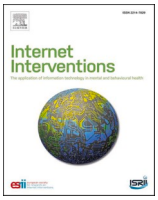
Internet Interventions 37 (2024) 100759

Contents lists available at ScienceDirect

Internet Interventions

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



Effectiveness of online psychological interventions to prevent perinatal depression in fathers and non-birthing partners: A systematic review and meta-analysis of randomized controlled trials

Paula de-Juan-Iglesias [a,b], Irene Gómez-Gómez [e], Carlos Barquero-Jimenez [a,b], Claire A. Wilson [c,d], Emma Motrico [a,b,*]

[a] Institute of Biomedicine of Seville (IBiS), Hospital Universitario Virgen del Rocío, CSIC, University of Seville, Spain
[b] Department of Developmental and Educational Psychology, Universidad de Sevilla, Spain
[c] Institute of Psychiatry, Psychology and Neuroscience, Kings College London, United Kingdom
[d] South London and Maudsley NHS Foundation Trust, United Kingdom
[e] Department of Psychology, Universidad Loyola, Seville, Spain

ARTICLE INFO

Keywords:
Perinatal depression
Fathers
Prevention
Internet interventions
Systematic review
Meta-analysis

ABSTRACT

Little is known about the effectiveness of online preventive interventions for paternal perinatal depression (PPD). This systematic review (SR) and meta-analysis (MA) of randomized controlled trials (RCTs) evaluated the effectiveness of online psychological interventions to prevent PPD in fathers and non-birthing partners. The PRISMA 2020 guidelines were followed. The search was conducted in eight electronic databases and other sources from inception to 12 May 2023. The pooled standardized mean difference (SMD) was computed using random-effect models. Seven RCTs were included in the SR and 6 were included in the MA, representing 1.042 fathers from five different countries. No trials focused on non-birthing partners were found. The pooled SMD was −0.258 [95 % confidence interval − 0.513 to −0.004; $p < 0.047$]. The heterogeneity was moderate (I2 = 51 %; 95%CI [0 % to 81 %]) and nonsignificant ($p = 0.070$). However, sensitivity analyses showed that the effectiveness was stable only when the fixed effect model and the Egger's g were used to estimate the pooled SMD.

No publication bias was found. Only two RCTs had an overall low risk of bias assessed by using the Cochrane ROB 2.0 tool. The quality of evidence based on GRADE was very low. In conclusion, online psychological interventions may be effective for the prevention of PPD. More high-quality evidence is warranted.

1. Introduction

The perinatal period is considered a critical life-course transition that requires maternal, paternal, couple, and family adjustments (Cowan and Cowan, 2012). Specifically, fathers and non-birthing partners in the twenty-first century are more interested in caring for their children and consider it an essential part of their identity (Livingston and Parker, 2019). New parents must balance the obligations of their social, professional, and personal lives, in addition to their families' financial strains and emotional demands (Pérez and Brahm, 2017). All of this occurs while assuming a new and unknown role and trying to face the demands of coparenting (Pérez and Brahm, 2017). Even when desired and planned, fatherhood may be challenging and demanding. Parenthood can have a detrimental effect on men's mental health, leading to an increased risk of depression (Kim and Swain, 2007; Veskrna, 2010). Paternal perinatal depression (PPD) is characterized by mood alterations during the perinatal period (from pregnancy to one year postpartum), such as irritability, sleeplessness, fatigue and lack of appetite. In addition, other symptoms are related to interpersonal conflicts and behavioural problems such as impulsivity, avoidance behaviour, substance abuse, and violence (Peixoto et al., 2022). PPD is not recognized as an official psychiatric disorder due to the absence of diagnostic criteria in the DSM-5 (American Psychiatric Association, 2013). There is a lack of consensus about its defining factors that could be influenced by the presence of methodological issues in the assessment and complex nature of PPD (Bruno et al., 2020). Nonetheless, the

* Corresponding author at: Universidad de Sevilla, C/ Camilo José Cela, s/n., 41018 Seville, Spain.
E-mail addresses: pdejuan@us.es (P. de-Juan-Iglesias), igomezg@uloyola.es (I. Gómez-Gómez), cbarquero@us.es (C. Barquero-Jimenez), claire.1.wilson@kcl.ac.uk (C.A. Wilson), emotrico@us.es (E. Motrico).

https://doi.org/10.1016/j.invent.2024.100759
Received 9 September 2023; Received in revised form 29 June 2024; Accepted 12 July 2024
Available online 18 July 2024

prevalence of PPD ranges from 8 % to 13 % in new fathers (Cameron et al., 2016; Paulson and Bazemore, 2010) and 15–20 % of women meet the diagnostic criteria for perinatal depression or/and anxiety disorder (Fawcett et al., 2019).

When left untreated, PPD negatively affects fathers' and mothers mental and physical health (Admon et al., 2021; Chhabra et al., 2020). It is well known that mental disorders in parents may harm family functioning and children's well-being (Stein et al., 2018). PPD is associated with increased symptoms of depression in mothers during pregnancy and the first six months postpartum. It has been established that depression in fathers and mothers is related and codependent (Paulson et al., 2016) Furthermore, PPD is linked to increased community care costs (Edoka et al., 2011).

PPD interventions are crucial for the well-being of new fathers and their families (Rodrigues et al., 2022). The disease burden of PPD cannot be alleviated by treatment alone. Therefore, reducing the number of new cases is necessary, which can only be accomplished through prevention (Cuijpers et al., 2012). Psychological interventions are effective for the prevention of perinatal depression in women (Motrico et al., 2023). Currently, online psychological interventions (provided through the internet, mobile devices, or tablet computers) are attracting more interest for preventing depression. Compared to face-to-face interventions, online interventions are remarkably accessible and sustainable and provide low-cost scalable opportunities (Rigabert et al., 2020). Evidence has shown that online interventions are effective in preventing maternal perinatal depression (Martín-Gómez et al., 2022; Motrico et al., 2023). Nevertheless, the evidence of the effectiveness of online interventions in fathers and non-birthing partners is unknown. Therefore, as far as we know, this is the first SR&MA study to evaluate the effectiveness of online preventive interventions in fathers and other non-birthing partners. Given the reasons mentioned above, the aim of this study was to conduct a SR&MA of randomized control trials (RCTs) assessing the effectiveness of online psychological interventions for preventing PPD in fathers and non-birthing partners. The secondary aim was to analyse the theories and components of the interventions and describe the modules designed specifically for fathers and non-birthing partners.

2. Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews and meta-analysis (Page et al., 2021). The study protocol was previously registered in PROSPERO (registration number: CRD42022367282).

2.1. Eligibility criteria

The inclusion and exclusion criteria of the studies were defined based on the Population (P), Intervention (I), Comparison (C), Outcome (O), and Study Design (S) (PICO-S) model (Higgins and Green, 2011). Specifically, the included studies met the following established eligibility criteria: a) Studies including fathers or women's non-birthing partners (adults or teenagers) during the perinatal period. To ensure that RCTs evaluated the prevention of perinatal depression (P), studies in which the target population included patients who met the diagnostic criteria for clinical depression were excluded, as these interventions are considered treatments. b) Studies including online psychological interventions delivered completely online (through the internet, mobile devices, or tablet computers) or blended interventions (combined face-to-face interventions and at least one online intervention) (I); c) Studies in which the comparators were usual care, attention control (e.g., active control), waiting lists or no intervention (C); d) Studies in which the outcome was the incidence of new cases of perinatal depression and/or the reduction of perinatal depressive symptoms using different measures to assess the outcome, we selected the instrument with the best properties adapted to the setting and country in which the intervention was performed, ensuring representativeness (Cuijpers et al., 2016). When different scales were used to assess PPD in the same study and one of them was the 10-item Edinburgh Postnatal Depression Scale (EPDS), the EPDS was selected first because it is a specific screening tool for PPD and is widely used (Shafian et al., 2022). RCTs reported measures of perinatal depression and other diseases in combination (e.g., anxiety). e) We selected RCTs because this experimental design has the least bias (S). All kinds of RCTs, such as randomized controlled pilot studies and cluster and hybrid implementation-effectiveness studies, were included. Finally, no limits were imposed on the study publication language or setting (see Supplementary Material, Appendix A, Table A.1) for a detailed description of the eligibility criteria).

