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The Effect of Virtual Psychological Interventions on Anxiety and Depression in the Perinatal Period: A Systematic Review of Internet-Delivered Smartphone Apps and Chatbot-Based Programs

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Abstract

Background: Anxiety and depression during the perinatal period can negatively impact maternal and infant well-being. Identifying effective approaches to promote perinatal mental health is important. Although previous reviews have examined digital psychological interventions, evidence across different virtual modalities, particularly chatbot-based interventions, remains limited. We aimed to systematically synthesize evidence on the effectiveness of virtual psychological interventions for anxiety and depression during the perinatal period.

Methods: Published studies in Persian and English were searched from inception to February 2026 in Embase, Cochrane Library, Web of Science, Google Scholar, PubMed, Scopus, SID, and Magiran. The review was reported in accordance with PRISMA guidelines. We included randomized controlled trials (RCTs) assessing virtual psychological interventions for anxiety and/or depression during the perinatal period. Risk of bias was assessed using the Cochrane Risk of Bias tool (RoB 1), and certainty of evidence was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

Results: Of 3,976 records identified, 23 RCTs involving 4,133 women were included. Studies were categorized as internet/web-based (11 studies), telephone-based (3 studies), and mobile app- and chatbot-based (9 studies). Twelve studies assessed depression in 2,456 women, and 11 studies assessed depression and anxiety in 1,677 participants. Overall, the included studies generally reported reductions in depression and/or anxiety symptoms following virtual psychological interventions compared with usual care.

Conclusions: Virtual psychological interventions may reduce perinatal depression and anxiety symptoms. However, the certainty of evidence was low, with substantial clinical and methodological heterogeneity. Further well-designed RCTs are needed.

Registration: This study was registered on PROSPERO (ID: CRD420261279726).

Keywords: Anxiety, Depression, Virtual psychological interventions, Perinatal, Digital health

Introduction

The perinatal period is special in women's lives, characterized by physical, emotional, social, and hormonal changes, and is an important period for mental health (1). Non-psychotic perinatal mental disorders (PMDs) refer to common mental health conditions (i.e., anxiety, depression) that occur during pregnancy or in the first year after birth (2). Even in specific subpopulations (low- and lower-middle-income countries), the average prevalence of PMDs (such as anxiety and depression) is about 16% prenatally and 20% postnatally (3) and between 10% and 13%, respectively, in high-income countries (4,5). A study showed substantial variation in the prevalence of women with perinatal anxiety, ranging from 3% to 39% (6).

Women who experience depression or anxiety during pregnancy are at higher risk of developing postpartum mental disorders (7) and impaired maternal-infant bonding (8). Mothers with anxiety and/or depressive symptoms during the perinatal period are also at risk of experiencing negative physical health outcomes and adverse birth outcomes (9). They are also at risk of experiencing preterm birth (i.e., birth before 37 weeks of gestation), low birth weight (i.e., < 2500 g), increased rates of cesarean delivery, and their babies are more likely to be admitted to the neonatal intensive care unit (10-12). This condition has also been linked to a wide range of emotional problems, attachment issues, externalizing difficulties, and less positive cognitive development (13,14). Therefore, depression and anxiety during pregnancy are a major public health problem.

One meta-analysis found that psychological interventions are effective in reducing symptoms of both anxiety and depression in both the antenatal and postnatal periods (14). Cost-effective, scalable, and accessible interventions are therefore needed, and the use of virtual care has expanded rapidly (15). By definition, virtual care is any intervention that uses technology to improve or deliver patient care while the patient and their care

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team are not in the same location (e.g., telephone, video consultations, mobile applications, internet-based) and facilitates or enhances the quality and effectiveness of patient care (16,17). Virtual psychological interventions may facilitate use of interventions where in-person access is not possible (18,19).

Different virtual psychological interventions have been implemented for depression and anxiety in the perinatal period. Available systematic reviews and meta-analyses examining online or technology-based interventions for mental health during pregnancy and the postpartum period have focused on the impact of programs specifically for depression (20) or have examined only internet/web-based interventions (21-23). Although these reviews provide important evidence, they have not comprehensively addressed the broader range of virtual delivery modalities, particularly smartphone applications and chatbot-based interventions, for both depression and anxiety. Therefore, considering the evolving range of virtual psychological interventions, including internet/web-based, smartphone app-, and chatbot-based programs, the present review aimed to systematically synthesize the available evidence on their effects on anxiety and depression during the perinatal period and to identify effective intervention approaches.

Methods

Search Strategy

The search strategy was developed to identify randomized controlled trials (RCTs) published up to February 2026, using open-ended terms commonly used in the scientific literature and PubMed's MeSH terms. Search terms were developed based on PICO (Population, Intervention, Comparison, Outcome)-formulated questions. Search terms included counseling, virtual psychological interventions, anxiety, depression, and perinatal. This systematic review was performed by searching English-language databases of the Cochrane Library, PubMed, Embase, Web of Science, Scopus, and Google Scholar, and Persian databases of Magiran and SID. References were manually searched to identify additional relevant studies that were not identified through electronic searches. The complete search strategies for all databases are presented in Supplementary file 1.

For Google Scholar, combinations of terms related to the perinatal period, anxiety, depression, psychological interventions, and virtual/digital delivery modalities were used. Searches were conducted using combinations of the main concepts to identify potentially relevant studies.

