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SYSTEMATIC REVIEW

Global prevalence of perinatal depression and anxiety during the COVID-19 pandemic: An umbrella review and meta-analytic synthesis

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Abstract

Introduction: The prevalence of depression and anxiety symptoms in pregnant and postpartum women during the COVID-19 pandemic was assessed by several systematic reviews (SRs) and meta-analyses which provided contrasting and different results. We aimed to summarize the evidence relating to the global prevalence of anxiety and depression among pregnant and postpartum women during the COVID-19 pandemic.

Material and methods: An umbrella review of SRs and meta-analyses was performed. Searches were conducted in electronic databases up to April 2023. SRs and meta-analyses reporting the prevalence of perinatal anxiety and depression during the COVID-19 pandemic were selected for eligibility. Primary studies extracted from eligible meta-analyses were included in the quantitative synthesis. The research protocol was registered on PROSPERO (CRD42020173125).

Results: A total of 25 SRs (198 primary studies) and 12 meta-analyses (129 primary studies) were included in the qualitative and quantitative synthesis, respectively. Studies involved data from five continents and 45 countries. The pooled prevalence of antenatal and postpartum depression was 29% ($n = 55$; 95% CI: 25%–33%) and 26% ($n = 54$; 95% CI: 23%–30%), respectively. In the case of anxiety, the pooled antenatal and postnatal prevalence was 31% ($n = 44$; 95% CI: 26%–37%; $n = 16$; 95% CI: 24%–39%). Differences emerged between continents, with Africa having the highest prevalence of perinatal depression and Oceania and Europe having the highest prevalence of antenatal and postnatal anxiety. The prevalence also varied depending on the assessment tools, especially for antenatal anxiety. A medium-high quality of the studies was observed. One SR assessed strength-of-evidence, reporting very low strength.

Conclusions: During the COVID-19 pandemic, depression and anxiety were common, affecting almost one in three perinatal women globally. A high heterogeneity and a risk of publication bias were found, partially due to the variety of assessment tools

Abbreviations: GRADE, Gradings of Recommendations Assessment Development and Evaluation system; MA, meta-analysis; SR, systematic review.

and cut-offs. The results may not be generalized to minorities. Studies on the prevalence of clinical diagnoses are needed. Based on our results it is not possible to firmly affirm that the COVID-19 pandemic was the main factor that directly increased perinatal depression and anxiety during the past few years. Future studies should study other factors' impact.

KEYWORDS
anxiety, COVID-19 pandemic, depression, postpartum, pregnancy, prevalence, umbrella review

1 | INTRODUCTION

Maternal mental health represents a public health concern, considering its short and long-lasting impact on women and children's health.[1,2] It is worth noticing that psychiatric disorders are one of the main predisposing factors of maternal mortality in Western countries.[3,4] In particular, mood and anxiety disorders are among the main psychiatric conditions observed in pregnant and postpartum women.[5,6]

Before the coronavirus disease 2019 (COVID-19) pandemic, the prevalence of antenatal depression symptoms was estimated at around 20.7% worldwide, with differences among high-income countries (9%) and low-income countries (19%).[7,8] The prevalence of postpartum depression symptoms was instead 17%.[9,10] Furthermore, antenatal and postnatal anxiety prevalence was 22.9% and 15%, respectively.[11] Research has shown that if untreated, depression and anxiety symptoms could have several consequences on pregnancy (eg, spontaneous abortion, lower immunity, operative delivery, cesarean section, preterm birth, lower birthweight), children (lower immunity, reduced cognitive development, behavioral and emotional difficulties) and mother-infant outcomes (risk for mother-infant bonding).[1,2,12]

Since the beginning of the COVID-19 pandemic, women in the perinatal period have been indicated as a vulnerable population due to the risk that changes in their immune systems could have in predisposing them to higher severity of respiratory symptoms caused by COVID-19 infection,[13] as was observed for severe acute respiratory syndrome-CoV (SARS-CoV) and Middle East respiratory syndrome-CoV (MERS-CoV).[14,15] Synthesis results have shown that pregnant women were not at a higher risk of contagion or severity of COVID-19-related symptoms than nonpregnant women.[16] Nevertheless, women infected by COVID-19 during pregnancy showed a major risk of preterm delivery, maternal mortality, and neonatal death.[17] The risk of the virus's vertical transmission resulted instead in a rare possibility.[16]

Several systematic reviews (SRs) and meta-analyses (Mas) on the prevalence of depression and anxiety symptoms in women in the perinatal period during the COVID-19 pandemic have been published so far.[18,19] A large variation in prevalence rates of perinatal depression and anxiety was found among these studies, reporting a generally high heterogeneity.[18] Some factors influenced the founded heterogeneity, with special mention of the country of residence of participants.[18] To our knowledge, no comprehensive umbrella review has been conducted to compare and contrast existing SRs and provide a clear picture of the global pooled prevalence of depression and anxiety both in pregnant and postpartum women during the COVID-19 pandemic. Therefore, the global impact of the COVID-19 pandemic on the prevalence of perinatal depression and anxiety is unknown.

Key message

This overview included 25 systematic reviews and meta-analyses involving 198 primary studies from 45 countries and five continents. Perinatal depression for one in four women and perinatal anxiety for one in three women were reported. Risk of publication bias and high heterogeneity were found.

We aimed to summarize, from SRs and MAs, the evidence relating to the global prevalence of anxiety and depression symptoms among pregnant and postpartum women during the COVID-19 pandemic. This evidence will be useful for decision-making policies in future pandemics or public health crises.[20]

2 | MATERIAL AND METHODS

An umbrella review is a high-level synthesis that offers the possibility to strengthen information systems by summarizing the evidence from multiple secondary studies.[21] The current umbrella review included both a narrative and a quantitative synthesis of the results, performed through a MA. For the report of the current umbrella review, the Preferred Reporting Items for Overviews of Systematic Reviews (PRIOR)[22,23] and the Cochrane Collaboration's Guideline for overviews of reviews[24] were followed (Table S1). The research protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO), registration number: CRD42020173125.

2.1 | Eligibility criteria

Studies were eligible if they met the following inclusion criteria: (a) Participants: Women during the perinatal period (from pregnancy

up to a maximum of 1 year postpartum); (b) Key variable: Data collection was enrolled during the COVID-19 pandemic; (c) Outcome: We selected studies whose outcomes were perinatal depression (prenatal depression and/or postpartum depression) and/or perinatal anxiety (prenatal anxiety and/or postpartum anxiety), assessed with validated questionnaires or standardized clinical interviews (d) Study design: SR&MA were considered eligible if they presented a systematic study design correspondent to Cochrane guidelines[24]; (e) Date of publication: studies that were published from September 2019 to April 2023.

Consequently, (a) scoping reviews, literature or narrative reviews, or papers focused on interventions or on the evaluation of health organizations; (b) articles that reported aggregate data on COVID-19 and other epidemics or aggregate data on perinatal women and other populations; and (c) articles that did not report data on the prevalence of depression or anxiety were excluded from the current umbrella review.