2.2. Search strategy and study selection

The search for eligible articles was conducted in the following electronic databases from inception to 12 May 2023: literature databases such as the PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL Complete), PsycINFO, Scopus, and Web of Science (WoS) databases and databases of clinical trial records such as the Cochrane Central Register of Controlled Trials (CENTRAL), ClinicalTrials.gov, Australian New Zealand Clinical Trials Registry (ANZCTR), Beacon 2.0 and Psychotherapy Randomized Controlled and Comparative Trials databases. Grey literature in Opengrey was explored, and experts in the field were asked about trial references or published studies not identified in the search. In addition, the reference lists of the included studies and other pertinent systematic reviews and meta-analyses on related subjects were manually searched. Thesis dissertations and ongoing trials could have been included if the study had available data about effectiveness. The search was piloted in PubMed and then adapted to the other databases. The search strategy used for each database is available in Supplementary Material, Appendix B.

After removing duplicate records, two independent researchers (PD-J and CB-J) separately searched and screened articles by title and abstract according to the inclusion criteria. Then, the full texts of articles included by title and abstract screening were analysed. Disagreements were resolved by a third independent collaborator (EM).

2.3. Data extraction

Two researchers (PD-J and CB-J) separately extracted data on the prespecified characteristics of the included studies. Disagreements were resolved by consensus between the two researchers. Data were reported in a data extraction sheet. The interventions were described according to the modules in each programme and whether there were modules designed specifically for fathers or non-birthing partners or not. The preventive interventions were classified into: universal, directed at all participants; selective, targeting at-risk participants; and indicated, for participants experiencing symptoms of mental disorders (Cuijpers, 2022).

For the qualitative synthesis, the following data were extracted from the included studies: publication characteristics (author, year, country), demographics of the target population, and type of prevention (universal, selective, indicated). The number of participating couples and fathers, their allocation to intervention and control groups, intervention and control names, and delivery format (blended or online) were indicated. Information on psychological approach, perinatal phase, number of modules, intervention duration, and activity format (couple or individual) was included. The intervention provider and setting, recruitment strategy, dropout rates, type of outcome assessment for PPD prevention, and number of outcome evaluations were also reported. Studies lacking the necessary qualitative or quantitative data were excluded from the quantitative synthesis.

2.4. Risk of bias assessment

To examine the risk of bias in the included studies, the Cochrane risk-of-bias tool was used (RoB 2; Sterne et al., 2019), which comprises five domains: 1) bias related to the randomization process; 2) bias attributed to deviations from the intended interventions; 3) bias as a result of missing data; 4) bias in the measurement of the outcome; and 5) bias due the selection of the reported outcomes. Bias is scored using three different categories: "low risk," "some concerns," and "high risk." Each domain was evaluated, and the overall bias was determined according to the five domain scores. A study was considered to have an overall "high risk of bias" if it received a "high risk of bias" rating in at least one domain (Sterne et al., 2019). The risk of bias in the selected studies was independently assessed by three reviewers (PD-J, CB-J, CW). Independently, each of them evaluated all the studies and had to reach an agreement. In case of discrepancies, a fourth reviewer (EM) had to solved them.

Following previous studies, a quantitative evaluation of the risk of bias was performed for each study to get a more comprehensive assessment (Gómez-Gómez et al., 2024). Quantitatively, in domains 1–5, zero points were given for a low risk of bias, one point was given for some concerns, and two points were given for a high risk of bias. Thus, risk of bias scores varied from 0 to 10 points, indicating the risk of bias in RCTs as low for a score $\leq$ 2 points, moderate for a score from 3 to 4 points, and high for a score $\geq$ 5 points. Domains 1 to 5 were evaluated qualitatively following the algorithm for the suggested judgement of risk of bias.

2.5. Meta-analytical procedure

Comprehensive Meta-Analysis (CMA) software V.4 (Borenstein et al., 2009) and STATA-Release 18 (StataCorp, 2023) were used to conduct statistical analysis. The standardized mean difference (SMD) between the intervention and control groups at the first post-intervention and postpartum measures (Martín-Gómez et al., 2022) were used to pool the results using Cohen's d. The mean and standard deviation were extracted from each study to calculate the SMD. If the studies reported other statistical information such as the event rate, the CMA software was used to calculate the equivalent SMD. Specifically, a negative pooled SMD denoted a greater reduction in symptoms of PPD in the intervention group compared to the control group. The effect size was interpreted using Cohen's proposal, with the following criteria: 0.20 indicates a small effect size, 0.50 implies a moderate effect size, and 0.80 represents a large effect size (Cohen, 1989).

Due to the variability of the population included in the RCTs, a random effect model was chosen for calculating the pooled SMD (Higgins and Green, 2011). Despite the EPDS mainly being used in mothers, it is considered a reliable measure of PPD in fathers (Berg et al., 2022), so this outcome measure was chosen for the meta-analysis when multiple measures were available.

The heterogeneity between the studies was evaluated through visual inspection of the forest plots and Cochran's Q statistic and its *p*-value. Additionally, the I^2 index, which measures heterogeneity on a scale of 0 to 100 %, was used to quantify heterogeneity and interpreted as follows: 0–40 % implied irrelevant heterogeneity, 30–50 % implied moderate heterogeneity, 60–90 % implied moderate heterogeneity, and75–100 % implied the presence of substantial heterogeneity (Higgins and Green, 2011). Sensitivity analyses were performed to explore variations in the pooled SMD according to 1) the fixed-effects model; 2) Hedges' g; 3) the average of all post-intervention follow-up measures in each study; 4) The exclusion of the RCT that most increased the heterogeneity between studies, as in previous studies (Gómez-Gómez et al., 2024) and 5) the exclusion of the RCT that applied a different screening instrument compared to the rest of the studies. In addition, sensitivity analyses were performed 6) excluding the studies with a high risk of bias and 7) including studies with a low risk of bias based on the quantitative and qualitative assessments. To identify the article contributing the most to heterogeneity among the studies, each article was sequentially excluded from the MA, and the variations in the percentage of heterogeneity were examined after each exclusion. The study that contributed the most to heterogeneity was identified as the one whose removal from the MA resulted in the largest reduction in heterogeneity percentage.

Publication bias was explored by visual inspection of the funnel plot (Stern et al., 2001) and by the trim-and-fill procedure (Duval and Tweedie, 2000). Egger's test (Stuck Chief et al., 1998) and Begg and Mazumdar rank correlation (Begg and Mazumdar, 1994) were also performed.

2.6. Quality of the evidence

We followed the Grading of Recommendations Assessment, Development and Evaluation (GRADE) working group methodology for assessing the certainty of the evidence (Balshem et al., 2011). The following five domains were assessed: risk of bias, consistency, directness, imprecision (random error), and publication bias (Guyatt et al., 2011). The GRADE methodology distinguishes four quality categories: high, moderate, low and very low.

3. Results

3.1. Study selection

A total of 7.879 records were obtained through the database search (see Fig. 1 to review the flow chart). From the total of records, 5637 were screened by title and abstract, 13 of which met the inclusion criteria and were assessed for eligibility based on full text. In parallel, 8 records were identified from citation searching, and all were excluded by full-text screening (see Supplementary Material Appendix C, Tables C.1 and C.2). Finally, 7 studies were included in the SR (Feinberg et al., 2020; Kavanagh et al., 2021; Missler et al., 2020; Shorey et al., 2017, 2019a, 2019b, 2023; Sulaiman and Bloomberg, 2021), and 6 in the MA, due to the unavailability of the requested data from one study (Shorey et al., 2023).

3.2. Study characteristics

The most relevant characteristics of the seven included studies are specified in Table 1. The RCTs were published from 2017 to 2023 in five different countries (Singapore ($n = 3$), the USA ($n = 1$), Australia (n = 1), The Netherlands (n = 1), and Pakistan (n = 1). Four of the seven RCTs included specific modules designed for fathers. Four of the seven RCTs included specific modules designed for fathers, in addition to the general content aimed at both mothers and fathers. The remaining three studies included the general content aimed at both mothers and fathers. The sample size ranged from 56 to 248 couples. Of those participants, the sample of fathers comprised less than half a percent of the total sample in two studies (Kavanagh et al., 2021; Missler et al., 2020). The mean age of fathers ranged from 30.2 (SD = 2.8) to 34.73 (SD = 5.67) years.

