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Health economic evaluation evidence of interventions for peripartum depression: A scoping review

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ABSTRACT

This scoping review provides a broad overview of the existing literature on economic evaluations of preventive, screening, and treatment programmes for peripartum depression (PPD). PPD is one of the leading causes of disease-related disability among women. However, PPD often goes undiagnosed and untreated, with as many as half of cases not being identified.

We followed the PICO-P (publication type) structure. Databases were searched from inception until 30 June 2023. The intervention stage in the studies was classified as prevention, screening, treatment, screening and treatment, and prevention and treatment. The health economics methods of the studies were divided into cost-effectiveness analysis, cost-utility analysis, cost-benefit analysis, cost-minimisation analysis, return of investment, and multiple. Ultimately, 38 studies were included for extraction and evaluation.

Several interventions for PPD may be cost effective, including peer support, psychological therapies, and screening strategies using tools like the Edinburgh Postnatal Depression Scale (EPDS). However, study limitations include heterogeneity across studies, methodological limitations, and limited generalisability to diverse populations.

The cost-effectiveness results of PPD interventions may differ across different health systems, partly due to differences in the amount and distribution of resources available. By implementing suggested policy recommendations, policymakers can significantly improve the identification, treatment, and prevention of PPD, ultimately improving the health and well-being of mothers, children, and families.

1. Background

Peripartum depression (PPD) is one of the leading causes of disease-related disability among women [28]. PPD is typically characterised as a depressive episode that occurs during pregnancy or within the first year after birth, affecting many women, and becoming a dominant public health issue, with prevalence rates approaching 20 % [44]. Several symptoms may be associated with PPD, such as feelings of sadness or constant anxiety, lack of energy, sleep disturbances, appetite changes, and difficulties bonding with the infant [42]. The consequences, both for the mother and the infant, can last a lifetime, with an increased risk of adverse child outcomes regarding child development and health [60]

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and severe cases can even be associated with suicide and infanticide [43]. However, PPD often goes undiagnosed and untreated, with as many as half of cases not being identified [41].

In addition to human suffering for women and potentially their children, PPD has further societal, health, and economic burden with both direct and indirect costs [50]. Direct costs include increased visits to psychiatrists, higher rates of hospital admissions, and escalated use of antidepressant medications and therapeutic interventions. Indirect costs are substantial, encompassing productivity losses, family conflicts, increased child healthcare utilisation due to maternal mental health issues, and long-term societal impacts such as reduced workforce participation and increased reliance on social support systems [59]. The lifetime cost of PPD alone have been estimated at GBP 75,728 per affected woman in 2016 [6]. More recent estimates from Brazil and South Africa show that cost in proportion to Gross Domestic Product (GDP) are likely to be even higher in low-and middle-income countries (LMICs) [4,5]. Therefore prevention, screening, and treatment have an important role in reducing the costs of PPD.

However, early systematic reviews have provided contradictory and limited evidence regarding the cost-effectiveness of interventions for PPD management, such as psychological interventions, educational interventions, pharmacological interventions or supplements, social support, midwifery-led interventions, complementary and alternative medicine or treatment options [39], and screening of affected and exposed individuals [66]. These results may be due to insufficient evidence [9,29], the studies including multiple interventions, and the study population being complex.

Economic analyses in healthcare include a variety of methods to evaluate the value and impact of health interventions. The most preferred methods are cost-effectiveness, cost-minimisation, cost-utility, and cost-benefit analyses [65]. Cost-Effectiveness Analysis (CEA) compares the costs and health outcomes of different treatments, focusing on natural measures such as years of life gained. Cost-Minimisation Analysis focuses on cost minimisation while maintaining or improving health outcomes [49]. Cost-Utility Analysis (CUA) evaluates interventions based on their impact on patients' quality of life, often using Quality-Adjusted Life Years (QALYs) as a measure. Cost-Benefit Analysis (CBA) uses monetary values to measure benefits of interventions [30]. Lastly, Cost-Consequences Analysis (CCA) offers a detailed comparison of interventions' costs and outcomes, presenting them separately for a thorough assessment of advantages and disadvantages [19]. Each approach provides different perspectives, contributing to informed resource management and strategic decision-making in the healthcare sector.