For inclusion in the quantitative synthesis of the current study, MAs were considered eligible if they presented separate and extractable data on pregnancy and the postpartum period. Hence, MAs that presented the prevalence of depression or anxiety by aggregating data on pregnant and postpartum women were excluded from the quantitative synthesis. According to the protocol, a minimum of four MAs reporting the prevalence of perinatal depression and anxiety were required for quantitative synthesis. However, to avoid duplicates, we decided to extract primary studies' statistical data from MAs. Thus, the number of included studies (higher than 4 studies) in MAs made it possible to carry out the quantitative synthesis.

2.2 | Search strategy

SR&MAs were retrieved up to April 14, 2023, from the following electronic databases: Pubmed, The Cochrane database of Systematic Reviews, PsycINFO, CINAHL, Embase, Scopus, Web of Science. A prototype of the search string was created for PubMed using a combination of terms related to (a) 'systematic review' and 'meta-analyses', (b) 'depression' and 'anxiety', (c) 'COVID-19', and (d) 'perinatal period' including 'pregnancy' and 'postpartum'. Then, it was adapted to the other databases. Additionally, the search was completed manually, reviewing the reference list of the included studies. The search strategy's details can be found in Table S2.

2.3 | Selection strategy

The selection strategy followed the steps suggested by the PRISMA statement.[25] It was conducted by two independent researchers (A.C. and C.B.) and discussed with a third researcher who assumed the role of supervisor (E.M.). First, all duplicate papers were deleted. Then, studies were screened based on abstracts and titles. Finally, full-text articles were evaluated for inclusion. The screening process has been carried out using Rayyan web app.[26]

2.4 | Data extraction

Data extraction was undertaken independently by two pairs of reviewers (A.C., G.M., C.B., and P.J.), and disagreements were solved through discussion until consensus was obtained. For SR&MA, the following information was extracted: author(s), year of publication, type of study (S.R. and M.A.), last date search, number of primary studies included in the review, number of participants and target population (pregnant and/or postpartum), countries, number of searched databases, the study design of the included primary studies, the tool used for quality assessment, the outcome(s) (depression, anxiety), and instruments used to assess outcomes in the primary studies. In addition, pooled prevalence rates with their 95% confidence intervals (CI) and heterogeneity were also extracted from eligible MAs.

For the quantitative synthesis, first, all the primary articles included in MAs were checked for duplicates according to reference and doi. Then, the number of events, and the sample size of each primary study were extracted from the included MAs. No additional primary studies were included in the umbrella review beyond those included in eligible MAs.

2.5 | Quality assessment

The methodological quality of each SR was assessed independently by two pairs of reviewers (A.C., G.M., C.B., and P.J.) using the 11-point JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses.[27] The first nine items of the checklist appraised the validity criteria for SR, such as: (a) clear and explicit questions; (b) appropriate inclusion criteria; (c) appropriate search strategy; (d) adequate sources and resources; (e) appropriate critical assessment of the studies; (f) critical appraisal by two or more reviewers independently; (g) methods chosen to minimize biases in data extraction; (h) appropriate synthesis of the study's findings; and (i) assessment of publication bias. The last two criteria instead referred to the quality of the research report and include (j) recommendations for policy and practice, and (k) directives for future further research.

Each item allows four response options: yes, no, unclear, not applicable. Although the checklist is not intended to be scored, the percentage of "yes" responses was calculated for each SR&MA. To assess the quality, we used thresholds consistent with previous umbrella reviews: low quality (0%–33% of criteria met), medium quality (34%–66% of criteria met), and high quality (67% or more of criteria met).[28,29] All studies, regardless of their methodological quality, were included in the umbrella review.

2.6 | Quality of the evidence

The strength of evidence for each meta-analytic effect was reported based on the Gradings of Recommendations, Assessment,

Development and Evaluation system (GRADE).[30] Assessment of the quality of the evidence considers five aspects: risk of bias, publication bias, imprecision (random error), inconsistency, and indirectness.[31] Specifically, we evaluated the strength of evidence of each SR&MA based on the corresponding results from the SR&MA.

2.7 | Statistical analyses

A meta-analytic synthesis was performed. To obtain the pooled prevalence of perinatal depression and anxiety, the number of events and sample size of the studies included in MAs were used to obtain the logit-transformed proportions to back-transform them into the pooled prevalence rates. Random-effect models were used to obtain the pooled prevalence and its 95% CI. To explore the study heterogeneity, the Q statistic and its *p*-value were used. In addition, the I^2 index and its 95% CI were calculated to quantify between-study heterogeneity. It was interpreted as follows: unimportant heterogeneity (0%–40%), moderate heterogeneity (30%–60%), substantial heterogeneity (50%–90%), and considerable heterogeneity (75%–100%).[24] Subgroup analyses were performed using a mixed-effects model based on the continent and instrument used to assess the prevalence of perinatal depression or anxiety. To measure publication bias, the Egger test was performed.[32] Analyses were performed independently for women in the antenatal period and for women in the postpartum period.

Analyses were performed with Stata (version 14.2) using the metaprop command.[33]

3 | RESULTS

3.1 | Selected studies

The search procedure yielded a total of 1268 studies. Among them, 585 were duplicates and were deleted. After screening titles and abstracts, 643 studies were excluded, and 40 full-text articles were reviewed. In the full-text screening step, 15 articles were excluded for reasons reported in Table S3. In the end, 25 SR&MA were included in the umbrella review (Appendix S7). Among them, 12 MAs, involving 129 primary studies, were included in the quantitative synthesis (Figure 1).

3.2 | Characteristics of the included SR&MA

The characteristics of the SR&MA included in this umbrella review were summarized in Table S4. Considering the outcome, 23 SR&MA reported the prevalence of depression, whereas 19 SR&MA synthesized data on the prevalence of anxiety. Considering target population, eight SR&MA focused on pregnant women, five reviewed data on postpartum, and 12 included studies both on pregnant and postpartum women. The SR&MA included a number of primary studies which varied within the range from eight to 90. A total of 198 unique primary studies were detected in the included SR&MA (Appendix S8). The SR&MA involved data on 45 countries and five continents. Considering the publication date, 73 studies were published in 2020, 108 in 2021, and 17 in 2022.

3.3 | Methodological quality

The results of the quality assessment were detailed in Table 1. Among the total, 4 SR&MA responded to the criteria of JBI Checklist[27] achieving 100% yes responses. Considering thresholds, 20 SR&MA scored >67%, and five SR&MA received an assessment score between the range of 34%–66%, corresponding to high and medium levels of quality, respectively (Table 1). Two validity domains emerged as particularly critical: the choice of sources that often exclude gray literature investigations (item 4–7/25 SR&MA received unclear or no assessment), insufficient procedures aimed at limiting extraction biases and assessing the quality of the studies (items 6–7—6/25 SR&MA received unclear or no assessment).