The reviewed studies focused on inclusive partner interventions for heterosexual couples provided from 24 to 38 weeks of gestation to 6 months postpartum. Four of the seven studies included in the SR were comprised of only first-time parents (Feinberg et al., 2020; Kavanagh et al., 2021; Shorey et al., 2023; Sulaiman and Bloomberg, 2021), and the remaining trials recruited both first-time parents and couples who had at least one child (Missler et al., 2020; Shorey et al., 2017, 2019a, 2019b). No trials focused on non-birthing partners were found.

The interventions were categorized as selective prevention (Feinberg et al., 2020), indicated prevention (Sulaiman and Bloomberg, 2021), or universal prevention (Missler et al., 2020; Shorey et al., 2017, 2019a, 2019b, 2023), and the psychological frameworks used included psychoeducational programs (Missler et al., 2020; Shorey et al., 2017,

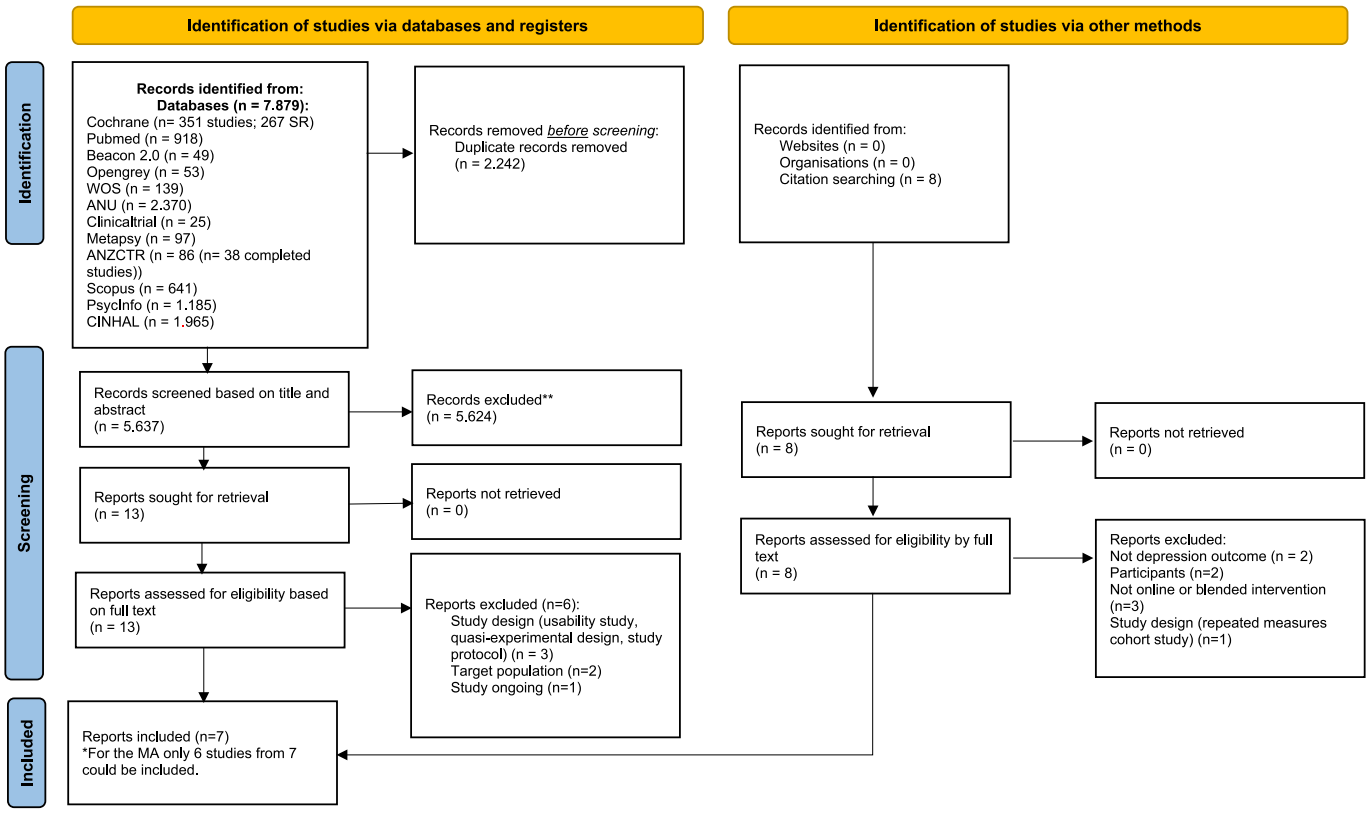


Fig. 1. PRISMA 2020 Flow chart of the study inclusion process.

2019a, 2019b, 2023), interpersonal therapy (IPT) (Feinberg et al., 2020; Sulaiman and Bloomberg, 2021), and cognitive behavioural therapy (CBT) (Kavanagh et al., 2021). The components of each intervention and the modules specifically focused on fathers are reported in Supplementary Material, Appendix D, Table D.1.

The interventions varied in duration, ranging from 4 (Shorey et al., 2017, 2019a, 2019b) to 24 weeks (Feinberg et al., 2020; Kavanagh et al., 2021; Shorey et al., 2023). Regarding the format, three interventions had an individual format in which the couples participated as independent users (Kavanagh et al., 2021; Shorey et al., 2017, 2019a, 2019b), and in the rest, the couples participated together (Feinberg et al., 2020; Missler et al., 2020; Shorey et al., 2023; Sulaiman and Bloomberg, 2021). Most interventions were provided online (Feinberg et al., 2020; Kavanagh et al., 2021; Missler et al., 2020; Shorey et al., 2017, 2019a, 2019b, 2023; Sulaiman and Bloomberg, 2021), with one study using a blended approach combining online and face-to-face sessions (Missler et al., 2020). All studies included in the MA reported symptoms of PPD, with three reporting them as primary outcomes and four as secondary outcomes. None of the studies reported any incidence using standardized interviews.

3.3. Quality of studies ROB 2.0

Based on the quantitative assessment, five studies had a low risk of bias (Kavanagh et al., 2021; Missler et al., 2020; Shorey et al., 2017, 2019a, 2019b, 2023), one had a moderate risk of bias (Feinberg et al., 2020), and the other had a high risk of bias (Sulaiman and Bloomberg, 2021). From the qualitative criteria, three studies were classified as having a low risk of bias (Kavanagh et al., 2021; Missler et al., 2020; Shorey et al., 2023), one was classified as having a moderate risk of bias (Shorey et al., 2019a, 2019b), and the last three were classified as having a high risk of bias (Feinberg et al., 2020; Shorey et al., 2017; Sulaiman and Bloomberg, 2021). Fig. 2 shows the traffic light plot of the assessment of the risk of bias.

3.4. Effectiveness of online psychological interventions to prevent PPD

The negative and significant pooled SMD (−0.258; $p = 0.047$) indicated a significant reduction of PPD symptoms in the intervention group compared with the control group, which means online psychological interventions were effective in reducing symptoms of PPD (see Fig. 3 and Appendix E, Table E.1 for the effect size of each study and the pooled effect size calculated by the random-effects model). Nevertheless, the effect size was small according to Cohen's proposal. There was moderate (I2 = 51 %; 95 % CI [0 % to 81 %]) and non-significant heterogeneity between the studies (Q = 10.23; $p = 0.069$).

It must be noted that, the number of studies included in the MA was small, and thus the evidence derived from this study is not certain. It must be noted that, the number of studies included in the MA was small, and thus the evidence derived from this study is not certain.