As an example, the search strategy for the PubMed database was as follows:

("Pregnancy"(Mesh) OR "Postpartum Period"(Mesh) OR "Perinatal Care"(Mesh) OR pregnancy(tiab) OR pregnant(tiab) OR perinatal(tiab) OR prenatal(tiab) OR antenatal(tiab) OR postpartum(tiab) OR postnatal(tiab) *(tiab)) AND ("Anxiety"(Mesh) OR "Depression"(Mesh) OR anxiety(tiab) OR anxious(tiab) OR depression(tiab) OR depressive(tiab) OR "depressive symptom*"(tiab)) AND ("Internet"(Mesh) OR "Telemedicine"(Mesh) OR "Mobile Applications"(Mesh) OR "Computer-Assisted Therapy"(Mesh) OR internet(tiab) OR online(tiab) OR web(tiab) OR "web-based"(tiab) OR "internet-based"(tiab) OR "internet-delivered"(tiab) OR digital(tiab) OR ehealth(tiab) OR "e-health"(tiab) OR telehealth(tiab) OR telemedicine(tiab) OR smartphone*(tiab) OR "mobile app*"(tiab) OR application*(tiab) OR chatbot*(tiab) OR "conversational agent*"(tiab) OR telephone(tiab) OR phone(tiab) OR "text message*"(tiab) OR SMS(tiab)) AND (psychotherapy*(tiab) OR "psychological intervention*"(tiab) OR "psychological therapy*"(tiab) OR counseling(tiab) OR "cognitive behavioral therapy"(tiab) OR CBT(tiab) OR psychoeducation(tiab) OR "behavior therapy"(tiab) OR "behavioral activation"(tiab) OR mindfulness(tiab) OR "cognitive therapy"(tiab)).

Inclusion and Exclusion Criteria

The inclusion criteria were RCTs published in English or Persian that investigated virtual psychological interventions or counseling approaches for anxiety and/or depression during the perinatal period. The PICO criteria defined for this review included participants (women in the perinatal period), virtual psychological interventions (counseling approaches, psychological, and educational interventions), comparison group (routine care or standard care), and outcomes (anxiety, depression). The exclusion criteria were the lack of access to the full text of articles and reporting of irrelevant results.

Selection of Studies

After compiling the findings from all databases, the articles were exported to Microsoft Excel. Two authors (S.S and M.D) independently screened the titles and abstracts and assessed potentially eligible full-text articles. Disagreements between the two reviewers during title/abstract screening and full-text assessment were initially resolved through discussion and consensus. When consensus could not be reached, a third reviewer independently reviewed the relevant record and participated in the discussion until a final decision was reached. The study-related data, including author, year, type of intervention, study design, participant characteristics, and number of participants, were extracted. The study selection process was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement (24). The identification, screening, eligibility assessment, and inclusion of studies were presented in a PRISMA 2020 flow diagram (Figure 1).

Assessment of Risk of Bias in Included Studies

Two researchers (S.S and M.D.) independently assessed the risk of bias in all included studies using the Cochrane

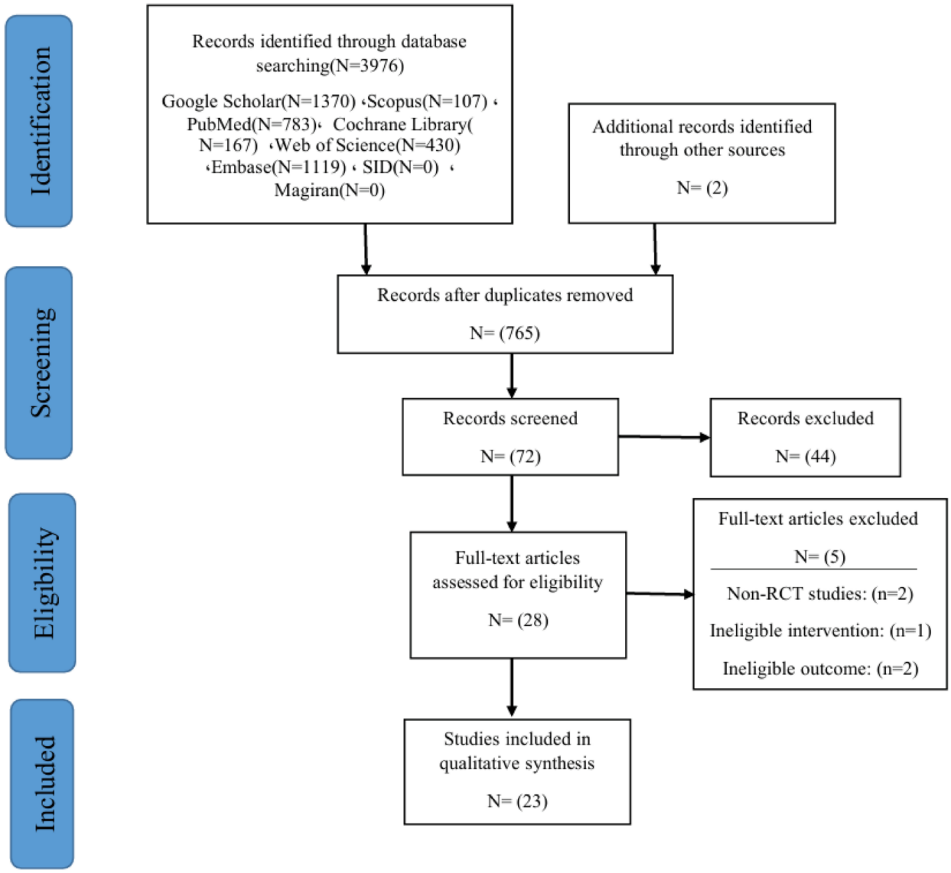

Figure 1. PRISMA Flowchart of the Included Studies.

Risk of Bias tool (RoB 1) (25). All studies were evaluated in terms of the following domains: selection bias, performance bias, detection bias, attrition bias, and reporting bias. The risk of bias for each domain was classified as "low risk," "high risk," or "unclear risk." The reviewers' judgments were compared, and disagreements were initially resolved through discussion and consensus. When consensus could not be reached, a third reviewer was consulted to independently review the assessment and resolve the disagreement.

Data Synthesis

Given the substantial clinical and methodological heterogeneity among the included studies, a quantitative meta-analysis was not considered appropriate. The studies differed in terms of intervention modality and characteristics, duration and intensity of interventions, degree of professional involvement, timing of intervention during the perinatal period, comparator conditions, outcome measurement instruments, and follow-up periods. Therefore, the findings were synthesized narratively in accordance with the synthesis without meta-analysis (SWiM) reporting guideline (26).

In this review, the term "virtual psychological interventions" was used as an overarching term for psychological interventions delivered remotely through technology-based platforms.