3.4 | Quality of the evidence

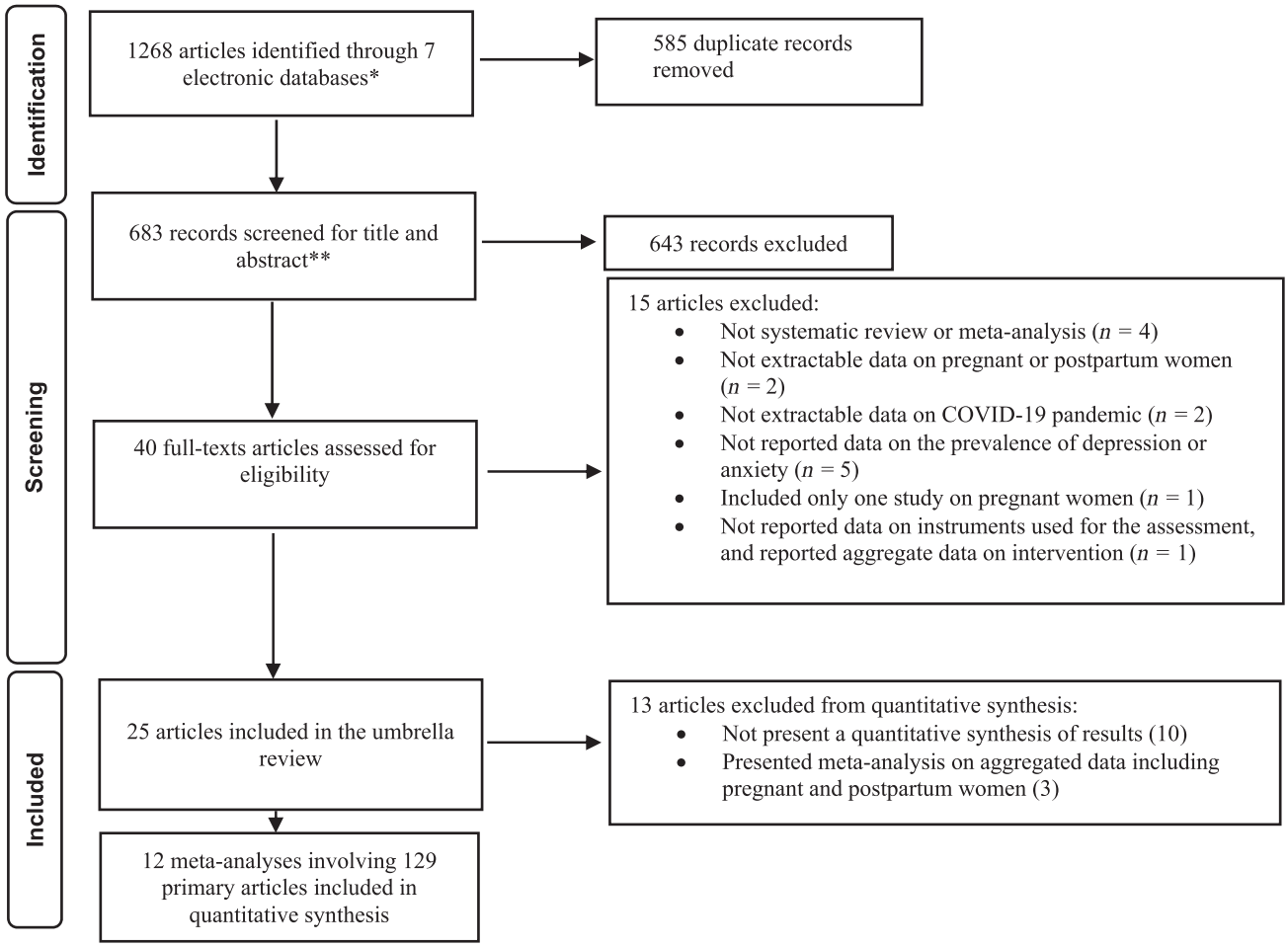
One SR[34] accessed the strength of evidence, according to the GRADE system.[30] In this SR, the certainty of evidence of the 25 revised primary articles was considered very low due to the observational design of the studies, inconsistency and imprecision. No MA measured or mentioned GRADE.

3.5 | Characteristics of the included MA

The main results of the 12 MAs included in the quantitative synthesis of this overview were presented in Tables S5 and S6 according to the outcome (depression and anxiety).

A total of 129 primary studies were detected from the MAs. Of them, the 118 primary articles for which we were able to extract the minimum data to perform quantitative synthesis were combined in meta-analysis.

Among the total, 55 reported data on antenatal depression, 54 reported data on postpartum depression, 44 provided results on antenatal anxiety and 16 on postnatal anxiety. Data derived from: Oceania ($n=1$), Africa ($n=2$), South America ($n=9$), North America ($n=18$), Europe ($n=26$), Asia ($n=61$) (mainly China, $n=30$), and multicontinents ($n=1$). Prenatal and postnatal depression were assessed mainly with the Edinburgh postnatal depression scale (EPDS: $n=29$; $n=46$), PHQ-9 ($n=11$; $n=6$), and other instruments ($n=14$; $n=4$). Prenatal and postnatal anxiety were assessed with GAD-7 ($n=12$; $n=6$), STAI ($n=10$; $n=5$), and others ($n=22$; $n=5$).



*Databases considered: Pubmed, The Cochrane database of systematic reviews, CINAHL (via EBSCO), APA PsycInfo (via EBSCO), Embase, Scopus, Web of Science.
** The screening for title and abstract was performed by researchers through Rayyan software (33)

FIGURE 1 Flow diagram of excluded and included systematic reviews and meta-analyses.

3.6 | Main findings of SR&MA

Moderate to severe levels of perinatal depression and anxiety were mainly reported by SRs.[35-37] An increase in perinatal depression and anxiety during the COVID-19 pandemic than before was supported,[35,38,39,40] though some contrasting results emerged.[46] Assessment tools influenced prevalence rate variations.[39,41] In the case of perinatal anxiety, instruments could be focused on: general anxiety, COVID-19-related anxiety, pregnancy-related anxiety.[36]

3.7 | Global prevalence of perinatal depression

The pooled prevalence of antenatal depression ($n = 55$) was 29% (95% CI: 25%—33%). The study with the highest prevalence was the study by He et al.[42] conducted in China (71%; 95% CI: 69%–73%) and the study with the lowest prevalence was the study by Berthelot et al.[43] conducted in Canada (2%; 95% CI: 2%–3%). There was considerable heterogeneity between studies ($I^2 = 99.39\%$; 95% CI: 99%–99%) and it was significant ($Q_{54} = 8878.56$; $p < 0.001$). Regarding postpartum depression ($n = 54$), the pooled prevalence was 26% (95% CI: 23%–30%). The study with the highest prevalence was the study conducted in Poland by Chrzan-Dętkoś et al.[44] with a prevalence of 74% (95% CI: 64%–83%). On the other side, Janevic et al.[45] (6%; 95% CI: 3%–10%) and Silverman et al.[46] (6%; 95% CI: 5%–9%) were the studies with the lowest prevalence. Both were conducted in the USA. Again, the heterogeneity was considerable ($I^2 = 98.18\%$; 95% CI: 98%–98%) and significant ($Q_{53} = 2906.01$; $p < 0.001$). Egger's test indicated publication bias for antenatal depression (bias, 0.27; 95% CI: 0.22–0.32; $p < 0.001$) and for postnatal depression (bias, 0.26; 95% CI: 0.21–0.32; $p < 0.001$; Figures 2 and 3).