To determine whether an intervention provides good or very good value for money, cost-effectiveness thresholds are often employed. In 2001, the World Health Organization's Commission on Macroeconomics and Health proposed thresholds based on multiples of a country's per-capita (GDP). While these thresholds have sometimes been used as decision-making rules for funding health interventions, practical experience has highlighted their limitations. Specifically, GDP-based thresholds often lack country-specific relevance, and, when combined with the uncertainty inherent in modelled cost-effectiveness ratios, they can result in suboptimal allocation of healthcare resources [7]. The other important issue is different perspectives result in different cost/cost-effectiveness ratios. The types of perspectives commonly encountered in the health economics literature target a broad audience - including patients, payers, healthcare providers, the healthcare sector, health systems, and society [58].

The heterogeneity of healthcare systems globally further influences the cost-effectiveness of interventions for PPD. Differences in healthcare funding structures, availability of mental health services, workforce capacity, and cultural attitudes toward mental health can significantly impact the implementation and outcomes of these interventions [18, 31]. For instance, strategies deemed cost effective in high-income countries (HICs) with universal healthcare systems may not yield the same results in LMICs due to resource constraints and differing priorities [31]. Variations in reimbursement policies and access to trained professionals across regions also highlight the need to contextualise economic evaluations to specific healthcare settings. Tailoring interventions to the unique characteristics of healthcare systems is crucial to achieving meaningful and equitable outcomes [57].

A growing literature on the economic evaluation of PPD has been discussed in different contexts over the last two decades [29]. This paper aims to provide a broad overview of the existing literature on economic evaluations of preventive, screening, and treatment interventions for PPD through a scoping review. The current study will support policy-makers' and healthcare providers' decision-making, and point researchers toward future research priorities.

2. Method

2.1. Study design

A scoping review was deemed the more suitable review methodology, being able to assess a broader question and to map the existing evidence to analyse the gaps in the field, in comparison to a systematic review which tends to be more specific in nature [47]. In order to identify all studies related to the subject published up to the time of the research, no restrictions were placed on the date, language of publication or geographical location, and a comprehensive search was conducted from the inception of the databases.

2.2. Study selection

Study selection was performed based on the eligibility criteria within the aims of this review, using a PICO-P (publication type) strategy to inform the search:

Population: Pregnant women or women in the postpartum/postnatal (here after only the term *postpartum* will be used) period - up to 12 months after delivery - with the infant born alive, and fathers/partners and families of such women.

Intervention: Interventions focus on screening, preventing, and treating PPD.

Comparator: Interventions compared with routine practice or no intervention, or with any other relevant intervention.

Outcome: Health economic evaluations including cost-effectiveness, cost-minimisation, cost-utility, cost-benefit, return-on-investment, and cost-consequences analyses.

Publication type: Peer-reviewed papers or health technology assessment (HTA) reports.

2.3. Exclusion criteria

The following were used as exclusion criteria: Any intervention not related to PPD screening, prevention or treatment; papers which did not include total health economic evaluations, describing only effectiveness or only costs of screening or prevention or treatment of PPD; and papers which even if describing health economic evaluations were not peer reviewed or not an HTA report (editorials, conference papers, posters, PhD theses, book chapters, case reports etc.). Systematic reviews were also excluded even if related to screening, prevention and treatment of PPD.

2.4. Search strategy

A comprehensive and systematic search strategy appropriate for a scoping review was constructed by adapting strategies in previous studies on PPD and/or economics coupled with input from the project team. This was trialled in a sample database, edited based on comments from the team, and implemented by the team's information specialist. The Cochrane Database of Systematic Reviews, CINAHL (Ebsco), Econlit

(Ebsco), Embase (Elsevier), International HTA Database, Maternity & Infant Care (Ovid), Medline (Ebsco), PsycINFO (Ebsco), and Web of Science (Clarivate) were all searched from inception until 30 June 2023. No date or language limitations were imposed during these database searches; however, during screening only results in English were included.

An example search from Medline is included in the Appendix.