Before study classification, interventions were categorized according to their primary mode of delivery. The taxonomy was based on the main technological platform through which the psychological intervention was delivered, rather than on the intervention content or the terminology used by the original authors. Three predefined categories were used: (a) internet/web-based interventions, in which the intervention was primarily delivered through websites or web-based platforms accessed via a computer or mobile device; (b) telephone-based interventions, in which psychological support or counseling was primarily delivered through telephone calls; and (c) mobile app- and chatbot-based interventions, in which the intervention was primarily delivered through a smartphone or tablet application or an interactive chatbot.

When an intervention used more than one delivery modality, classification was based on the primary or dominant modality through which the therapeutic content was delivered, while additional delivery modalities were recorded in the intervention description. Studies were not classified according to whether the intervention was described as "digital," "eHealth," or "mobile" by the original authors. Within these intervention categories, findings were further organized according to the primary

outcomes of depression and anxiety.

For each outcome, the synthesis considered the number of contributing studies, the total number of participants represented across these studies, intervention characteristics, comparator conditions, outcome measurement instruments, follow-up periods, and the reported direction and statistical significance of intervention effects. The reported participant numbers were used descriptively to characterize the body of evidence and did not represent pooled sample sizes or a statistical aggregation of participants across studies.

The direction of effect was classified according to whether the reported findings favored the intervention, favored the comparator, or showed no statistically significant difference between groups. This classification was based on the results reported by the original studies.

Similarities and differences across studies were considered in relation to intervention modality, intervention characteristics, study population, timing of intervention, outcome measurement instruments, and follow-up duration. Findings were presented narratively and organized by intervention modality and outcome to facilitate comparison across studies.

Assessing the Quality of the Body of Evidence Using the GRADE Approach

The certainty of evidence for the main outcomes was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. In this method, the evidence from the included studies is appraised across five domains—risk of bias, imprecision, inconsistency, indirectness, and publication bias—to determine the overall quality of evidence (27).

Results

A total of 3,976 records were initially identified by searching the aforementioned databases. After removing duplicate records, titles and abstracts of the remaining studies were screened. Subsequently, 72 articles were considered eligible for full-text assessment. Full-text articles were assessed for eligibility according to the predefined inclusion and exclusion criteria. The reasons for exclusion of studies assessed at the full-text stage were recorded and are presented in the PRISMA 2020 flow diagram. Finally, 23 studies met the inclusion criteria and were included in the final review (Figure 1). Any disagreements between reviewers were resolved by discussion, and a third reviewer was consulted when consensus could not be reached.

Furthermore, studies including a total of 4,133 women in the perinatal period were included in this review. The sample size varied from 42 participants (28) to 660 participants (29). The follow-up period after the intervention ranged from 24 hours to six months.

Across the included studies, intervention characteristics, comparator conditions, outcome measurement instruments, and follow-up periods varied considerably. Depression was assessed using instruments such as the EPDS and PHQ-9, while anxiety was assessed using instruments including the GAD-7, STAI, and DASS-21. Most studies reported findings favoring the intervention, although the magnitude and statistical significance of effects varied across studies. Detailed characteristics of the interventions are presented in Table 1.

Overall, the interventions performed across the included studies were classified into the following categories:

Internet/web-based interventions: including internet-based behavioral activation—treatment for postnatal depression (30); Internet-based cognitive behavioral therapy (ICBT) for the antenatal and postpartum period (28,32,34,35); therapist-assisted internet-delivered cognitive behavioral therapy (TA-ICBT) (33); online mindfulness training (36, 45); online one-day cognitive behavioral therapy–based workshops (40); MumMoodBooster (MMB) (41,47).

Telephone-based interventions: including telephone-based cognitive-behavioral therapy on postnatal depression (31), technology-based peer-support intervention program (PIP) (37), nurse-delivered telephone interpersonal psychotherapy (IPT) (39).

Mobile app- and chatbot-based interventions: including psychoeducational smartphone-based intervention (29), an app-based cognitive behavioral therapy (38), Smiling Mind (smartphone) application (42), mobile health application based on mindfulness and social support theory (43), Happy Mother App (44), the mental health chatbot (46), mobile-delivered mindfulness-based intervention (48), MamaLift Plus Digital Therapeutic (49), Smart Mama intervention (50).

Risk of Bias in Included Studies

The overall risk-of-bias assessments of the included studies are presented in Figures 2 and 3. Most studies showed a low risk of bias in random sequence generation (23/23), allocation concealment (22/23), incomplete outcome data (20/23), and selective reporting (23/23). Greater concerns were observed in the blinding domains, particularly blinding of participants and personnel, where 15 studies were rated as high risk of bias and 8 as low risk. Blinding of outcome assessment showed the greatest concern, with 21 studies rated as high risk of bias and only 2 as low risk. For other biases, 4 studies were rated as low risk, while the remaining studies had unclear risk of bias (Figures 2 and 3).

The results of the present review suggested that internet/web-based, telephone-based, mobile app- and chatbot-based interventions may reduce anxiety and depression during the perinatal period.

In addition, a GRADE assessment was conducted to evaluate the certainty of evidence for the main outcomes. The certainty of evidence was rated as low for depression and anxiety, reflecting concerns related to risk of bias