Table 2 shows subgroup analyses by continent for perinatal depression. The highest pooled prevalence of antenatal (44%; 95% CI: 36%–53%) and postpartum (38%; 95% CI: 35%–41%) depression was found in Africa, with the pooled prevalence of antenatal depression being higher. However, only one study has been included. The same pattern was found in North America and South America. In contrast, in Europe the pooled prevalence of postnatal depression

TABLE 1 Methodological quality of the included SR&MA ($N = 25$).

	JBI critical appraisal items											
Author (Year)	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**	**Percentage of yes**
Adrianto et al. (2022)	+	+	+	+	+	+	+/−	+	+	+/−	+	81.82
Ahmad & Vismara (2021)	+/−	+	+/−	+/−	+	+	+	+/−	NA	+	+	54.55
Ansariniaki et al. (2021)	+	+/−	+	+	+	+	+/−	+	NA	+	+/−	63.64
Cevik et al. (2022)	+	+	+	+	+	+	+	+/−	+	+	+	90.91
Chen et al. (2022)	+	+	+	+	+	+	+	+	+	+	+	100
Chmielewska et al. (2021)	+/−	+	+	+	+	+	+	+	+	+	+	90.91
Delanerolle et al. (2023)	+	+	+	+	+/−	+/−	+	−	+	+	+/−	63.64
Demissie et al. (2021)	+	+	+	+	+	+	+	+/−	+	+	−	81.82
Fan et al. (2021)	+	+	+	+	+	+/−	−	+	+	+	−	72.73
Gao et al. (2022)	+	+	+	+	+	+	+	+	+	+	+	100
Gao et al. (2022)	+	+/−	+/−	+	+	+	+	−	+	+	+	72.73
Hessami et al. (2022)	+	−	+	+	−	−	+	+	+	+	+	72.73
Iyengar et al. (2021)	+	+	+	+	+	+	+	+	+	+	+	100
Lin et al. (2022)	+	+	+	+/−	+	+	+	+	−	+	+	90.91
Low et al. (2023)	+	+	+/−	+/−	+	+	+	+	NA	+	+	72.73
Muñoz-Vela et al. (2023)	+	+	+	+	+	+	+	+/−	NA	+	+	81.82
Rahimi et al. (2020)	+	+/−	+	+	+	+	+	+	NA	+	+	90.91
Safi-Keykaleh et al. (2021)	+	+	+	+	+	+	+	+	+	+	+	100
Shorey et al. (2021)	+	+	+	+	+	+	+	+	+/−	+	+	90.91
Sun et al. (2020)	+/−	+	+	+	+	+	+	+	+	+	+	90.91
Thakur et al. (2022)	+	+	+/−	−	−	−	−	+	NA	+	−	36.36
Tomfohr-Madsen et al. (2021)	+	+	+	−	+	−	+	+	+	+	+	81.82
Usmani et al. (2021)	+	+	−	−	+	+	+	+	NA	+	+	72.73
Wall et al. (2022)	+	+	+	−	+	+/−	+/−	+	NA	+	+	63.64
Yan et al. (2020)	+	+	+	+	+	+	+	+	−	+/−	+	81.82

Note: + = Yes; − = No; +/− = Unclear; NA = nonaccessible.

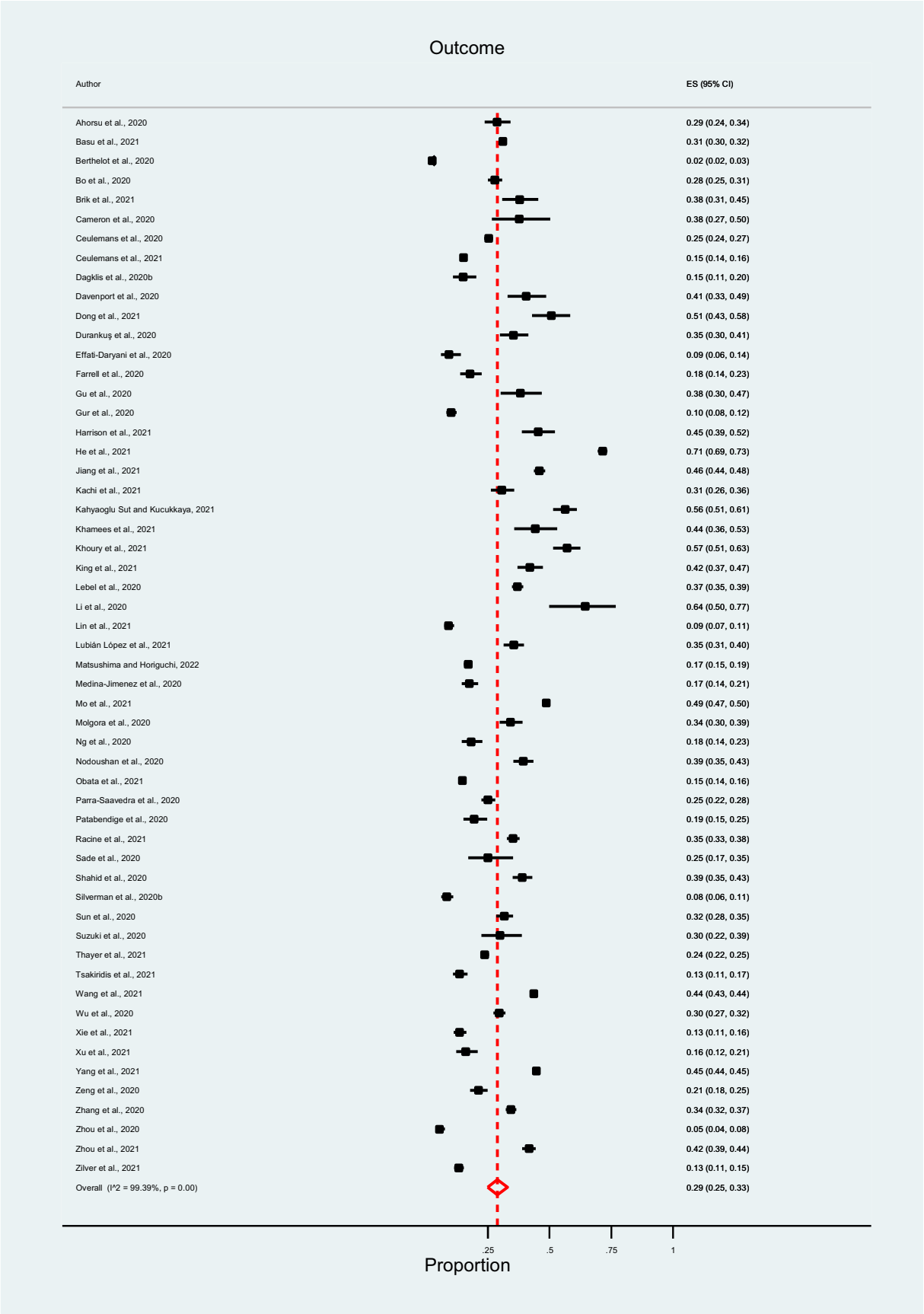


FIGURE 2 Forest plot of the pooled prevalence (proportion) of antenatal depression.