3. Results

3.1. Screening

The search strategy resulted in a total of 5806 studies to be screened for eligibility which were uploaded into Covidence for management and manipulation as recommended by Cochrane [13]; after deduplication, 3347 were screened at title/abstract level by any two of five of the team (MÇB, AGA, RPC, NÖ, GT). This led to 191 studies being screened at full-text level by any two of four reviewers (MÇB, AB, NÖ, GT), and ultimately, 38 studies were included for extraction and evaluation. A PRISMA 2020 diagram [45] (Fig. 1) is included in the Appendix.

3.2. Data extraction

Data were extracted from papers included in the review by any two of four independent reviewers (MÇB, AB, NÖ, GT). Any conflict between the two reviewers was resolved by a third reviewer who had not evaluated the study in screening. The data extracted included specific details about the country, intervention period, stage of intervention, type of intervention, comparator, type of economic evaluation and key findings relevant to the review question.

3.3. Characteristics of studies

See Table 1 in the Appendix, which lists the characteristics of the included studies.

All included studies were published between 2000 and 2023. The studies focused mostly on the postpartum period (25 out of 38), with only two studies focusing specifically on pregnant women [25,63]. For one study, the target population were fathers [2] whilst the target population in all other studies were mothers.

The majority of the studies were from the UK ($n = 17$), USA ($n = 7$), Australia ($n = 4$) and Canada ($n = 3$). Other publications were from India, New Zealand, Nigeria, Portugal, Singapore, and Sweden. Five of the included studies were HTA reports. The intervention stage in the studies was classified as prevention [15,16,20,24,32,35,37,39,48,54,55,67], screening [2,10–12,25,26,33,34,38,46,53], treatment [1,3,8,17,21–23,40,61,63,70,71], screening and treatment [27,68]; and others. Other interventions included one study focused on testing the efficacy of a community-delivered consultation aimed at improving infant sleep and maternal well-being delivered at eight months postpartum for which maternal depression was a secondary outcome [56], and another study testing a maternal-infant attachment intervention during pregnancy and the first six months after birth, assessing the infant's cognitive outcomes and lasting maternal mood at 13 years after birth [62].

The health economics methods of the studies were divided into cost-effectiveness analysis (CEA through CUA) [1,2,8,10–12,16,21–27,32–34,38–40,46,48,53–56,61,63,68,71], cost-utility analysis (CUA) ([17,20,37,67]), cost–benefit analysis [3], cost-minimisation analysis [15,62,70], and CEA and return of investment (ROI) [35].

3.3.1. Health economics analyses results

In this section, studies are divided into HTA reports, studies focusing on prevention, studies focusing on screening, and studies focusing on treatment. However, since some studies focus on screening and treatment together, they are given separately under the heading of screening and treatment. Likewise, if an intervention was carried out for prevention and treatment purposes, these studies were collected under the heading of prevention and treatment.

3.3.2. HTA reports

Hewitt et al. [26] investigated the cost-effectiveness of screening for postpartum depression. They compared the Edinburgh Postnatal Depression Scale (EPDS) with usual care through a decision-analytic model. Although EPDS's performance was validated, their decision model indicated that the use of formal screening strategies, such as EPDS, was probably not cost effective. However, this conclusion is due to significant additional costs associated with treating non-depressed women wrongly diagnosed as depressed (false positives). With false positive cost reduced to 0, screening would be in the willingness-to-pay threshold. The study was limited, with major depression of the mother and data insufficient to evaluate all scenarios.

MacArthur et al. [34] examined the costs of redesigned postpartum care compared with current care on women's physical and psychological health through an HTA report. Redesigned postpartum care included systematically screening and planning the treatment of women in the postpartum period, led by midwives with contact with the GP only when required. The EPDS was the core mental health measure and individual care and visit plans were based on need. Evidence-based guidelines were used to manage women's needs and healthcare was delivered for a longer period. Outcome measures included the Physical and Mental Component Scores (PCS and MCS) of the Short-Form 36 (SF-36) and the EPDS. The authors compared screening intervention provided by midwives and a GP versus usual care. Based on the worst-case scenario, the intervention remained cost saving (intervention costing at a maximum GBP 81.90 more per woman to deliver, but possibly representing a saving of GBP 78.30 per woman).