Table 1. Characteristics of the Studies Used in This Review

Author (year)/Reference	Type of study	Main findings	Intervention delivery modality[a]	Type of intervention	Participants number	Outcomes	Measurement instrument
O'Mahen et al (2013) (30)	RCT	Significant reduction in depressive symptoms	1	Internet-based behavioral activation—Treatment	Intervention group: 172 Control group: 138	Depression	EPDS
Ngai et al (2015) (31)	RCT	Significant reduction in depressive symptoms	2	Telephone-based CBT	Intervention group: 197 Control group: 200	Depression	EPDS
Milgrom et al (2016) (32)	RCT	Significant reduction in depressive symptoms	1	ICBT	Intervention group: 21 Control group: 22	Depression	EPDS
Pugh et al (2016) (33)	RCT	Reduction in postnatal anxiety and depression	1	TA-ICBT	Intervention group: 24 Control group: 23	Depression Anxiety	EPDS DASS21
Forsell et al (2017) (28)	RCT	Significant reduction in depressive symptoms	1	ICBT	Intervention group: 22 Control group: 20	Depression	EPDS
Loughnan et al (2019) (34)	RCT	Reduction in antenatal anxiety and depression	1	ICBT	Intervention group: 43 Control group: 44	Depression Anxiety	PHQ-9 GAD-7
Loughnan et al (2019) (35)	RCT	Reduction in postpartum anxiety and depression	1	ICBT	Intervention group: 69 Control group: 62	Depression Anxiety	PHQ-9 GAD-7
Potharst et al (2019) (36)	RCT	Reduction in postpartum anxiety and depression	1	8-Session online mindful parenting training for mothers	Intervention group: 43 Control group: 33	Depression Anxiety	PHQ-4
Shorey et al (2019) (37)	RCT	Reduction in postpartum anxiety and depression	2	A technology-based PIP	Intervention group: 69 Control group: 69	Depression Anxiety	EPDS STAI
Chan et al (2019) (29)	RCT	Significant reduction in depressive symptoms	3	Psychoeducational mobile app (smartphone-based intervention)	Intervention group: 330 Control group: 330	Depression	EPDS
Jannati et al (2020) (38)	RCT	Significant reduction in depressive symptoms	3	Mobile application based on the principles of CBT	Intervention group: 39 Control group: 39	Depression	EPDS
Dennis et al (2020) (39)	RCT	Reduction in postpartum anxiety and depression	2	Nurse-delivered telephone IPT	Intervention group: 120 Control group: 121	Depression Anxiety	EPDS STAI
Van Lieshout et al (2021) (40)	RCT	Reduction in postpartum anxiety and depression	1	Online 1-day cognitive behavioral therapy–based workshops	Intervention group: 202 Control group: 201	Depression Anxiety	EPDS GAD-7
Milgrom et al (2021) (41)	RCT	Reduction in postpartum anxiety and depression	1	Web-based CBT interventions (internet CBT+coach calls) for PND (MMB) with FTF CBT	Intervention group MMB: 39 Intervention group FTF-CBT: 39 Control group: 38	Depression Anxiety	PHQ-9 DASS-21
Bear et al (2022) (42)	RCT	Reduction in postpartum anxiety and depression	3	Smiling Mind (smartphone) application	Intervention group: 49 Control group: 50	Depression Anxiety	DASS-21

Table 1. Continued

Author (year)/Reference	Type of study	Main findings	Intervention delivery modality[a]	Type of intervention	Participants number	Outcomes	Measurement instrument
Liu et al (2022) (43)	RCT	Significant reduction in depressive symptoms	3	Mobile health application based on mindfulness and social support theory	Intervention group: 65 Control group: 65	Depression	EPDS
Seo et al (2022) (44)	RCT	Significant reduction in depressive symptoms	3	The mobile CBT-based app (Happy Mother)	Intervention group: 50 Control group: 50	Depression	EPDS
Hulsbosch et al (2023) (45)	RCT	Significant reduction in depressive symptoms	1	Online mindfulness-based intervention	Intervention group: 109 Control group: 110	Depression	EDS
Suharwardy et al (2023) (46)	RCT	Significant reduction in depressive symptoms	3	The mental health chatbot smartphone application with perinatal-specific content	Intervention group: 96 Control group: 96	Depression	PHQ-9
Danaher et al (2023) (47)	RCT	Reduction in postpartum anxiety and depression	1	Perinatal version of the MMB eHealth program (MMB2; optimized for, but not limited to, smartphone use and incorporating text messages in a healthcare delivery setting)	Intervention group: 96 Control group: 95	Depression Anxiety	EPDS DASS-21
Leng et al (2023) (48)	RCT	Significant reduction in depressive symptoms	3	Mobile-delivered four-week mindfulness-based interventions (MBI)	Intervention group: 38 Control group: 37	Depression	EPDS
Dixit et al (2025) (49)	RCT	Significant reduction in depressive symptoms	3	MamaLift Plus (an 8-week digital therapeutic for the treatment of symptoms of PPD) that is used on a mobile device, such as a smartphone or tablet.	Intervention group: 140 Control group: 70	Depression	EPDS
Osman et al (2025) (50)	RCT	Reduction in postpartum anxiety and depression	3	Smart Mama intervention (smartphone app-based intervention)	Intervention group: 74 Control group: 74	Depression Anxiety	EPDS STAI

TA-ICBT, Therapist-Assisted, Internet-Delivered Cognitive Behavior Therapy; ICBT, Internet-delivered cognitive behavioral therapy; PIP, peer-support intervention program; CBT, cognitive behavioral therapy; IPT, interpersonal psychotherapy; MMB, MumMoodBooster; FTF, face-to-face; EDS, Edinburgh Depression Scale; STAI, The State-Trait Anxiety Inventory; PHQ-4, Patient Health Questionnaire-4; GAD-7, Generalized Anxiety Disorder 7-item scale; DASS-21, Depression Anxiety and Stress Scale Short Form; EPDS, Edinburgh Postnatal Depression Scale.

[a] Intervention delivery modality: 1 = Internet/web-based; 2 = Telephone-based; 3 = Mobile app-/chatbot-based.

and inconsistency across the included studies. A detailed summary of findings table is provided in Table 2.

Discussion

This systematic review investigated the effects of virtual psychological interventions, including internet/web-based, telephone-based, mobile app- and chatbot-based interventions, on anxiety and depression among women during the perinatal period, based on studies identified through searches conducted up to February 2026. The results of the present review suggested that various virtual psychological interventions may reduce anxiety and depression among women during the perinatal period.