3.5. Sensitivity analyses

Regarding sensitivity analyses (see Table 2), the pooled SMD calculated using the fixed effect model slightly decreased but remained statistically significant −0.202 (95 % CI [−0.396 to −0.035]; $p = 0.018$; I^2 = 51.1 % [0 % to 81 %]). The pooled SMD estimated using Hedges´ g remained stable and significant −0.256 (95 % CI [−0.508 to −0.004]; p = 0.047; I^2 = 51.01 % [0 % to 81 %]). Conversely, the pooled SMD decreased and did not remain significant when the RCT that increased the heterogeneity the most was excluded −0.105 (95 % CI [−0.288 to 0.077]; $p = 0.259$; I^2 = 0.00 % [0 % to 75 %]). When the outcome was operationalized as the follow-up average, the pooled SMD increased and was statistically significant −0.375 (95 % CI [−0.589 to −0.161; p = 0.001). The exclusion of the RCT that used the CES-D to evaluate PPD slightly increased the pooled SMD, but it was not significant −0.266 (95 % CI [−0.557 to −0.025]; $p = 0.073$; I^2 = 60.9 % [0 % to 85 %]). The inclusion of RCTs with a low quantitative risk of bias produced a small decrease in the pooled SMD, which was no longer significant −0.229

Table 1
Characteristics of the RTC included in the systematic review and meta-analysis.

Author (year) country	Target population/type of prevention	Total N of couples/ total N of fathers (Intervention/ control)/ (% fathers) /Fathers' Age (SD)	Conditions (Intervention/control)	Intervention: online or blended (Orientation; Period; Number of modules; Duration of the intervention; Format)	Provider/setting	Recruitment strategy/fathers who dropped out at the last follow-up (IG)	Prevention PPD outcome assessment/Type of outcome measure (primary or secondary)	Outcome evaluations
Feinberg et al. (2020) USA	Heterosexual couples, ≥ 18 years old, μ = 24.4 weeks of gestation, first-time parents, one parent in the military/Selective	56 (29*/27) (50 %) 31 (5.3)	1. Family Foundations Program (FF) adapted to military 2. No treatment	Online (ITP; PRE and POST; 9 modules; 24 weeks; completed individually by couples)	Self-guided/ Internet	Online resources and worksite/ 21.05 % at T1	Depressive symptoms (CES—D, 14) Secondary	T0: upon recruitment during pregnancy; T1: 24 weeks postpartum
Kavanagh et al. (2021) Australia	Heterosexual couples, ≥18 years old, 26–38 weeks of gestation, first-time parents/Universal	248 (124/124) (44.35 %) 33 (0.27)	1. Childcare information (Baby Care) + interactive program (Baby Steps Wellbeing) 2. Active control group (Baby Care)	Online (CBT; PRE and POST; 9 modules; 24 weeks; individual)	Self-guided/ Internet	Health centre and community setting/16.1 % at T2	Depressive symptoms (EPDS, 10) Primary	T0: third trimester; T1: 12 weeks postpartum; T2: 24 weeks postpartum
Missler et al. (2020) The Netherlands	Women with or without partners, NA, < than 34 weeks of gestation, first-time parents, and those who already had a child or children/Universal	138 w + 96 p (45/44) (41.03 %) IG: 35.03 (4.08) CG: 34.73 (5.67)	1. Psycho-educational intervention 2. Waitlist control group	Blended (Psychoeducation and supportive program; PRE and POST; 4 modules; 8–10 weeks approx.; individual by couples)	Self-guided and clinical psychologist/ home visits and internet	Online media and midwifery practices/31.31 % at T3	Depressive symptoms (EPDS, 10) Secondary	T0: 26–34 weeks of gestation; T1: 34–36 weeks of gestation T2: 6 weeks postpartum; T3: 10 weeks postpartum
Shorey et al. (2023) Singapore	Heterosexual couples, ≥ 21 years old, > 24 weeks of gestation, first-time parents/Universal	200 (100/100) (50 %) IG: 32.1 (4.9) CG: 33.3 (5.4)	1. Supportive Parenting App (SPA) + peer support + care as usual 2. Care as usual	Online (Psychoeducation program; PRE AND POST; 6 modules; 24 weeks; individual)	Self-guided/ Internet	2 public health care institutions/ NA	Depressive symptoms (EPDS, 10) Secondary	T0: 24 weeks of gestation; T1: 4 weeks postpartum; T2: 8 weeks postpartum; T3: 16 weeks postpartum; T4: 24 weeks postpartum; T5: 36 weeks postpartum; T6: 48 weeks postpartum
Shorey et al. (2019a, b) Singapore	Heterosexual couples, ≥ 21 years old, > 28 weeks of gestation, first-time parents, and those who already had a child or children/ Universal	118 (59/59) (50 %) IG: 32.1 (4.6) CG: 33.9 (5.1)	1. Supportive Parenting Educational Program (SEPP) + care as usual 2. Care as usual	Online (telephone based) (Psychoeducation program; PRE and POST; 3 modules; 4 weeks; individual)	Self-guided and guided by the Research Assistant/Internet	Clinic of a tertiary hospital/16.98 % at T3	Depressive symptoms (EPDS, 10) Secondary	T0: third trimester; T1:2 days, T2: 4 weeks postpartum, T3:12 weeks postpartum
Shorey et al. (2017) Singapore	Heterosexual couples, ≥ 21 years old, 4 weeks postpartum, first-time parents, and those who already had a child or children/Universal	125 (63/62) (50 %) NA	1. Educational program + care as usual 2. Care as usual	Online (Psychoeducation program; POST; 3 modules; 4 weeks; individual)	Self-guided/ Internet	Local tertiary hospital in Singapore (day of discharge)/17.46 % at T1	Depressive symptoms (EPDS, 10) Primary	T0: before mothers were discharged from the hospital; T1: 4 weeks postpartum
Sulaiman and Bloomberg (2021) Pakistan	Heterosexual couples at risk of depression, years, >24 weeks of gestation/ Indicated	212 (102/104) (50 %) IG: 30.2 (2.8) CG: 30.67 (3.8)	1. Care as usual + Intervention Group Standard antenatal classes and eACoP 2. Care as usual	Online (IPT; PRE; 8 online videos in a website; 8 weeks; completed individually by couples)	Self-guided/ Internet	AKUH University hospital/48 % at T2	Depressive symptoms (EPDS, 10) Primary	T0 (second and third trimester; EPDS score of >12 were given a referral to the gynaecologist); T1: 4–6 weeks postpartum; T2: 12 weeks postpartum

Note. Approx. = approximately; CBT = Cognitive Behavioural Therapy; CES-D = 14-item version for Epidemiological Studies Depression Scale (Radloff, 1977); CG = Control group; eACoP = eHealth Antenatal Coparenting Intervention; EPDS = The 10-item Edinburgh Postnatal Depression Scale (Cox et al., 1987); IG = Intervention Group; ITP = Interpersonal Therapy; NA = Not Available; NI = No Information; P = partners; PPD = Paternal Perinatal Depression; T = time follow-up; W = women. * 29 allocated to the intervention but ultimately only 19 couples received the intervention; + = plus.

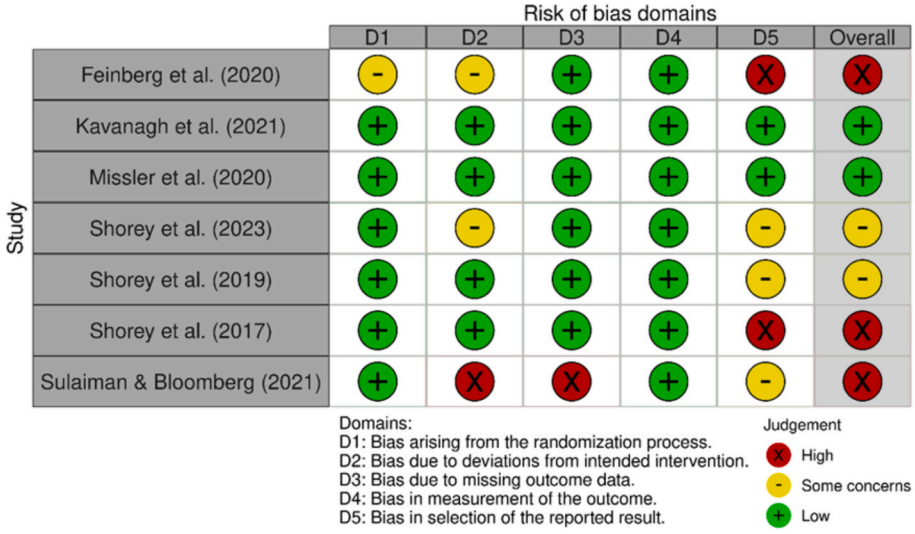


Fig. 2. Risk of bias traffic light plot.