Morrell et al. [40] evaluated through a randomised controlled trial the cost-effectiveness of universal screening of depressive symptoms in postpartum women (using EPDS and clinical assessment skills on mood, suicidal thoughts and feelings about the baby at six, 12 and 18 months after delivery) and treatment to those scoring $\geq$12 in the EPDS in psychological interventions for postnatal depression (PoNDER trial). Screening and treatment were delivered by health visitors trained in Cognitive-Behavioural Approach (CBA) and Person-Centred Approach (PCA). Treatment was combined with a selective serotonin reuptake inhibitor (SSRI) if needed. The results indicated that psychological approaches were cost effective at two different follow-ups by six-month intervals. CBT was the most cost-effective intervention in all groups.

Morrell et al. [39] synthesised evidence on the effectiveness, safety, and cost-effectiveness of all available preventive interventions for PPD during pregnancy and the postpartum period up to six months after birth, compared with usual care and enhanced usual care. Considering the EPDS scores, none of the preventive programmes showed consistent clinical benefit regardless of their type (universal, selective or indicative). The authors further present their modelling analysis conducted on a range of universal, selective and indicative preventive interventions. According to these, midwifery-redesigned postpartum care, person-centred approach (PCA) and CBT when given as universal interventions seem to be the most cost effective. Selective interpersonal psychotherapy (IPT) seems to be the most cost effective. Similarly, indicated programmes aiming to promote parent-infant interaction, peer support, education on preparing for pregnancy, IPT and PCA seem to be the most cost-effective. The authors suggest caution when considering these results given that the models were built based on considerable levels of uncertainty.

Wiggins et al. [67] examined two postpartum support service for mothers in disadvantaged inner-city areas. The first was a programme of visits from health visitors trained in supportive listening [Support Health Visitor (SHV)] and encompassed one year of monthly supportive listening visits focused on the woman's needs, with practical support and information provided on request. The second intervention concerned the services of local community support organisations

[Community Group Support (CGS)] and encompassed drop-in sessions, home visiting and/or telephone support for one year. The authors observed mothers' and infants' health outcomes and cost utility, and found neither intervention to provide cost savings or benefit on preventing worsening of maternal wellbeing.

3.3.3. Prevention

Counts et al. [15] examined whether it is value based to share with clinicians 50 % of the estimated five-year savings that would result from reduced incidence of PPD compared to traditional value-based models that share 100 % of one-year actual savings to prevent PPD. For this purpose, the authors used a decision-analytical model with a simulated 1000 pregnant cohort enrolled in Medicaid. They found that under low insurance churn, sharing 50 % of five-year expected savings with clinicians can avoid more than double the PPD compared to 100 % shared savings over one year and offer a strong return for payers.

Dukhovny et al. [16] examined the cost-effectiveness of telephone-based volunteer peer support intervention for preventing PPD among high-risk women at 12 weeks postpartum. The primary outcome depressive symptoms were assessed with an EPDS score at 12 weeks postpartum. The authors found the intervention to be cost effective (95 % probability of being cost-effective at <USD 20,196 per case of PPD averted).

Franta et al. [20] built a theoretical model to assess the cost-effectiveness of preventive counselling delivered to pregnant adolescents. The intervention could consider a median of eight sessions across eight weeks, with a median duration of 12 h and included group sessions, individual sessions, and couples' sessions. The authors found that it was not only cost effective but also cost saving (21,976 additional QALYs gained and a cost savings of USD 223,549,872).

Grote et al. [22] calculated the benefit of collaborative care model (MOMCare, consisting of a brief IPT programme, or pharmacotherapy, or both) in preventing depression. They found the incremental net benefit of MOMCare was greater if one day without depression was valued at a minimum of USD 20 and for women with probable depression and PTSD.

Henderson et al. [24] investigated health visitor training in assessing postpartum depression and delivering CBT and PCA to women at risk of depression (as a universal programme) by re-analysing data from the PoNDER trial performed by Morrel et al. [40]. Health visitor training was highly cost effective in preventing symptoms of PPD in a population of lower-risk women over six months.