The results of a randomized controlled trial (30) revealed that a minimal support, widely accessible internet behavioral activation program for postpartum depression is feasible to deliver to community populations when embedded within popular parenting sites. The findings of studies using internet/web-based cognitive behavioral therapy for the antenatal and postpartum period (28,32,34,35) indicated that an internet CBT program is a feasible, acceptable, and efficacious treatment option for women with anxiety or depression during pregnancy and postnatal. The results of interventional studies with approaches including TA-ICBT (33), Online mindfulness training (36, 45), Online 1-Day Cognitive Behavioral Therapy–Based Workshops (40), and MMB CBT (41) indicated a reduction in depression and anxiety during the postpartum period. One study used an optimized MomMoodBooster eHealth program to ameliorate perinatal depression, and its results support the effectiveness of using this program as a treatment option for depression in the perinatal period (47). Taken together, these findings suggest that internet/web-based interventions may be beneficial across different psychological approaches; however, differences in intervention duration, intensity, degree of therapist involvement, and participant characteristics make direct comparisons between individual programs difficult.

Among telephone-based interventions, the findings of studies on CBT by telephone (31) and interventions such as nurse-delivered telephone psychotherapy (39) revealed a significant effect on perinatal depression and anxiety. The findings of a study with the PIP (37) evaluating a technology-based intervention for preventing postnatal depression showed significant effectiveness in reducing the risk of postnatal depression and anxiety among new mothers. Compared with fully self-guided interventions, telephone-based approaches may provide greater opportunities for interpersonal support and professional

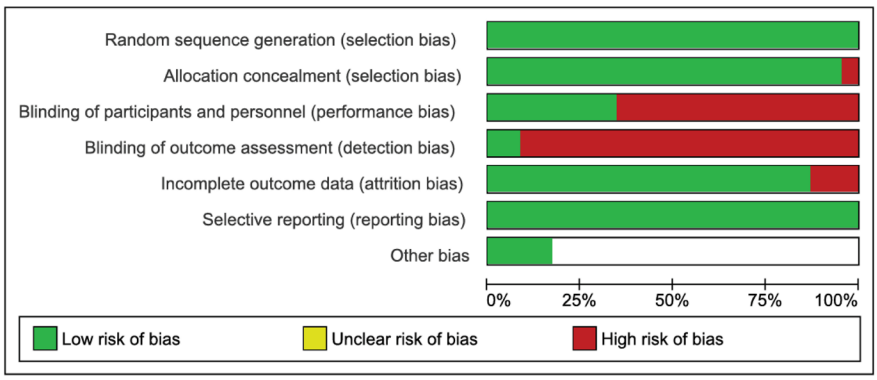

Figure 2. Risk of Bias Graph: Review Authors' Judgments About Each Risk of Bias Item Presented as Percentages Across All Included Studies

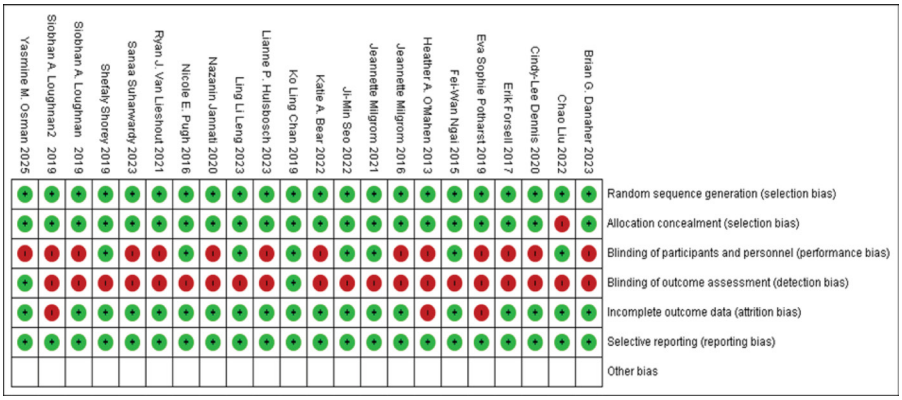

Figure 3. Risk of Bias Summary: Review Authors' Judgments About Each Risk of Bias Item for Each Included Study.

Table 2. Summary of Findings and Certainty of Evidence (GRADE) for Virtual Psychological Interventions in Depression and Anxiety in the Perinatal Period

Outcome	No. of studies	Participants	Direction of effect	Consistency of findings	Risk of bias	Imprecision	Indirectness	Publication bias	Certainty of evidence
Depression	12	2456	Favors intervention	Serious[a]	Serious[b]	No serious	No serious	Suspected	⊕⊕◯◯ Low
Depression and Anxiety	11	1677	Favors intervention	Serious[a]	Serious[b]	No serious	No serious	Suspected	⊕⊕◯◯ Low

GRADE: Grading of Recommendations Assessment, Development and Evaluation

GRADE Working Group grades of evidence:

[a] Downgraded by one level for inconsistency because the direction and magnitude of findings varied across studies and substantial clinical and methodological heterogeneity was observed across interventions, populations, outcome measures, and follow-up periods.

[b] Downgraded by one level for risk of bias because a substantial proportion of included studies had high risk of bias in the blinding domains, particularly blinding of participants and personnel and blinding of outcome assessment.

The findings were synthesized narratively without statistical pooling because substantial clinical and methodological heterogeneity precluded calculation of a meaningful overall pooled effect estimate.

guidance, which could contribute to treatment engagement and symptom improvement. Nevertheless, the limited number of telephone-based studies and differences in intervention content and intensity prevent firm conclusions regarding the relative effectiveness of this modality.

Chan et al, in their study, reported that a psychoeducational mobile App (smartphone-based intervention) was effective in reducing postnatal depression at 4 weeks postpartum (29). The findings of studies on CBT by App (38), MamaLift Plus Digital Therapeutic Mobile App (49), interventions such as Happy Mother App (44), and apps that used mindfulness (43,48) revealed a significant effect on perinatal depression and/or anxiety. Additionally, Suharwardy et al performed a study to assess the feasibility and impact of a mental health chatbot on postpartum mental health. The findings revealed high feasibility and efficacy in reducing depression scores (46). Bear et al, in their study, show that delivery of mindfulness via smartphones could be a viable and affordable resource for reducing postnatal depression and anxiety (42). Osman et al indicated a significant reduction in postpartum depressive and anxiety symptoms due to the Smart Mama application. This App had registration instructions, a homepage, and sessions (50). The findings suggest that mobile applications and chatbot-based programs may offer accessible and flexible approaches for supporting perinatal mental health. However, the interventions varied considerably in their content, duration, level of human involvement, and degree of interactivity. In particular, chatbot-based evidence remains limited compared with other virtual modalities, with only a small number of studies available, and therefore its effectiveness should be interpreted cautiously.