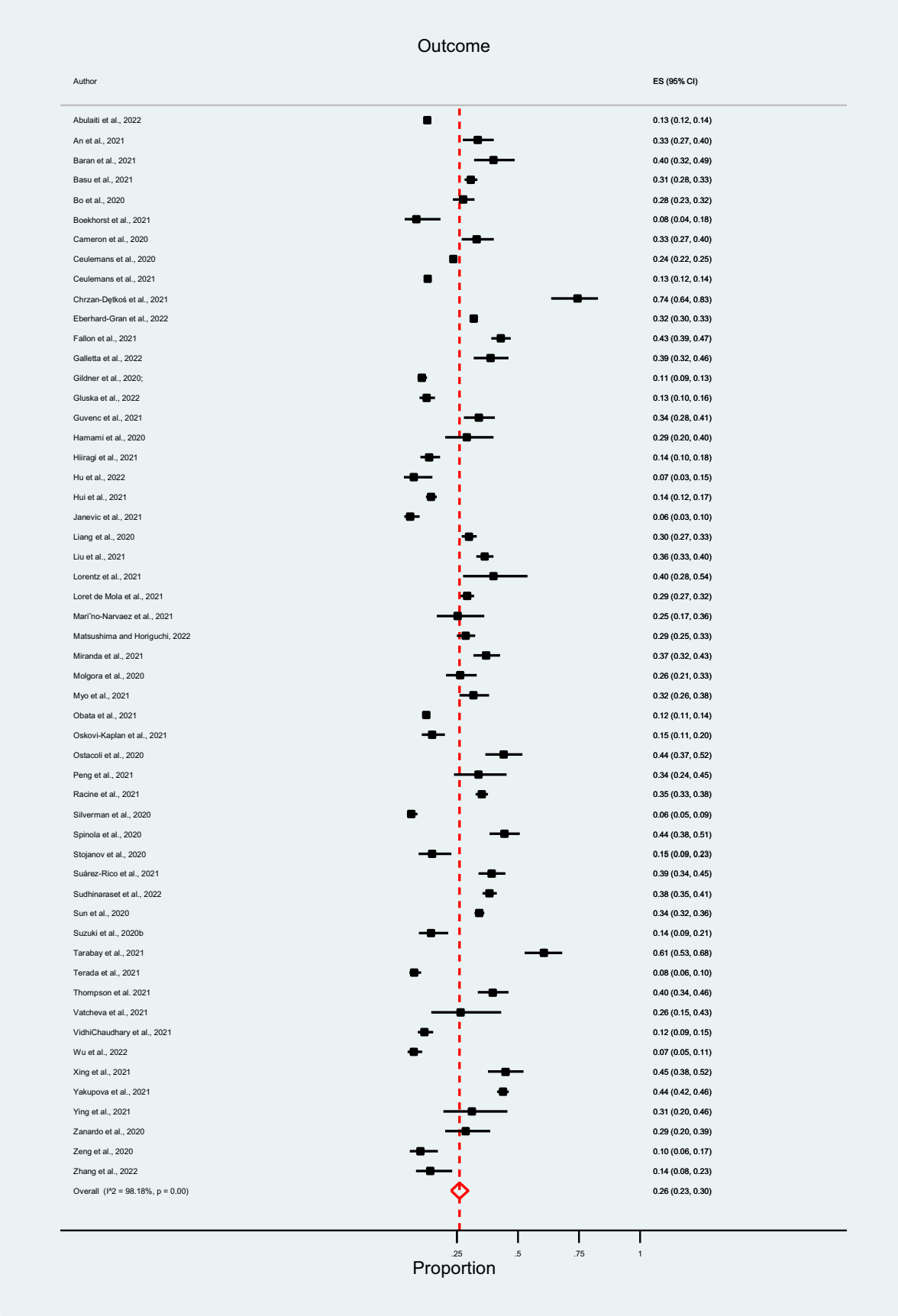


FIGURE 3 Forest plot of the pooled prevalence (proportion) of postpartum depression.

TABLE 2 The pooled prevalence of antepartum and postpartum depression by continent and instrument.

	Subgroup analysis	*n*	Proportion	Proportion, 95% CI	*p*-value	I^2 (%)	Between-group heterogeneity
Country	**Antenatal depression**						
	Africa	1	0.44	0.36–0.53	–	–	$Q_5 = 2091.53$; $p < 0.001$
	Asia	32	0.31	0.26–0.36	<0.001	99.40%	
	Europe	9	0.25	0.19–0.32	<0.001	97.69%	
	North America	11	0.26	0.16–0.37	<0.001	99.22%	
	South America	1	0.25	0.22–0.28	–	–	
	Multiplies countries	1	0.31	0.30–0.32	–	–	
	Postnatal depression						
	Africa	1	0.38	0.35–0.41	–	–	$Q_5 = 383.70$; $p < 0.001$
	Asia	24	0.22	0.17–0.27	<0.001	97.51%	
	Europe	15	0.32	0.25–0.39	<0.001	98.68%	
	North America	9	0.23	0.13–0.34	<0.001	98.48%	
	South America	4	0.35	0.29–0.41	0.01	75.43%	
	Multiplies countries	1	0.31	0.28–0.33	–	–	
Instrument	**Antenatal depression**						
	EPDS	29	0.30	0.24–0.36	<0.001	99.17%	$Q_2 = 2187.15$; $p < 0.001$
	PHQ-9	11	0.29	0.22–0.35	<0.001	99.50%	
	Others	14	0.27	0.17–0.37	<0.001	99.01%	
	Postnatal depression						
	EPDS	43	0.27	0.23–0.31	<0.001	98.30%	$Q_2 = 188.41$; $p < 0.001$
	PHQ-9	6	0.18	0.10–0.28	<0.001	97.66%	
	Others	4	0.32	0.25–0.39	<0.001	87.92%	

Abbreviations: CI, confidence interval; EPDS, Edinburgh postnatal depression scale. PHQ-9, Patient Health Qustionnaire 9 items.

(32%; 95% CI: 25%–39%) was higher compared to the pooled prevalence of antenatal depression (25%; 95% CI: 19%–32%). Considering the instrument, the pooled prevalence of antenatal depression was similar across the subgroups (EPDS, PHQ-9, and other instruments) and it ranged from 27% (other instruments; 95% CI: 23%–31%) to 30% (EPDS; 95% CI: 24%–36%). For postnatal depression, the pooled prevalence ranged from 18% (PHQ-9; 95% CI: 10%–28%) to 32% (other instruments; 95% CI: 25%–39%).