Lal et al. [32] examined the cost-effectiveness of IPT and exercise classes to prevent PPD by using the Markov model. They found IPT was dominant when delivered by psychologists in a combination of group and individual settings. IPT is also potentially cost saving when delivered by maternal and child health nurses. Exercise classes were also dominant, but uncertainty remains on their effectiveness in preventing PPD.

Mallender et al. [35] investigated the effectiveness and cost-effectiveness of health visitors as delivery agents in the scope of the Healthy Child Programme through a rapid review. They produced a return on investment (ROI) tool and calculated ROI of public health interventions on breastfeeding and PPD. They used the Morrell et al. [39] review and in ROI analysis they found three PPD interventions - midwifery-redesigned postpartum care, peer support intervention and group physical therapy exercises - all dominant over usual care in ROI estimation. For CBT, education on parenting, IPT, calcium prescription, booklet, and early contact with care providers, it was not possible to have a clear vision of the effectiveness and the authors concluded that investing in these interventions is not feasible.

Monteiro et al. [37] performed cost-utility analysis of self-guided web-based CBT (Be a Mom) to prevent PPD in low-risk mothers. The authors used costs related to healthcare use, costs related to productivity losses and costs related to the intervention to estimate costs. Health outcomes were measured in terms of QALYs based on the EQ-5D-3L. The results showed that the intervention is cost saving. Bootstrapping results showed the intervention to be dominant. Though results were statistically nonsignificant, at the EUR 0 willingness-to-pay threshold, the intervention is cost effective at 96 % (resulted in a yearly cost-saving of EUR 165.47 (−361.77, 28.51) and a QALY gain of 0.0064 (−0.0116, 0.0244)).

Petrou et al. [48] studied the effectiveness of counselling and specific support in mother-infant relationships for women at high risk of developing postpartum depression. The intervention was delivered by trained health visitors. It encompassed visiting mothers in their homes at 35 and 37 weeks pregnant to establish a supportive relationship, identify areas of vulnerability, and help the mother plan for the management of any problems. It proceeded after birth with visits at days three, seven, and 17 and then weekly for eight weeks, with counselling support and further specific support, principally to focus on difficulties in the mother-infant relationship. The primary outcome was the duration of PPD during the first 18 months postpartum assessed using the SCID-II. Data on health and social care use during the 18 months postpartum were collected and combined with unit costs. The authors found the intervention is cost effective (reduced the average duration of maternal depression 2.21 months vs. 2.70 months for routine care, the mean costs were higher in the intervention group GBP 2397 vs GBP 2278 for routine care).

Ride et al. [55] examined the cost-effectiveness of a nurse-led psychoeducational intervention targeting the parental partner relationship, management of infant behaviour and parental fatigue and found it is potentially cost effective. Furthermore, Ride [54] developed hypothetical models to investigate extended effects of preventive interventions applied to mothers in the first postpartum year on children. The estimated ICER initially exceeded the upper bound of the NICE threshold (GBP 30,000). However, when the time horizon was extended beyond three years, the ICER decreased below the threshold, but the ICER was above the threshold at an 11-year time horizon.

Zheng et al. [71] found that a one-month web-based intervention for first-time postpartum mothers dominated not only usual care but also in-home CBT programmes. The web-based intervention could be accessed through a website where audio files and videos about breastfeeding techniques, breast engorgement management, infant bathing, Kegel exercises combined with a peer-discussion forum and a confidential corner (where participants could communicate with other mothers or with the researchers) were available. Maternal health outcomes included maternal parental self-efficacy, social support, postpartum depression, and anxiety.

In the included studies of preventive interventions for PPD were the value of clinician-shared savings models [15]; telephone-based peer support for high-risk women [16]; counselling for adolescents [20]; IPT combined with exercise classes [32]; web-based platforms [37] and postpartum support interventions [71]; and community group interventions [67].

3.3.4. Screening

Asper et al. [2] examined EPDS nurse-led screening for PPD in fathers followed by a treatment option (antidepressants, therapy) between three to five months after childbirth. Health was measured using EPDS and QALYs. The screening programme dominated not screening. The base case analysis resulted in a negative ICER (– 35,567) with lower cost (EUR 28,494 compared to the no screening cost of EUR 29,561 and increased QALYs of 0.03) that indicating that postpartum screening for fathers could be cost effective with regards to the WTP threshold of EUR 47,580.