Several factors may explain the variation in effectiveness observed across the included studies. First, intervention intensity differed substantially in terms of duration, number of sessions, frequency of contact, and amount of therapeutic content. Second, the extent of professional guidance varied from fully self-guided programs to interventions involving therapists, nurses, or other healthcare professionals. Greater professional involvement may facilitate individualized support, monitoring, and adherence, although the available evidence does not allow a direct comparison of guided and unguided interventions. Third, differences in baseline symptom severity may have influenced the observed effects, as interventions delivered to women with clinically elevated symptoms may produce different outcomes from those implemented among women with mild or subclinical symptoms. The timing of intervention may also be relevant, because psychological needs and contextual factors may differ between pregnancy and the postpartum period. Finally, the use of different outcome measurement instruments, including the EPDS, PHQ-9, GAD-7, STAI, and DASS-21, as well as differences in assessment time points and follow-up duration, may have contributed to variation in the reported findings. Therefore, differences in effectiveness should be interpreted in the context of these clinical and methodological characteristics rather than being attributed solely to the intervention delivery modality.

Strengths and Limitations

This review has several notable strengths. To the best of our knowledge, this review provides a comprehensive synthesis of the effects of multiple modalities of virtual psychological interventions—including internet/web-based interventions, mobile app-based interventions, and chatbot-based interventions—on perinatal depression and anxiety. The inclusion of these diverse virtual modalities, particularly smartphone applications and chatbot-based platforms, allows a broader assessment of technology-mediated psychological interventions during the perinatal period. The search strategy was extensive, covering major databases (e.g., PubMed, Web of Science, Scopus) up to February 2026 without language restrictions. Additionally, the included studies represented a total of 4,133 women with depression and/or anxiety, providing a broad body of evidence for the synthesis, and the quality of the included evidence was assessed using the GRADE approach, which adds methodological rigor despite the

final low-certainty rating. Furthermore, the inclusion of diverse interventional approaches (CBT, mindfulness, peer-support, and psychoeducation) offers a broad clinical perspective for maternal health providers.

Notwithstanding these strengths, several limitations should be considered when interpreting the findings. First, the number of studies evaluating smartphone app- and chatbot-based interventions was relatively limited, which restricts the strength and generalizability of conclusions regarding these newer digital modalities. Second, substantial clinical and methodological heterogeneity was observed across the included studies, particularly with respect to intervention modality and type, intervention characteristics, duration and intensity, timing of intervention (antenatal versus postpartum), outcome measurement instruments, and follow-up periods. This heterogeneity limits direct comparisons across studies and may affect the consistency and interpretability of the findings. Third, the overall certainty of evidence was limited according to the GRADE assessment, which reduces confidence in the estimated direction and magnitude of the observed effects.

In addition, potential publication bias should be considered, as studies with statistically significant or favorable findings may be more likely to be published. The methodological quality of the included studies also varied, and several studies had concerns regarding risk of bias, particularly in the blinding of participants and personnel and outcome assessment. These differences in methodological quality may have influenced the consistency and reliability of the findings.

Another important limitation was the variation in the level of professional support provided during intervention delivery. Some interventions were guided by healthcare professionals through regular contact, feedback, or monitoring, whereas others were largely unguided and required participants to engage with the intervention independently. Differences in the degree of guidance may influence adherence, engagement, and intervention efficacy, as professional support may facilitate motivation and completion of intervention components, while unguided interventions may be more vulnerable to reduced engagement or incomplete adherence. Conversely, unguided digital interventions may provide greater accessibility, flexibility, and scalability. Because the included studies varied substantially in the extent and frequency of professional involvement, the independent effect of guided versus unguided delivery on adherence and intervention efficacy could not be determined and may have contributed to the observed heterogeneity. Finally, given the differences in culture across countries, the findings cannot be generalized to all circumstances.

Conclusions

This systematic review, which included 4,133 women in the perinatal period, suggested that virtual psychological interventions may reduce depression and anxiety symptoms. The findings of this review may provide useful evidence for researchers and maternal healthcare providers regarding the potential role of virtual psychological interventions during the perinatal period .Overall, the findings suggest that virtual psychological interventions may reduce depressive and anxiety symptoms; however, the certainty of the evidence was low according to the GRADE assessment, and substantial clinical and methodological heterogeneity was observed among the included studies. Considering the quality of the included studies and the limitations identified, future research should use more robust methods to evaluate interventions for reducing depression and anxiety during the perinatal period.

Authors' Contribution

Conceptualization: Shiva Shamsdanesh, Mahrokh Dolatian
Data curation: Shiva Shamsdanesh, Mahrokh Dolatian.
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Conflict of Interests

The authors declare that they have no competing interests.

Ethical Issues

This systematic review was conducted following approval by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.REC.1404.077).

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Data Availability Statement

The datasets used during the current study are available from the corresponding author upon reasonable request.

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Supplementary files

Supplementary file 1. Complete Search Strategies for All Databases.

References

1. Rallis S, Skouteris H, McCabe M, Milgrom J. A prospective examination of depression, anxiety and stress throughout pregnancy. Women Birth. 2014;27(4):e36-e42. doi:10.1016/j.wombi.2014.08.002
2. Fairbrother N, Janssen P, Antony MM, Tucker E, Young AH.