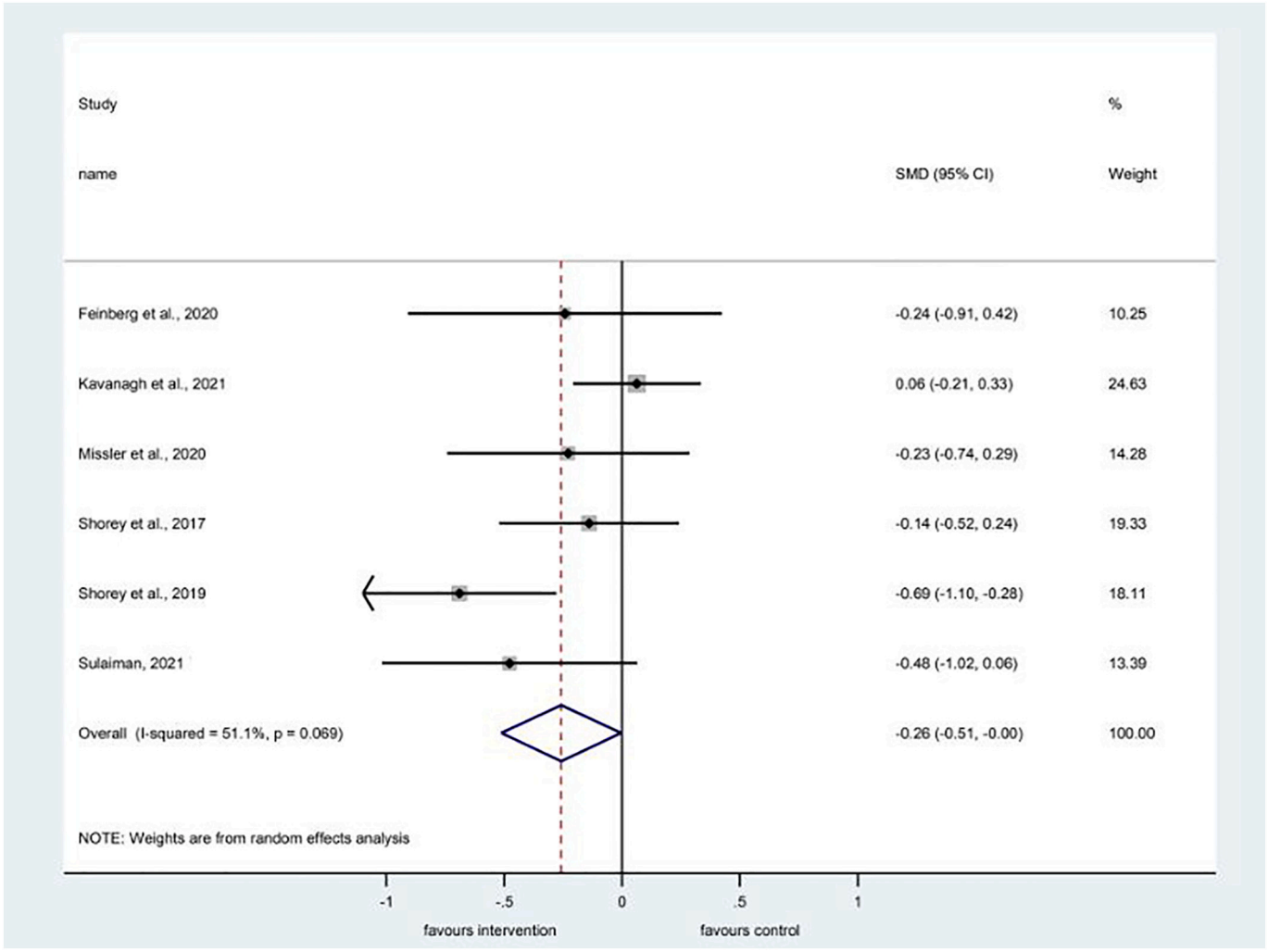


Fig. 3. The forest plot (random effects).

(95 % CI [−0.562 to 0.104]; $p = 0.178$; $I^2 = 66.99$ % [0 % to 89 %]). When the RCTs with a high quantitative risk of bias were excluded, the pooled SMD decreased −0.226 (95 % CI [−0.510 to −0.058]; $p = 0.118$; $I^2 = 56.20$ % [0 % to 84 %]); and it was not statistically significant. In addition, when the RCTs with a low qualitative risk of bias were included, the pooled SMD highly decreased and was no longer

Table 2
Effectiveness of psychological interventions to prevent paternal perinatal depression.

Primary analysis	Numbers of RCTs	SMD (95 % CI)	*P* Value	I^2
Effectiveness to prevent PPD[†]	6	−0.258 [−0.513 to −0.004]	0.047	51.14 % [0 %–81 %]
Sensitivity analyses				
Fixed effect	6	−0.202 [−0.396 to −0.035]	0.018	51.1 % [0 % to 81 %]
Hedges' g random effect	6	−0.256 [−0.508 to −0.004]	0.047	51.02 % [0 % to 81 %]
Shorey et al., 2019a, 2019b excluded [a]	5	−0.105 [−0.288 to 0.077]	0.259	0.00 % [0 % to 75 %]
Follow-up averaged[¶]	6	−0.375 [−0.589 to −0.161]	0.001	31.70 % [0 % to 72 %]
Feinberg et al., 2020 [§]	5	−0.266 [−0.557 to −0.025]	0.073	60.9 % [0 % to 85 %]
RCTs were excluded because of the high risk of bias (quantitative)[!]	5	−0.226 [−0.510 to −0.058]	0.118	56.20 % [0 % to 84 %]
Including only RCTs with low risk of bias (quantitative) [@]	4	−0.229 [−0.562 to 0.0104]	0.178	66.99 % [0 % to 89 %]
RCTs were excluded because of the high risk of bias (qualitative) [&]	3	0.270 [−0.749 to 0.210]	0.271	77.9 % [29 % to 93 %]
Including only RCTs with low risk of bias (qualitative)[?]	2	−0.001 [−0.240 to 0.239]	0.996	0.00 % [−% to -%]

[†] The first post-intervention measure that was assessed after delivery.
[a] Exclusion of the RCTs that most increased heterogeneity.
[¶] Taking the different post-intervention evaluations as an average.
[§] Exclusion of the RCT that used a different PPD outcome measure instead of EPDS (CES—D).
[!] Exclusion of RCTs according to the quantitative coding criteria: high risk of bias ≥5.
[@] Inclusion of RCTs according to the quantitative coding criteria: low risk of bias ≤2.
[&] Exclusion of RCTs according to the qualitative coding criteria: any item (1–5) coded as high risk of bias.
[?] Inclusion of RCTs according to the qualitative coding criteria: all items (1–5) coded as low risk of bias.

significant −0.001 (95 % CI [−0.240 to 0.239]; $p = 0.996$; $I^2 = 0.00$ % [−% to -%]).

3.6. Publication bias

Egger's test (intercept, −2.612; 95 % CI -7.702 to 2.481; $p = 0.228$) and Beg and Mazumdar's test ($z = 1.13$; $p = 0.260$) were not statistically significant. The funnel plot (see Supplementary Material, Appendix E, Fig. F.1) was symmetrical, and Duval and Tweedie's trim-and-fill procedure did not impute missing RCTs. Therefore, no statistical evidence for the presence of publication bias was found.

3.7. Quality of evidence

Since only RCTs were included, the initial assessment of the quality of the evidence was high. The heterogeneity was not significant, and there was no publication bias. However, the number of studies included was small, and thus the evidence derived from this study is not certain. According to the first category related to the risk of bias, three of the seven RCTs in the qualitative assessment had a high risk of bias, and one had a moderate risk of bias. Following the quantitative criteria, one study had a high risk of bias, and two had a moderate risk of bias. Additionally, the exclusion of the studies with an overall high risk of bias in the sensitivity analysis did not change the statistical significance. The inconsistency was very low since the heterogeneity was not significant; only one study did not have the expected effect on the intervention group, and only one study had a significant effect on the intervention group. Since the target population, interventions, and results measures were the same as those of the main objective, indirectness was low. Only a small number of RCTs were available; it was considered that they were not enough to increase the precision of the MA. In conclusion, the certainty of evidence was considered very low due to the "risk of bias", the small number of studies included and the "imprecision".