Camacho et al. [10] investigated the cost-effectiveness of PPD case-finding in high-risk postpartum women. They found the most cost-effective case-finding strategy was the EPDS with a cut-off of ≥10 (EPDS-10). Among high-risk women, there is a high probability that EPDS-10 case-finding for PPD is cost effective compared to no case-finding (78.5 % at a threshold of GBP 20,000/QALY), with an ICER

of GBP 8146/QALY gained. Universal case-finding is even more likely to be cost effective at GBP 2945/QALY gained (versus no case-finding). There is a greater health improvement with universal rather than targeted case-finding.

Campbell et al. [11] examined the cost-effectiveness of a routine screening programme for PPD encompassing the use of PHQ as screening tool at six weeks postpartum performed by a GP or practice nurse, and again at four months postpartum performed by a well-child provider. The intervention was compared against treatment as usual in a time horizon of 12 months. The maternal health measures included in the model were the benefits of PPD screening in terms of maternal health and health-related quality of life. Although the model did not capture the impact that successful treatment of PPD has on children and society in general, nor likely future savings to other government jurisdictions in the base case, the programme was found highly cost effective (NZD 3461 ~ USD 2024) from a government perspective when compared to current practice.

Chambers et al. [12] studied the cost-effectiveness of screening women with Peripartum Integrated Psychosocial Assessment (PIPA) which included EPDS, the Antenatal Risk Questionnaire-Reviser, sociodemographic and clinical information, compared with usual care which does not assess risk for PPD. The authors found that PIPA was cost effective at detecting true-positive patients.

Heslin et al. [25] examined screening of depression during pregnancy (Whooley questions only, the EPDS only, or Whooley questions followed by the EPDS, compared to no screening) and found all three screening approaches had a probability (30 %) of being cost effective compared with the no-screen option. But it is not certain which option is more cost effective when compared to the other(s).

Littlewood et al. [33] investigated the cost-effectiveness of screening (with Whooley questions only, EPDS only, Whooley questions followed by EPDS, Whooley questions followed by PHQ-9 versus standard case identification) and treatment (FSH, intensive psychological therapy or pharmacological treatment) in PPD. In the postpartum period screening/case-finding using the Whooley questions was never a cost-effective strategy; on the other hand, the EPDS alone has a probability of cost-effectiveness. A two-stage strategy, Whooley questions followed by the PHQ, was the most cost-effective strategy in the range between GBP 20,000 and 30,000 per QALY in both pregnancy and postpartum decision models.

Morrell et al. [38] investigated the effectiveness of postpartum support (aimed to help women rest and recover after childbirth lasting for up to 10 home visits in the first month after delivery, of up to three hours duration and led by a community postpartum support worker). General health status was measured using the SF-36 and by assessing risk of postpartum depression. The authors did not find any health benefits and savings even though the women were satisfied.

Paulden et al. [46] investigated the cost-effectiveness of different screening universal strategies, using EPDS or general depression questionnaires (Hospital Anxiety and Depression Scale; PHQ). They found that universal routine screening was not cost effective compared to usual care. The ICER has a wide variety for all other strategies compared with usual care. In contrast, the status-quo dominated the screening of PPD.

Premji et al. [53] investigated the cost-effectiveness of one-time PPD screening versus inaction within public health settings in a population of pregnant and postpartum women. They concluded PPD screening did not dominate the do-nothing strategy. However, they stated that screening may be most valuable where all women screened as high-risk attend referral and participation and compliance are maximised.

Screening interventions for PPD were EPDS-based strategies [2,10]; routine PHQ screening at postpartum stages [11]; integrated psychosocial assessments [12]; two-stage approaches, combining tools like Whooley questions and PHQ-9, [33]; universal screening [46] and postpartum support [38]; and one-time screening strategies [53].

3.3.5. Treatment

Ammerman et al. [1] examined cost-effectiveness of in-home CBT as a treatment strategy for low-income women diagnosed with PPD, delivered weekly sessions of CBT for 15 weeks in their home by a master's-level therapist, between 28 weeks' gestation and up to three months after birth. The treatment was delivered concurrently with ongoing home visiting and was aimed to facilitate engagement, make content relevant to the needs of the mothers, allow delivery at home, and promote a collaborative relationship for a smooth coordination of services. They found in-home CBT was cost effective.