3.8 | Global prevalence of perinatal anxiety

The pooled prevalence of antepartum ($n = 44$; 31%; 95% CI: 26%–37%) anxiety was higher compared to the overall prevalence of prepartum and postpartum depression (Figure 4). The prevalence of prepartum anxiety ranged from 2% (95% CI: 1%–4%)[47] to 77% (95% CI: 70%–83%).[48] These studies were conducted in China and Italy, respectively. The heterogeneity was considerable ($I^2 = 99.27\%$; 95% CI: 99%–99%) and significant ($Q_{43} = 5886.84$; $p < 0.001$). The pooled prevalence of postnatal anxiety was 31% ($n = 16$; 95% CI: 24%–39%; Figure 5). It ranged from 10% (95% CI: 9%–11%)[49] to 61% (95% CI: 57%–65%).[50] These studies were conducted in Belgium and UK, respectively. The heterogeneity was considerable ($I^2 = 99.08\%$; 99% CI: 98%–99%) and significant ($Q_{15} = 1638.21$; $p < 0.001$). Egger's test indicated significant publication bias, for antenatal anxiety (bias, 0.24; 95% CI: 0.17–31; $p < 0.001$) and for postnatal anxiety (bias, 0.26; 95% CI: 0.12–0.39; $p = 0.001$).

Table 3 shows subgroup analyses by continent and instrument used to assess prevalence. Regarding antenatal anxiety, Oceania (42%; 95% CI: 35%–49%) and Europe (41%; 95% CI: 32%–51%) presented the highest pooled prevalence and Asia presents the lowest (23%; 95% CI: 18%–19%). A similar pattern was found for postnatal anxiety, being Oceania (42%; 95% CI: 35%–48%), Europe (34%; 95% CI: 19%–51%), and North America (34%; 95% CI: 23%–46%) the continents with the highest pooled prevalence and being Asia (14%; 95% CI: 13%–16%) the continent with the lowest.

The pooled prevalence varied for both prenatal and postnatal anxiety depending on the instrument, with the STAI being the measure associated with the highest prevalence (prenatal = 58%; 95% CI: 43%–71%; postnatal = 43%; 95% CI: 29%–58%).

4 | DISCUSSION

To the best of our knowledge, this is the first umbrella review to present an overall synthesis of the global prevalence of depression and anxiety symptoms in pregnant and postpartum women during the COVID-19 pandemic. We found that antenatal and postpartum

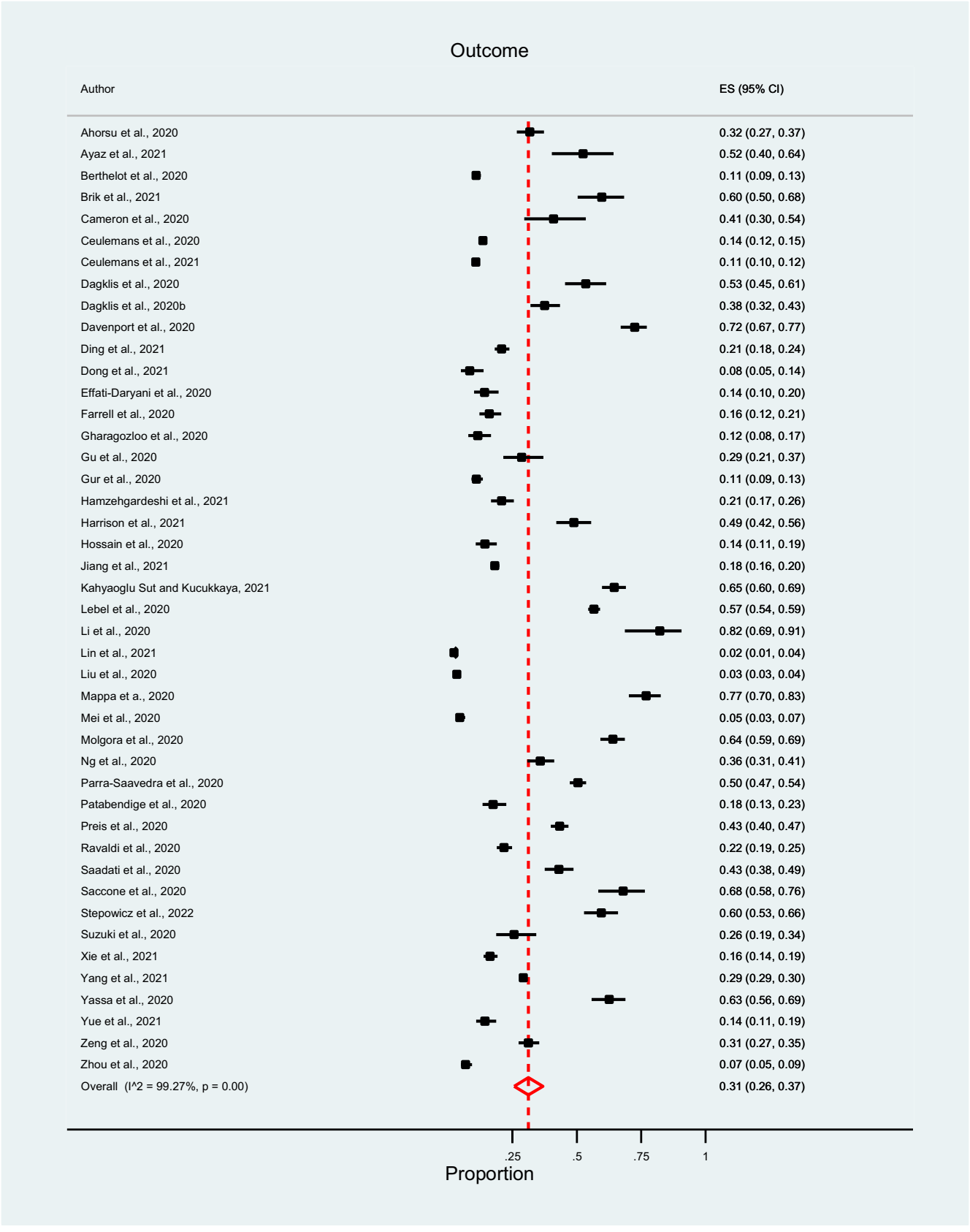


FIGURE 4 Forest plot of the pooled prevalence (proportion) of antenatal anxiety.

depression affected one in four women (29% and 26%), whereas antenatal and postnatal anxiety affected one in three women (31% and 31%). Variation was observed in prevalence estimates between continents, with Africa found to have the highest prevalence of perinatal depression and Oceania and Europe the highest prevalence of antenatal and postnatal anxiety. Rates also varied depending on the instrument used to assess prevalence, especially in the case of antenatal anxiety. These findings provide a clear picture of the burden of perinatal depression and anxiety among women during the COVID-19 pandemic.