4. Discussion

4.1. Summary of findings

We found that online psychological interventions had a small and significant preventive effect on PPD; however, their effectiveness was not robust according to sensitivity analyses, because they did not support the main result. When excluding the study, through the leave-one-out method, which increases the heterogeneity between the studies the most, including only those with low or high risk of bias and the study which used a different PPD outcome measure (CES—D) the statistical significance disappeared. However, sensitivity analyses showed that the effectiveness was stable only when the fixed effect model and Egger's g were used to estimate the pooled SMD.

The heterogeneity was moderate and not statistically significant. These findings were derived from 7 RCTs including 1042 fathers from five countries. No RCTs investigated non-birthing partners. All included interventions were focused on heterosexual couples and were based on psychoeducational, interpersonal psychotherapy (IPT), and cognitive-behavioural therapy (CBT) principles; only four included specific modules for fathers. Only two RCTs had an overall low risk of bias. According to the GRADE methodology, the strength of the evidence was very low. We found no publication bias, although the test may not have been significant due to a lack of statistical power to interpret the results with robust evidence.

4.2. Comparison with previous research

Our findings are consistent with previous evidence from other SRs and MAs that showed that online psychological interventions are effective in preventing depression in the general population (Rigabert et al., 2020) and in postpartum depression in women without depression (Martín-Gómez et al., 2022). Furthermore, a recent umbrella review found that psychological interventions are effective in preventing perinatal depression (Motrico et al., 2023). Unlike previous reviews, we found only a few studies with a very low level of evidence, thus our results should be interpreted with caution. Even though we did not find studies specifically focused on non-birthing partners, they are particularly important to consider in light of changes to family structures (Fisher and Glangeaud-Freudenthal, 2023). Although birth rates are increasing within LGBTQIA+ (Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual +) communities and perinatal mental health disorders have a significant impact, this area remains under-researched (Howat et al., 2023).

However, to date, in comparison to previous research, most preventive interventions delivered to fathers have been conducted face-to-face, highlighting a scientific gap in online interventions focused on fathers (Shorey et al., 2019a). This study reveals the necessity of developing online programs to prevent PPD in fathers and non-birthing partners in order to support them in the crucial and challenging period of parenthood. Only four (Kavanagh et al., 2021; Shorey et al., 2017, 2019a, 2019b, 2023) of the seven studies included specific modules for

fathers in conjunction with dyad sessions. Kavanagh et al. (2021) developed a chapter related to promoting individual fathers' well-being and infant care information targeted specifically to them. Mothers could have access to these modules if they wished (Kavanagh et al., 2021). Nonetheless, this was the unique study that obtained an SMD that favoured the control group. The use of an active control group that received part of the intervention to compare with the experimental group could explain this result (Boot et al., 2013).

Shorey et al. (2023) also introduced content that directly targeted fathers' well-being, as in the study of Kavanagh et al. (2021). Their app offered knowledge-based content about the prevalence of postpartum depression among fathers and their role, and significant others were introduced that could act as caregivers, such as grandparents, during the perinatal period. The intervention also included informational videos, audio clips in which interviews were shown about a father's role during the perinatal period and push notifications that provided specific supportive tips for fathers during the postnatal period.

The other two studies that offered modules for fathers indirectly targeted their wellbeing, explaining their supportive role to the mother (Shorey et al., 2017) and the father's role during the postnatal period (Shorey et al., 2019a, 2019b). They also directly targeted the fathers' well-being in these shared modules, as in the interventions that applied the same modules for fathers and mothers (Feinberg et al., 2020; Missler et al., 2020; Sulaiman and Bloomberg, 2021). Specifically, addressing the needs of both parents during pregnancy and the postpartum period (Shorey et al., 2017; Shorey et al., 2019a, 2019b) was introduced as a standard module for fathers and mothers rather than a separate module for fathers.

4.3. Strengths and limitations

This study has several strengths. The main one is that, to the best of our knowledge, this is the first SR and MA to analyse the effectiveness of online interventions to prevent PPD in fathers and non-birthing partners. The search process was comprehensive and included recognized databases, as well as exploration of the grey literature and additional hand searches. A wide range of search terms without language, publication year, or setting restrictions ensured a sensitive search. The study specifically reviewed RCTs that incorporated various psychological and psychoeducational interventions where fathers were participants receiving the interventions, either jointly with their partners or individually through generic content created for couples or specific content aimed at fathers during the perinatal period. We ensured an accurate methodological process (PRISMA guidelines, GRADE methodology); study selection, data extraction, and risk of bias assessments (ROB 2.0) were performed by trained and independent collaborators. We cannot dismiss the possibility of current publication bias, as the test's lack of significance might be due to insufficient statistical power. The heterogeneity was moderate and non-significant; this could be explained by the small number of studies. Therefore, the quality of evidence was very low. In addition, sensitivity analyses were calculated to check the degree of robustness.

However, the limitations of this SR and MA should be considered when interpreting our results. First, few RCTs were obtained due to the research gap in online preventive depression interventions for fathers during the perinatal period. Therefore, further research on the effectiveness of these interventions is warranted. Second, due to the small number of studies, subgroup and meta-regression analyses could not be performed (Higgins et al., 2020; Knapp and Hartung, 2003). In addition, only six of the seven studies selected were included in the MA, since data were not available. Thirdly, the certainty of evidence was considered very low due to the "risk of bias" and "imprecision" domains. Regarding the risk of bias following the qualitative criteria, three of the seven studies obtained a high risk of bias score, two obtained a moderate risk of bias score, and two obtained a low risk of bias score. Fourthly, the studies were conducted in high-income countries and focused on heterosexual couples; moreover, non-birthing partners other than fathers were not included, limiting the generalizability of the conclusions. Fifthly, six of the RCTs included did not identify participants with PPD at baseline through assessment; for this reason, it was not guaranteed that the participants included in the interventions did not have a diagnosis of depression at the beginning of the intervention. Only one study (Sulaiman and Bloomberg, 2021) excluded participants with PPD at baseline (EPDS score $>$ 12). Furthermore, no studies evaluated the diagnosis of paternal depression using diagnostic interviews. Consequently, the preventive effect of the included studies is not guaranteed, and their results should be interpreted with caution (Cuijpers, 2022). The final limitation was the short follow-up periods. Only three of the seven studies reported the most extensive follow-ups at 24 weeks postpartum (Feinberg et al., 2020; Kavanagh et al., 2021; Shorey et al., 2023).

4.4. Clinical implications

Online psychological interventions may protect fathers from developing perinatal depression, but interventions require further development and evaluation, including the impact on the parental dyad. For online interventions, their cost can be reduced and their scalability can be increased in comparison to face-to-face interventions (Cuijpers et al., 2012).

Indeed, the importance of supporting both women and their partners is highlighted in the NICE (2020) guidelines on antenatal and postnatal mental health. The WHO guideline (World Health Organization, 2022) indicated that most mental health services attend mainly to women and their infants, and because of this, partners believed they had no claim to assistance. Therefore, an inclusive perspective is necessary to promote the mental health of the whole family and develop services for all caregivers, which may comprise screening, treatment, and referral to support groups.

4.5. Future research

This SR and MA showed that further research in this field on online preventive interventions for fathers and non-birthing partners is needed. To this end, it seems necessary to incorporate the entire family system to prevent perinatal mental disorders (Fisher and Glangeaud-Freudenthal, 2023). Supporting this reason, it would be essential to review the content available for fathers because, in most couple-based interventions, the content dedicated to fathers was limited. It should be considered justified to design specific content because the fatherhood transition is linked to physical, mental, and social changes among others, which affect general health and the transition from the perinatal period to the life course (Grau Grau et al., 2022). In addition, psychological interventions involving new models of families are needed to ensure the well-being of both birthing parents and non-birthing parents. This approach will facilitate birthing parents' transition into parenthood while providing support for the mental health of all parents involved and overall family well-being (Fisher and Glangeaud-Freudenthal, 2023).