Perinatal anxiety disorder prevalence and incidence. J Affect Disord. 2016;200:148-155. doi:10.1016/j.jad.2015.12.082
3. Fisher J, Mello MC, Patel V, et al. Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. Bull World Health Organ. 2012;90(2):139G-149G. doi:10.2471/BLT.11.091850
4. Hendrick V, Altshuler LL, Cohen LS, Stowe ZN. Evaluation of mental health and depression during pregnancy: position paper. Psychopharmacol Bull. 1998;34(3):297-299.
5. O'Hara MW, Swain AM. Rates and risk of postpartum depression—a meta-analysis. Int Rev Psychiatry. 1996;8(1):37-54. doi:10.3109/09540269609037816
6. Leach LS, Poyser C, Fairweather-Schmidt AK. Maternal perinatal anxiety: a review of prevalence and correlates. Clin Psychol. 2017;21(1):4-19. doi:10.1111/cp.12058
7. Li X, Laplante DP, Paquin V, Lafortune S, Elgbeili G, King S. Effectiveness of cognitive behavioral therapy for perinatal maternal depression, anxiety and stress: a systematic review and meta-analysis of randomized controlled trials. Clin Psychol Rev. 2022;92:102129. doi:10.1016/j.cpr.2022.102129
8. Muzik M, McGinnis EW, Bocknek E, et al. PTSD symptoms across pregnancy and early postpartum among women with lifetime PTSD diagnosis. Depress Anxiety. 2016;33(7):584-591. doi:10.1002/da.22465
9. Alder J, Fink N, Bitzer J, Hösli I, Holzgreve W. Depression and anxiety during pregnancy: a risk factor for obstetric, fetal and neonatal outcome? A critical review of the literature. J Matern Fetal Neonatal Med. 2007;20(3):189-209. doi:10.1080/14767050701209560
10. Chung TK, Lau TK, Yip AS, Chiu HF, Lee DT. Antepartum depressive symptomatology is associated with adverse obstetric and neonatal outcomes. Psychosom Med. 2001;63(5):830-834. doi:10.1097/00006842-200109000-00017
11. Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction. Arch Gen Psychiatry. 2010;67(10):1012-1024. doi:10.1001/archgenpsychiatry.2010.111
12. Yonkers KA, Smith MV, Forray A, et al. Pregnant women with posttraumatic stress disorder and risk of preterm birth. JAMA Psychiatry. 2014;71(8):897-904. doi:10.1001/jamapsychiatry.2014.558
13. Stein A, Pearson RM, Goodman SH, et al. Effects of perinatal mental disorders on the fetus and child. Lancet. 2014;384(9956):1800-1819. doi:10.1016/S0140-6736(14)61277-0
14. Howard LM, Khalifeh H. Perinatal mental health: a review of progress and challenges. World Psychiatry. 2020;19(3):313-327. doi:10.1002/wps.20769
15. Zhu D, Fialke C, L'Esperance S, et al. Exploring telemental health practice before, during, and after the COVID-19 pandemic. J Telemed Telecare. 2024;30(1):72-78. doi:10.1177/1357633X211025943
16. Austin T, Tahsin F, Larsen D, Baker R, Steele Gray C. Exploring the sustainability of virtual care interventions: a scoping review. PLOS Digit Health. 2025;4(6):e0000893. doi:10.1371/journal.pdig.0000893
17. Tao X, Zhu W, Chu M, Zhang Y. Nurse-led virtual interventions in managing chronic diseases: a protocol for a systematic review of randomised controlled trials. BMJ Open. 2023;13(5):e070583. doi:10.1136/bmjopen-2022-070583
18. Watt JA, Fahim C, Straus SE, Goodarzi Z. Barriers and facilitators to virtual care in a geriatric medicine clinic: a semi-structured interview study of patient, caregiver and healthcare provider perspectives. Age Ageing. 2022;51(1):afab218. doi:10.1093/ageing/afab218
19. Liu L, Goodarzi Z, Jones A, Posno R, Straus SE, Watt JA. Factors associated with virtual care access in older adults: a cross-sectional study. Age Ageing. 2021;50(4):1412-1415. doi:10.1093/ageing/afab021
20. Aștefanei A, Miclea M. Technology-based interventions for the treatment of peripartum depression: an in-depth systematic review. Int J Cogn Behav Ther. 2025;18(1):53-93. doi:10.1007/s41811-025-00245-4
21. Lau Y, Cheng JY, Wong SH, Yen KY, Cheng LJ. Effectiveness of digital psychotherapeutic intervention among perinatal women: a systematic review and meta-analysis of randomized controlled trials. World J Psychiatry. 2021;11(4):133-146. doi:10.5498/wjp.v11.i4.133
22. Loughnan SA, Joubert AE, Grierson A, Andrews G, Newby JM. Internet-delivered psychological interventions for clinical anxiety and depression in perinatal women: a systematic review and meta-analysis. Arch Womens Ment Health. 2019;22(6):737-750. doi:10.1007/s00737-019-00961-9
23. Silang KA, Sanguino H, Sohal PR, et al. eHealth interventions for treatment and prevention of depression, anxiety, and insomnia during pregnancy: systematic review and meta-analysis. JMIR Ment Health. 2022;9(2):e31116. doi:10.2196/31116
24. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Rev Panam Salud Publica. 2022;46:e112. doi:10.26633/RPSP.2022.112
25. Higgins JP, Altman DG, Gøtzsche PC, et al; Cochrane Bias Methods Group; Cochrane Statistical Methods Group. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. BMJ. 2011;343:d5928. doi:10.1136/bmj.d5928
26. Campbell M, McKenzie JE, Sowden A, et al. Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. BMJ. 2020;368:l6890. doi:10.1136/bmj.l6890
27. Goldkuhle M, Jakob T, Kreuzberger N, Skoetz N. "Transferability": is GRADE the solution?. Z Evid Fortbild Qual Gesundhwes. 2019;140:52-57. doi:10.1016/j.zefq.2019.02.001
28. Forsell E, Bendix M, Holländare F, et al. Internet delivered cognitive behavior therapy for antenatal depression: a randomised controlled trial. J Affect Disord. 2017;221:56-64. doi:10.1016/j.jad.2017.06.013
29. Chan KL, Leung WC, Tiwari A, Or KL, Ip P. Using smartphone-based psychoeducation to reduce postnatal depression among first-time mothers: randomized controlled trial. JMIR Mhealth Uhealth. 2019;7(5):e12794. doi:10.2196/12794
30. O'Mahen HA, Woodford J, McGinley J, et al. Internet-based behavioral activation—treatment for postnatal depression (Netmums): a randomized controlled trial. J Affect Disord. 2013;150(3):814-822. doi:10.1016/j.jad.2013.03.005
31. Ngai FW, Wong PWC, Leung KY, Chau PH, Chung KF. The effect of telephone-based cognitive-behavioral therapy on postnatal depression: a randomized controlled trial. Psychother Psychosom. 2015;84(5):294-303. doi:10.1159/000430449
32. Milgrom J, Danaher BG, Gemmill AW, et al. Internet cognitive behavioral therapy for women with postnatal depression: a randomized controlled trial of MumMoodBooster. J Med Internet Res. 2016;18(3):e49. doi:10.2196/jmir.4993
33. Pugh NE, Hadjistavropoulos HD, Dirkse D. A randomised controlled trial of therapist-assisted, internet-delivered cognitive behavior therapy for women with maternal depression. PLoS One. 2016;11(3):e0149186. doi:10.1371/journal.pone.0149186
34. Loughnan SA, Joubert AE, Grierson A, Andrews G, Newby JM. A randomized controlled trial of 'MUMentum Pregnancy':