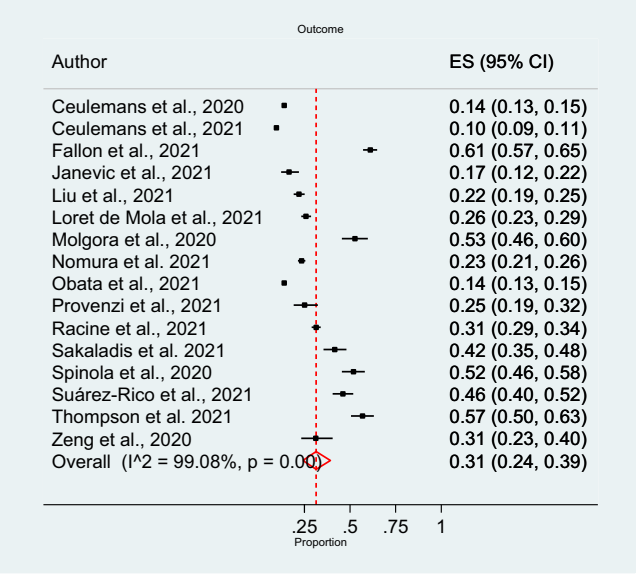


FIGURE 5 Forest plot of the pooled prevalence (proportion) of postnatal anxiety.

The findings were derived from 25 SR&MA including 198 primary studies from 45 countries and five continents. We found a risk of publication bias and high heterogeneity. Most of the included SR&MA scored >63% in the JBI assessment, showing a high quality Nevertheless, the strength of evidence, according to GRADE, was only assessed in one SR, which reported very low strength. GRADE was no assessed in any MAs.

The pooled prevalence of antenatal and postpartum depression symptoms was 29% and 26%, respectively. Comparing these results with prepandemic data, showing a 20.7% prevalence of antenatal depression[7] and 17% of postpartum depression,[9,10] the prevalence during the COVID-19 pandemic appeared higher. Moreover, the pooled prevalence of antenatal anxiety was 31%, resulting higher if compared to prepandemic data (22.9%, 11). Even in the case of postnatal anxiety the pooled prevalence (31%) was higher than the 15% reported before the COVID-19 pandemic.[11]

The different prevalence rates observed among continents might be attributed to several groups of factors: (a) COVID-19-related variables, like restrictions imposed by governments to limit the contagion, or the impact of COVID-19 infection in terms of mortality and contagion rates; (b) and cultural differences.[51]

TABLE 3 The pooled prevalence of antenatal and postnatal anxiety by continent and instrument.

	Subgroup analysis	*n*	Proportion	Proportion 95% CI	*p*-value	I^2 (%)	Between-group heterogeneity
Country	**Antenatal anxiety**						
	Asia	28	0.23	0.18–0.29	<0.001	99.03%	$Q_4 = 848.98$; $p < 0.001$
	Europe	17	0.41	0.32–0.51	<0.001	99.36%	
	North America	11	0.36	0.23–0.49	<0.001	99.29%	
	South America	3	0.33	0.18–0.49	—		
	Oceania	1	0.42	0.35–0.48	—		
	Postnatal anxiety						
	Asia	2	0.14	0.13–0.16	—		$Q_4 = 848.98$; $p < 0.001$
	Europe	6	0.34	0.19–0.51	<0.001	99.51%	
	North America	5	0.34	0.23–0.46	<0.001	97.31%	
	South America	2	0.24	0.23–0.26	—		
	Oceania	1	0.42	0.35–0.48	—		
Instrument	**Antenatal anxiety**						
	GAD-7	12	0.21	0.14–0.29	<0.001	99.29%	$Q_2 = 792.64$; $p < 0.001$
	STAI	10	0.58	0.43–0.71	<0.001	98.09%	
	Other	22	0.26	0.17–0.35	<0.001	99.32%	
	Postnatal anxiety						
	GAD-7	6	0.19	0.13–0.25	<0.001	97.77%	$Q_2 = 834.80$; $p < 0.001$
	STAI	5	0.43	0.29–0.58	<0.001	97.84%	
	Other	5	0.32	0.22–0.52	<0.001	98.99%	

Abbreviation: CI, confidence interval. GAD-7: Generalized Anxiety Disorder 7 item; STAI: State-trait anxiey inventory.

Considering the above-mentioned limits for subgroup results, the highest prevalence of perinatal depression was found in Africa (44%, 38%). With Africa being the continent with the lowest Gross World Product per capita,[52] this result can be read in continuity with studies that reported higher prevalence of perinatal depression in low-income countries.[7,11,53] The current result was also considerably higher than the pooled prevalence of depression observed in pregnant (22.8%) and (21.2%) postpartum women in Africa before the COVID-19 spread.[54] Moreover, the pooled prevalence of antenatal (25%) and postpartum (32%) depression in Europe was far from prevalence rates observed before pandemic, estimated at 17.9%[7] and 8%, respectively.[10] In Europe, as well as in Oceania, a particularly high prevalence of antenatal anxiety was also found (41%, 42%). Observing results for Asia, higher levels of prenatal depression (31%) than postpartum depression (22%) were found. In Asian countries the confinement represented a traditional ritual activated during postpartum, involving the partial retire from social life and the cohabitation with some family members.[10,55] Hence, it may be possible that this postpartum family-oriented cultural praxis buffered the impact of COVID-19-related restrictions, often involving social isolation. Asia also showed the lowest levels of antenatal and postnatal anxiety, confirming a trend previously shown in literature.[56,57] Similar prevalence rates were found for antenatal depression and anxiety in North (26%, 36%) and South America (25%, 33%), whereas surprisingly a larger gap was found for postpartum depression (23% and 35%) and anxiety (34% and 24%). In fact, closer rates of prevalence between North and South America were previously found in scientific literature on postpartum depression (16% and 19% respectively, 10). Thus, during the COVID-19 pandemic the postpartum depression rates seemed to increase in the American continent, with a special reference to the South. Instead, considering postnatal anxiety higher rates were found in the North rather than the South America.

Considering the instruments, the STAI measured the highest prenatal and postnatal anxiety prevalence. Research suggested that general anxiety measures assess somatic symptoms similar to typical pregnancy symptoms (nausea, vomiting, dizziness),[58] also resembling COVID-19 infection symptoms. Therefore, a critical stance toward the instrument used by the studies to assess perinatal anxiety during the COVID-19 pandemic should be applied.