In addition, the limited number of studies with a low risk of bias highlights the need for high-quality RCTs. Additionally, it would be recommended to evaluate the level of depressive symptoms at baseline using standardized interviews or validated scales. This evaluation serves to ensure that preventive interventions are accurately assessed and excluded participants who already met the criteria for depressive disorder.

5. Conclusion

In conclusion, online psychological interventions may have a small preventive effect on perinatal depression in fathers. Given that the quality of evidence was very low, and no trials focused on non-birthing partners were found, more high-quality evidence is required.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to thank the authors from included RCTs that have replied to our data request in order to conduct the meta-analysis.

Role of funding sources

This project received funding from the European Union's Horizon Europe, European Research Council under grant agreement No 101042319. Title: "Universal prevention of maternal perinatal mental disorders and its implementation as normalized routine practice- e-Perinatal". CAW is funded by the UK's National Institute for Health and Care Research (NIHR).

CRediT authorship contribution statement

PD-J: Verification; Formal analysis; Investigation; Writing - Original Draft. IG-G: Methodology; Formal analysis; Visualization; Writing - Review & Editing. CB-J: Verification; Formal analysis; Investigation Writing - Review & Editing. CW: Verification; Writing - Review & Editing. EM: Conceptualization; Methodology; Investigation; Resources; Writing - Review & Editing; Supervision; Project administration; Funding acquisition.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.invent.2024.100759.

References

Admon, L.K., Dalton, V.K., Kolenic, G.E., Ettner, S.L., Tilea, A., Haffajee, R.L., Brownlee, R.M., Zochowski, M.K., Tabb, K.M., Muzik, M., Zivin, K., 2021. Trends in suicidality 1 year before and after birth among commercially insured childbearing individuals in the United States, 2006-2017. JAMA Psychiatr. 78 (2), 171. https://doi.org/10.1001/jamapsychiatry.2020.3550.

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders, 5th ed. American Psychiatric Publishing.

Balshem, H., Helfand, M., Schünemann, H.J., Oxman, A.D., Kunz, R., Brozek, J., Vist, G. E., Falck-Ytter, Y., Meerpohl, J., Norris, S., 2011. GRADE guidelines: 3. Rating the quality of evidence. J. Clin. Epidemiol. 64 (4), 401–406. https://doi.org/10.1016/j.jclinepi.2010.07.015.

Begg, C.B., Mazumdar, M., 1994. Operating characteristics of a rank correlation test for publication bias. Biometrics 50 (4), 1088–1101. https://doi.org/10.2307/2533446.

Berg, R.C., Solberg, B.L., Glavin, K., Olsvold, N., 2022. Instruments to identify symptoms of paternal depression during pregnancy and the first postpartum year: a systematic scoping review. Am. J. Mens Health 16 (5), 155798832211149. https://doi.org/10.1177/15579883221114984.

Boot, W.R., Simons, D.J., Stothart, C., Stutts, C., 2013. The pervasive problem with placebos in psychology. Perspect. Psychol. Sci. 8 (4), 445–454. https://doi.org/10.1177/1745691613491271.

Borenstein, M., Hedges, L.v., Higgins, J.P.T., Rothstein, H.R., 2009. Introduction to Meta-analysis. Wiley. https://doi.org/10.1002/9780470743386.

Bruno, A., Celebre, L., Mento, C., Rizzo, A., Silvestri, M.C., de Stefano, R., Zoccali, R.A., Muscatello, M.R.A., 2020. When fathers begin to falter: a comprehensive review on paternal perinatal depression. Int. J. Environ. Res. Public Health 17 (4), 1139. https://doi.org/10.3390/ijerph17041139.

Cameron, E., Sedov, I., Tomfohr-Madsen, L., 2016. Prevalence of paternal depression in pregnancy and the postpartum: an updated meta-analysis. J. Affect. Disord. 206, 189–203. https://www.sciencedirect.com/science/article/pii/S0165032716305705.

Chhabra, J., McDermott, B., Li, W., 2020. Risk factors for paternal perinatal depression and anxiety: a systematic review and meta-analysis. Psychol. Men Masculin. 21 (4), 593–611. https://doi.org/10.1037/men0000259.

Cohen, J., 1989. Statistical power analysis for the behavioral sciences. J. Am. Stat. Assoc. 84 (408), 1096.

Cowan, P.A., Cowan, C.P., 2012. Normative family transitions, couple relationship quality, and healthy child development. In: Walsh, F. (Ed.), Normal Family Processes: Growing Diversity and Complexity, 4th ed. The Guilford Press, pp. 428–451.

Cuijpers, P., 2022. Why primary prevention often is no prevention at all. Eur. Neuropsychopharmacol. 58, 1–3. https://doi.org/10.1016/j.euroneuro.2022.01.004.

Cuijpers, P., Beekman, A.T.F., Reynolds, C.F., 2012. Preventing depression. JAMA 307 (10), 1033. https://doi.org/10.1001/jama.2012.271.

Cuijpers, P., Cristea, I., Karyotaki, E., Reijnders, M., Huibers, M., 2016. Meta-analyses in mental health research - a practical guide. In: World Psychiatry, 133. https://doi.org/10.1016/j.clinthera.2009.11.030.

Duval, S., Tweedie, R., 2000. Trim and fill: a simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. Biometrics 56 (2), 455–463. https://doi.org/10.1111/j.0006-341X.2000.00455.x.

Edoka, I., Petrou, S., Ramchandani, P., 2011. Healthcare costs of paternal depression in the postnatal period. J. Affect. Disord. 133 (1–2), 356–360. https://www.sciencedirect.com/science/article/pii/S0165032711001571.

Fawcett, E.J., Fairbrother, N., Cox, M.L., White, I.R., Fawcett, J.M., 2019. The prevalence of anxiety disorders during pregnancy and the postpartum period. J. Clin. Psychiatry 80 (4). https://doi.org/10.4088/JCP.18r12527.

Feinberg, M.E., Boring, J., Le, Y., Hostetler, M.L., Karre, J., Irvin, J., Jones, D.E., 2020. Supporting military family resilience at the transition to parenthood: a randomized pilot trial of an online version of family foundations. Fam. Relat. 69 (1), 109–124. https://doi.org/10.1111/fare.12415.

Fisher, S.D., Glangeaud-Freudenthal, N., 2023. Fathers as assets to support maternal mental health and family wellbeing. Arch. Womens Ment. Health 26 (1), 87–88. https://doi.org/10.1007/s00737-023-01292-6.

Gómez-Gómez, I., Barquero-Jiménez, C., Johnson, E., Conejo-Cerón, S., Moreno-Peral, P., Bellón, J.Á., Motrico, E., 2024. Effectiveness of multiple health behavior change interventions in reducing symptoms of anxiety in the adult population: a systematic review and meta-analysis of randomized controlled trials. Prev. Med. 107847 https://doi.org/10.1016/j.ypmed.2024.107847.

Grau Grau, M., Heras Maestro, M., Riley Bowle, H., 2022. Engaged Fatherhood for Men, Families and Gender Equality. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-75645-1.

Guyatt, G.H., Oxman, A.D., Schünemann, H.J., Tugwell, P., Knottnerus, A., 2011. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. J. Clin. Epidemiol. 64 (4), 380–382. https://doi.org/10.1016/j.jclinepi.2010.09.011.

Higgins, J., Green, S., 2011. Guide to the contents of a Cochrane protocol and review. In: Cochrane Handbook for Systematic Reviews of Interventions. John Wiley & Sons, Ltd., pp. 51–79. https://doi.org/10.1002/9780470712184.ch4

Higgins, J., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M., Welch, V., 2020. Cochrane Handbook for Systematic Reviews of Interventions (6.1.). Cochrane, Ed.

Howat, A., Masterson, C., Darwin, Z., 2023. Non-birthing mothers' experiences of perinatal anxiety and depression: understanding the perspectives of the non-birthing mothers in female same-sex parented families. Midwifery 120, 103650. https://doi.org/10.1016/j.midw.2023.103650.

