0) | | 8 | 27 624 | 8.4 (5.3–11.5) | |
| Selection bias | | | | 0.60 | | | | 0.57 |
| Low | 3 | 12 930 | 9.2 (4.7–13.8) | | 1 | 871 | – | |
| Moderate | 25 | 36 325 | 17.3 (14.2–20.5) | | 6 | 27 225 | 8.2 (4.6–11.8) | |
| High | 11 | 96 038 | 15.1 (12.0–18.2) | | 2 | 399 | 4.4 (2.4–6.4) | |
| Attrition bias | | | | 0.41 | | | | 0.91 |
| Low | 20 | 101 650 | 16.4 (13.5–19.3) | | 7 | 28 096 | 9.9 (5.4–14.4) | |
| Moderate | 15 | 37 971 | 17.3 (13.9–20.6) | | 2 | 399 | 4.4 (2.4–6.4) | |
| High | 4 | 5 672 | 8.7 (5.8–11.6) | | 0 | – | – | |

problems are managed. Health professionals in these settings often have limited clinical expertise and time for diagnostic interviews and with research clearly suggesting informal surveillance misses at least 50% of cases,[67] self-report measures are crucial for systematic case identification. To reflect the heterogeneity of the measures included in this meta-analysis, a range of prevalence estimates was reported in addition to a single estimate.

## Prevalence rates in different countries

The varying prevalence rates between the included studies may further be attributed to diverse settings, recruitment strategies, inclusion and exclusion criteria, data-collection methods and follow-up time periods. Language or translation complexities and variations in conveying psychiatric symptoms are other potential methodological issues.[68] However, there might also be real differences in prevalence rates because of cultural influences. This may partially explain the significantly higher self-reported anxiety rates found both antenatally and postnatally between low- to middle-income countries and high-income countries in this review. Whereas genetic and neurobiological determinants are probably evenly distributed among all women and are relevant aetiological factors,[68] the distribution of anxiety may be different across cultures, supporting environmental influences in the aetiology of perinatal anxiety. Our results are consistent with another systematic review that found rates of 'common perinatal mental disorders' among World Bank categorised low- and middle-income countries were significantly greater than those reported in high-income countries.[69] Together, these findings challenge the idea that women's mental health is protected by culturally prescribed traditional postpartum rituals. There is also growing evidence that many risk factors for perinatal mental health in low- and middle-income countries may be influenced by conditions that transcend the woman's control. These risk factors include gender-based issues such as bias against female infants, restricted housework and infant care roles, and excessive unpaid workloads especially in multigenerational households.[69] Perinatal mental health in low- and middle-income countries has only recently started to receive attention partially because of previous priorities targeting maternal mortality. As such, in this review there were considerably more studies conducted in high-income countries than in low- to middle-income countries. High-quality research addressing perinatal mental health in low- and middle-income countries is warranted to guide clinical interventions and policies.

## Prevalence rates over time

Although the media often portrays an increase in anxiety prevalence rates, there is no reliable evidence to support the notion that mental disorders in general are rising.[70,71] This is consistent with our results where we found no difference in prevalence rates for anxiety symptoms or disorders between studies published before 2010 and those published afterwards. However, rates of mental health treatment seeking have increased and may be the reason for the general perception that anxiety is more prevalent.[68] Despite improvements in treatment, anxiety remains undetected and untreated in the general population[72] and in perinatal women. To date, perinatal mental health research and clinical practice has disproportionately targeted depression



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with limited attention on anxiety. This is an important omission given a recent review indicating clinically relevant associations between antenatal anxiety and adverse child outcomes, with a 10 to 15% attributable risk of child behavioural problems related to antenatal anxiety and stress.[14]

## Comorbid maternal depression and anxiety

The importance of comorbid maternal depression and anxiety has been highlighted in several studies. An Australian study found that a third of pregnant and postnatal women with major depression had comorbid anxiety.[73] In a US population-based study incorporating 4451 postpartum women, a third of women with anxiety symptoms also reported depressive symptoms.[74] Assessing comorbidity is important because research with non-postnatal populations has shown that comorbid depression and anxiety manifests into more severe symptoms with poorer acute and long-term outcomes,[75] is more difficult to treat than each disorder alone,[76] increases the risk for suicide[77] and requires specific treatment strategies for both sets of symptoms.[75] The US Task Force for Prevention Screening now endorses screening for perinatal depression,[78] however, not identifying anxiety symptoms as well underestimates the prevalence of mental health disorders and the need for perinatal mental health services. Matthey *et al*[79] suggests there is a 'hierarchical diagnostic custom' where depression takes precedence in clinical practice even when anxiety symptoms are a prominent feature. This focus on depression can result in individuals with anxiety (but without depression) being undetected and untreated.

## Trait anxiety

Finally, trait anxiety, a condition clinically different from state anxiety symptoms, refers to the tendency to report negative emotions such as fears and worries across situations and is characterised by a stable perception of environmental stimuli as threatening. In this review, trait anxiety was high with prevalence rates ranging from 29 to 33% antenatally and decreasing to 23% postnatally. Although rarely examined, antenatal trait anxiety has been associated with increased risk for preterm birth among African American women.[80] If trait anxiety is an enduring maternal characteristic then its impact on the child is also likely to continue postnatally. This notion is supported in several studies. In a prospective US study with pregnant women, increasing trait anxiety was associated with poorer overall infant cognition.[81] In an Australian study, trait anxiety was a predictor of maternal report of difficult infant temperament at 4–6 months postpartum.[82] Further, a German study found trait anxiety was significantly correlated with impaired maternal bonding.[49] These results suggest that maternal trait anxiety may be as important as state anxiety symptoms or disorders and warrants further investigation. Antenatal psychological treatment interventions such as cognitive behavioural therapy may optimise child outcomes.[82] Further, treating maternal trait anxiety may be an important step to determine whether reducing trait anxiety has a direct effect on preterm birth risk.[80]

## Implications

The prevalence of maternal anxiety in the antenatal and postnatal periods were estimated among 221 974 women from 34 countries. Results suggest anxiety across the perinatal period is highly prevalent and merits clinical attention similar to that given to perinatal depression. Prevalence rates were significantly higher in low- to middle-income countries possibly indicating cultural influences. The Developmental Origins of Health and Disease paradigm (DOHaD)[83] suggests that human health and development have their origin in early life from conception to early childhood. During this period, the interplay between maternal and environmental factors programme fetal and child development through physiological changes that have long-lasting consequences on later health. Research to develop evidence-based interventions to reduce fetal and child exposure to risk factors such as perinatal anxiety is warranted in order to promote healthy child development.

**Cindy-Lee Dennis**, PhD, Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, and Li Ka Shing Knowledge Institute, St Michael's Hospital, Toronto, Canada; **Kobra Falah-Hassani**, PhD, Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, Canada; **Rahman Shiri**, MD, PhD, Finnish Institute of Occupational Health, Helsinki, Finland

**Correspondence**: Cindy-Lee Dennis, University of Toronto, 155 College Street, Suite 130, Toronto, ON M5T 1P8, Canada. Email: cindylee.dennis@utoronto.ca

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