internet-delivered cognitive behavioral therapy program for antenatal anxiety and depression. J Affect Disord. 2019;243:381-390. doi:10.1016/j.jad.2018.09.057
35. Loughnan SA, Joubert AE, Grierson A, Andrews G, Newby JM. A randomised controlled trial of 'MUMentum postnatal': internet-delivered cognitive behavioural therapy for anxiety and depression in postpartum women. Behav Res Ther. 2019;116:94-103. doi:10.1016/j.brat.2019.03.001
36. Potharst ES, Baartmans JMD, Aktar E. A randomized control trial evaluating an online mindful parenting training for mothers with elevated parental stress. Front Psychol. 2019;10:1550. doi:10.3389/fpsyg.2019.01550
37. Shorey S, Chee CYI, Ng ED, Lau Y, Dennis CL, Chan YH. Evaluation of a technology-based peer-support intervention program for preventing postnatal depression (part 1): randomized controlled trial. J Med Internet Res. 2019;21(8):e12410. doi:10.2196/12410
38. Jannati N, Mazhari S, Ahmadian L, Mirzaee M. Effectiveness of an app-based cognitive behavioral therapy program for postpartum depression in primary care: a randomized controlled trial. Int J Med Inform. 2020;141:104145. doi:10.1016/j.ijmedinf.2020.104145
39. Dennis CL, Grigoriadis S, Zupancic J, Kiss A, Ravitz P. Telephone-based nurse-delivered interpersonal psychotherapy for postpartum depression: nationwide randomised controlled trial. Br J Psychiatry. 2020;216(4):189-196. doi:10.1192/bjp.2019.275
40. Van Lieshout RJ, Yang L, Layton H, et al. Effect of online 1-day cognitive behavioral therapy–based workshops plus usual care vs usual care alone for postpartum depression: a randomized clinical trial. JAMA Psychiatry. 2021;78(11):1200-1207. doi:10.1001/jamapsychiatry.2021.2488
41. Milgrom J, Gemmill AW, Bilszta JL, et al. Internet and face-to-face cognitive behavioral therapy for postnatal depression compared with treatment as usual: randomized controlled trial of MumMoodBooster. J Med Internet Res. 2021;23(12):e17185. doi:10.2196/17185
42. Bear KA, Barber CC, Medvedev ON. The impact of a mindfulness app on postnatal distress. Mindfulness. 2022;13(11):2765-2776. doi:10.1007/s12671-022-01992-7
43. Liu C, Liang L, Zhang J, et al. Positive intervention effect of mobile health application based on mindfulness and social support theory on postpartum depression symptoms of puerperae. BMC Womens Health. 2022;22(1):413. doi:10.1186/s12905-022-01996-4
44. Seo JM, Kim SJ, Na H, Kim JH, Lee H. Effectiveness of a mobile application for postpartum depression self-management: evidence from a randomised controlled trial in South Korea. Healthcare (Basel). 2022;10(11):2185. doi:10.3390/healthcare10112185
45. Hulsbosch LP, Potharst ES, Schwabe I, Boekhorst MG, Pop VJ, Nyklíček I. Online mindfulness-based intervention for women with pregnancy distress: a randomized controlled trial. J Affect Disord. 2023;332:262-272. doi:10.1016/j.jad.2023.04.009
46. Suharwardy S, Agostini M, Nouri SS, et al. Feasibility and impact of a mental health chatbot on postpartum mental health: a randomized controlled trial. AJOG Glob Rep. 2023;3(3):100165. doi:10.1016/j.xagr.2023.100165
47. Danaher BG, Gemmill AW, Milgrom J, et al. Trial of a patient-directed eHealth program to ameliorate perinatal depression: the MomMoodBooster2 practical effectiveness study. Am J Obstet Gynecol. 2023;228(4):453.e1-453.e10. doi:10.1016/j.ajog.2022.09.027
48. Leng LL, Yin XC, Chan CLW, Ng SM. Antenatal mobile-delivered mindfulness-based intervention to reduce perinatal depression risk and improve obstetric and neonatal outcomes: a randomized controlled trial. J Affect Disord. 2023;335:216-227. doi:10.1016/j.jad.2023.04.133
49. Dixit S, Malladi I, Shankar S, Shah A. Evaluating the efficacy of MamaLift Plus digital therapeutic mobile app for postpartum depression (SuMMER): randomized, placebo-controlled pivotal trial. J Med Internet Res. 2025;27:e69050. doi:10.2196/69050
50. Osman YM, Hassan H, Abd El-Aal N, et al. Effectiveness of Smart Mama application on postpartum depression, anxiety, and maternal-infant bonding among women during the postnatal period: a randomized controlled trial. BMC Nurs. 2025;24(1):452. doi:10.1186/s12912-025-03072-2

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