Kavanagh, D.J., Connolly, J., Fisher, J., Halford, W.K., Hamilton, K., Hides, L., Milgrom, J., Rowe, H., Scuffham, P.A., White, K.M., Wittkowski, A., Appleton, S., Sanders, D., 2021. The baby steps web program for the well-being of new parents: randomized controlled trial. J. Med. Internet Res. 23 (11), e23659 https://doi.org/10.2196/23659.

Kim, P., Swain, J., 2007. Sad dads: paternal postpartum depression. Psychiatry (Edgmont) 4 (2), 35–47.

Knapp, G., Hartung, J., 2003. Improved tests for a random effects meta-regression with a single covariate. Stat. Med. 22 (17), 2693–2710. https://doi.org/10.1002/sim.1482.

Livingston, G., Parker, K., 2019. 8 facts about American dads. In: Pew Research Center, Fact Tank: News in the Numbers.

Martín-Gómez, C., Moreno-Peral, P., Bellón, J.A., Conejo-Cerón, S., Campos-Paino, H., Gómez-Gómez, I., Rigabert, A., Benítez, I., Motrico, E., 2022. Effectiveness of psychological interventions in preventing postpartum depression in non-depressed women: a systematic review and meta-analysis of randomized controlled trials. Psychol. Med. 52 (6), 1001–1013. https://doi.org/10.1017/S0033291722000071.

Missler, M., van Straten, A., Denissen, J., Donker, T., Beijers, R., 2020. Effectiveness of a psycho-educational intervention for expecting parents to prevent postpartum parenting stress, depression and anxiety: a randomized controlled trial. BMC Pregnan. Childb. 20 (1) https://doi.org/10.1186/s12884-020-03341-9.

Motrico, E., Bina, R., Kassianos, A.P., Le, H.-N., Mateus, V., Oztekin, D., Rodriguez-Muñoz, M.F., Moreno-Peral, P., Conejo-Cerón, S., 2023. Effectiveness of interventions to prevent perinatal depression: an umbrella review of systematic reviews and meta-analysis. Gen. Hosp. Psychiatry 82, 47–61. https://doi.org/10.1016/j.genhosppsych.2023.03.007.

National Institute for Health and Care Excellence, 2020. Antenatal and Postnatal Mental Health: Clinical Management and Service Guidance.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., Alonso-Fernández, S., 2021. Declaración PRISMA 2020: una guía actualizada para la publicación de revisiones sistemáticas. Rev. Esp. Cardiol. 74 (9), 790–799. https://doi.org/10.1016/j.recesp.2021.06.016.

Paulson, J.F., Bazemore, S.D., 2010. Antenatal and postpartum depression in fathers and its association with maternal depression. JAMA 303 (19), 1961. https://doi.org/10.1001/jama.2010.605.

Paulson, J.F., Bazemore, S.D., Goodman, J.H., Leiferman, J.A., 2016. The course and interrelationship of maternal and paternal perinatal depression. Arch. Womens Ment. Health 19 (4), 655–663. https://doi.org/10.1007/S00737-016-0598-4.

Peixoto, C., Rego, D., Cruz, M., Medeiros, H., 2022. "Dad is feeling blue": what to know about paternal perinatal depression. Eur. Psychiatry 65 (S1), S481–S482. https://doi.org/10.1192/j.eurpsy.2022.1224.

Pérez, F., Brahm, P., 2017. Depresión posparto en padres: ¿por qué también es importante? Rev. Chil. Pediatr. 88 (5), 582–585. https://doi.org/10.4067/S0370-41062017000500002.

Rigabert, A., Motrico, E., Moreno-Peral, P., Resurrección, D.M., Conejo-Cerón, S., Cuijpers, P., Martín-Gómez, C., López-Del-Hoyo, Y., Bellón, J.Á., 2020. Effectiveness of online psychological and psychoeducational interventions to prevent depression: systematic review and meta-analysis of randomized controlled trials. Clin. Psychol. Rev. 82, 101931 https://doi.org/10.1016/j.cpr.2020.101931.

Rodrigues, A.L., Ericksen, J., Watson, B., Gemmill, A.W., Milgrom, J., 2022. Interventions for perinatal depression and anxiety in fathers: a mini-review. Front. Psychol. 12 https://doi.org/10.3389/FPSYG.2021.744921/FULL.

Shafian, A.K., Mohamed, S., Nasution Raduan, N.J., Hway Ann, A.Y., 2022. A systematic review and meta-analysis of studies validating Edinburgh Postnatal Depression Scale in fathers. Heliyon 8 (5), e09441. https://doi.org/10.1016/j.heliyon.2022.e09441.

Shorey, S., Lau, Y., Dennis, C., Chan, Y.S., Tam, W.W.S., Chan, Y.H., 2017. A randomized-controlled trial to examine the effectiveness of the "Home-but not Alone" mobile-health application educational programme on parental outcomes. J. Adv. Nurs. (John Wiley & Sons, Inc.) 73 (9), 2103–2117. https://doi.org/10.1111/jan.13293.

Shorey, S., Ang, L., Tam, W.W.S., 2019a. Informational interventions on paternal outcomes during the perinatal period: a systematic review. Women Birth 32 (2), e145–e158. https://doi.org/10.1016/j.wombi.2018.06.008.

Shorey, S., Ng, Y.P.M., Ng, E.D., Siew, A.L., Mörelius, E., Yoong, J., Gandhi, M., 2019b. Effectiveness of a technology-based supportive educational parenting program on parental outcomes (part 1): randomized controlled trial. J. Med. Internet Res. 21 (2), e10816 https://doi.org/10.2196/10816.

Shorey, S., Law, E., Mathews, J., Lim, S.H., Shi, L., Chua, J.S., Du, R., Chan, Y.H., Tan, T. C., Chee, C., Chong, Y.S., 2023. Evaluating the effectiveness of the supportive parenting app on parental outcomes: randomized controlled trial. J. Med. Internet Res. 25, e41859 https://doi.org/10.2196/41859.

StataCorp, L.L.C., 2023. Stata Longitudinal-Data/Panel-Data Reference Manual Release, p. 18.

Stein, A., Netsi, E., Lawrence, P.J., Granger, C., Kempton, C., Craske, M.G., Nickless, A., Mollison, J., Stewart, D.A., Rapa, E., West, V., Scerif, G., Cooper, P.J., Murray, L., 2018. Mitigating the effect of persistent postnatal depression on child outcomes through an intervention to treat depression and improve parenting: a randomised controlled trial. Lancet Psychiatry 5 (2), 134–144. https://doi.org/10.1016/S2215-0366(18)30006-3.

Stern, J., Egger, M., Smith, G., 2001. Investigating and dealing with publication and other bias. In: Egger, M., Smith, G., Altman, D. (Eds.), Systematic Reviews in Health Care: Meta-analysis in Context, 2nd ed. BMJ Books.

Sterne, J.A.C., Savović, J., Page, M.J., Elbers, R.G., Blencowe, N.S., Boutron, I., Cates, C. J., Cheng, H.-Y., Corbett, M.S., Eldridge, S.M., Emberson, J.R., Hernán, M.A., Hopewell, S., Hróbjartsson, A., Junqueira, D.R., Jüni, P., Kirkham, J.J., Lasserson, T., Li, T., Higgins, J.P.T., 2019. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ l4898. https://doi.org/10.1136/bmj.l4898.

Stuck Chief, A.E., Rubenstein, L.Z., Wieland, D., 1998. Bias in meta-analysis detected by a simple, graphical test. BMJ 316, 469–477.

Sulaiman, S., Bloomberg, L.S., 2021. eHealth Antenatal Coparenting Intervention to Prevent Postpartum Depression among Primiparous Women, Karachi, Pakistan: A Pilot Randomized Controlled Trial.

Veskrna, L., 2010. Peripartum depression – does it occur in fathers and does it matter. J. Men's Health 7 (4), 420–430. https://doi.org/10.1016/j.jomh.2010.10.004.

World Health Organization, 2022. Guide for Integration of Perinatal Mental Health in Maternal and Child Health Services.