Overall, one of the strengths of the current study was the inclusion of several SR&MA and a large number of primary studies from 45 countries, covering five continents. A highly sensitive search was pursued including several electronic databases, and a combination of different search terms related to the topic of interest, and no exclusion criteria based on language. PRISMA and PRIOR guidelines (Table S1)[22,23,25] were applied to guarantee rigor of procedure and report, as well as instruments to ensure the quality of the included SRs (JBI Critical Appraisal Checklist and GRADE).[28,31] Although the PRIOR framework was designed for meta-studies on interventions, after a careful revision, we decided to use it as report guidelines. Surely, future studies will create more appropriate tools for epidemiological and prevalence-based studies.[59]

On the other hand, there are several limitations of this overview. One of the main limitations is the considerable heterogeneity between studies. First, this variability could be partially imputed to methodological differences among the studies. For example, the different sample sizes in primary studies, which ranged from 27 to 19 515 participants (a); sample characteristics, such as age, parity, trimester of pregnancy (b); and the variety of screening tools and cut-offs considered between the studies (c). Due to the paucity of information that could be retrieved from the included MAs, it was not possible to provide prevalence rates stratified for pregnancy trimesters. Delanarolle et al.[60] is the only meta-analysis that provided separated data for trimesters. It observed the highest prevalence of anxiety in the third trimester, confirming previous data.[60] Conversely, the first trimester appeared as the most at-risk for symptoms of depression,[60] in contrast with previous studies that did not find differences in depression between gestational trimesters.[7] In addition, we did not reanalyze the data considering the months after postpartum. Gao et al.[61] was the only study that reported increased levels of depression after 6 weeks from delivery compared to within the first 6 weeks postpartum. Furthermore, MAs included studies that measured depression and anxiety symptoms mainly through self-report scales despite clinical diagnostic tools. Thus, the results of the current umbrella review should not be used to draw inferences about the prevalence of psychiatric diagnoses in women in the perinatal period. In addition, in the cases in which MAs reported both state and trait anxiety scores measured through the STAI, only state anxiety was included in the quantitative synthesis to avoid overlap.

Second, the high heterogeneity between studies could also reflect the diversity of the perinatal experiences lived by women in relation to the impact of the COVID-19 pandemic, as well as it was found for other vulnerable populations, like health care workers.[28] First, we included studies regardless of the phase or the restricted measures in force in countries during the data collection. Hence, we aggregated data collected during total, partial, and nonlockdown periods. Among the eligibility criteria we stated that SR&MA had to include collected data during the COVID-19. This criterion was based on the authors' declarations and did not follow strict time or contextual criteria. Second, it was not part of the scope of this umbrella review to present evidence to support the notion that depression and anxiety symptoms increased during the COVID-19 pandemic in comparison to before. Although it did not represent an aim of the current research, contrasting results emerged from SR&MA reviewed. Some studies suggested that perinatal women during the COVID-19 pandemic were more likely to experience anxiety and depression symptoms than before.[39,62] Contrastingly, other results on pregnant women showed no difference in depression and anxiety levels before and during the COVID-19 pandemic.[63] Nevertheless, considering differences in between studies methodology and procedure these results are not comparable. Third, our results should be used in conjunction with the knowledge on how COVID-19 indirectly impacted maternal mental health, increasing risk factors like worries and concerns on health and finances, grief experiences, lack of social support, and loneliness.[64,65] Based on our results it is not possible to firmly affirm that

the COVID-19 pandemic was the main factor that directly increased perinatal depression and anxiety during the past few years. Future studies should study factors other than the COVID-19 pandemic that may have increased perinatal depression and anxiety in recent years, such as social and socioeconomic determinants.

Another limitation regarded the robustness of the results based on continents, due to high heterogeneity and the paucity of data available for some geographical areas. The few numbers of published papers in Africa and Oceania represented a gap in scientific literature that limits the availability of evidence-based research in these contexts and consequently impacted the consolidation of valid policies. In addition, the current study did not consider the differences in ethnicity within countries. Previous research highlighted in fact that immigrant women were more at risk for perinatal depression and anxiety than nonimmigrant populations.[66] This point was not examined in the current overview. Thus, the general findings of the overview may not be generalizable to minority populations.

Moreover, our findings were inconclusive due to the effect of publication bias. Publication bias suggested that studies with significant results were more likely to be published than those with nonsignificant findings.[32] Thus, our results may provide an over- or underestimation of prevalence compared to the true one. This finding could be transformed in invitations for authors and editors to publish negative significant results and to include unpublished articles in SR&MA.

Although a medium-high quality was attributed to the included SR&MA, only one SR has assessed the strength of evidence by GRADE,[31] showing a very low level between the studies. One possible explanation for this point is that GRADE still has a scarce application on prevalence studies in absence of formal guidelines.[67] The adoption of GRADE is recommended by the authors for future SR&MA on perinatal depression and anxiety prevalence to improve the quality of reported evidence.

Finally, we have to highlight that the extraction and analysis procedure of the current study partially deviated from the PROSPERO protocol.

This overview has several implications that will be useful for decision-making policies in future pandemics or public health crises. First, perinatal mental health problems during public health crises have a devastating impact on the whole family. In fact, 64% of global maternal deaths, 50% of newborn deaths, and 51% of stillbirths worldwide occur in 29 countries enduring humanitarian crises.[68] Therefore, mental health during crises must be considered a vital public health concern and appropriate care is needed to prevent any negative impact.[69,70]

Second, our results suggest the importance of strengthening or introducing programs for preventing and managing perinatal mental health disorders in the post-pandemic era. Clinical practice guidelines on perinatal mental health disorders must consider the impact of the pandemic or public health crisis on mental health[70] and consider special vulnerable groups, such as refugees or minority groups. The cultural and organizational differences between countries can still lead to legitimate variations in clinical recommendations, even in the presence of the same evidence.[71,72]

In addition, COVID-19 pandemic also impacted paternal perinatal mental health. Paternal perinatal depression prevalence during the pandemic ranged from 13.82% to 21.2%,[73,74] impacting the well-being of the entire family.[75] We hope further resources will be invested in promoting paternal mental health in perinatal healthcare services.[74]

Perinatal mental health remains a developing domain in health sciences in the absence of a network involving global institutions and stakeholders to improve mental health outcomes of pregnant and postpartum women around the world. Such attempts may promote adequate actions to respond to the increase of mental health symptoms in mothers, preventing the cascading effects on women, parents, and children's health.[2,12]

5 | CONCLUSION

The prevalence estimates from this umbrella review serve to provide evidence of the magnitude of the global burden of perinatal depression and anxiety during the COVID-19 pandemic. Thus, our findings demonstrate the urgent need to recognize perinatal depression and anxiety as a public health priority globally.

AUTHOR CONTRIBUTIONS

Alessia Caffieri, Giorgia Margherita, and Emma Motrico conceived and designed the study. Alessia Caffieri, Irene Gómez-Gómez, Carlos Barquero-Jimenez, Paula de-Juan-Iglesias, Giorgia Margherita, and Emma Motrico carried out the acquisition, analysis, or interpretation of data. Alessia Caffieri, Irene Gómez-Gómez, Giorgia Margherita, and Emma Motrico drafted the manuscript, tables, and figures. Irene Gómez-Gómez and Emma Motrico performed and refined the statistical analysis. EM supervised the research. All authors read, edited, and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY STATEMENT

Raw data are available from the corresponding author upon request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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