Barilla et al. [3] compared comprehensive psychological support intervention in postpartum mothers with limited psychosocial support intervention on new-born readmission. The comprehensive programme included breastfeeding support, health promotion and education, developmental assessments, social risk assessment, and referrals to appropriate agencies for new families. Hence, it included home and centre visits and walk-in breastfeeding clinics at six moments from 24 h following discharge up to 24 months after discharge. The intervention was delivered by a nurse, lactation consultant and a social worker. The limited intervention included breastfeeding support, weight and bilirubin- level control for infants, and referrals to appropriate providers or agencies. Hence it included centre visits at 3–14 days following birth and walk-in breastfeeding clinics, delivered by a registered nurse and a lactation consultant. The authors observed reduction in costs of about USD 515,000 in the comprehensive intervention.

Boath et al. [8] compared specialised psychiatric parent and baby day units (PBDU) with routine primary care. Primary usual care included health visitor and GP contacts, with occasional contacts with community psychiatric nurses. Visitors are sometimes trained to deliver listening visits based on principles of non-directive counselling. The treatment at the PBDU was individually tailored to each parent needs, where highly intensive and delivered by a multidisciplinary team of psychiatrists, psychiatric nurses, occupational therapists and nursery nurses. Treatments included pharmacotherapy, individual counselling, and group therapies (e.g., stress management and assertiveness training). Clinical outcomes were assessed using the Clinical Interview Schedule and EPDS. Hence social and marital adjustment were assessed using the Work Leisure and Family Life Questionnaire-Modified and the Dyadic Adjustment Scale. The intervention dominated usual care. However, the results were affected by GP engagement, health workers' visits, and medication use.

Eldar-Lissai et al. [17] compared brexanolone injection with SSRIs, modelling the clinical and economic effects of the two strategies over an 11-year time horizon and concluded it was cost effective in postpartum women with severe depression (EPDS $\geq$17 at two months postpartum), persistent depression (EPDS $\geq$17 at eight months postpartum), non-persistent depression (EPDS $<$17 at eight months postpartum), severe persistent depression and severe non-persistent depression.

Fuhr et al. [21] examined the benefits of basic CBT-based treatment (behavioural activation, active listening, collaboration with the family, guided discovery, and homework) delivered by trained peer counsellors compared to usual care and found that CBT delivered by trained peers remains cost saving.

Gureje et al. [23] compared light-intensity treatment (LIT) and high-intensity treatment (HIT). LIT included basic psychological CBT-based treatment (that incorporated behavioural activation, active listening, collaboration with the family, guided discovery, and homework). HIT included LIT plus eight weekly problem-solving therapy sessions with possible additional sessions determined by scores on the EPDS. Interventions were individually delivered to pregnant women with DSM-IV major depression by trained primary maternal care providers. The primary outcome was remission of PPD at six months postpartum (EPDS $<$ 6). HIT dominated LIT. However, the more intensive treatment did not report any significant differences with LIT in accordance with health outcomes and costs.

Trevillion et al. [63] revealed that the modified guided self-help

programme for women diagnosed with PPD during pregnancy according to SCID-II diagnostic interview was potentially cost effective. The treatment included psychoeducation on depression during pregnancy; managing relationships; planning for parenthood; health and lifestyle factors; and homework tasks. The primary outcomes were depressive status assessed with EPDS.

Yang et al. [70] also studied the combination of video-conferencing psychotherapy for mood and anxiety problems in the postpartum with usual office-based psychotherapy (treatment as usual which includes CBT or IPT-based psychotherapy sessions) compared with treatment as usual and found that when both interventions are delivered for at least three months, the combined intervention was cost saving.

Non-pharmacological treatment interventions for PPD in the included studies were in-home CBT for low-income women [1]; CBT delivered by trained staff [21]; comprehensive psychological support programmes [3]; psychiatric parent-and-baby day units [8]; psychological interventions [23]; video-conferencing psychotherapy combined with usual care [70]; and modified guided self-help programmes [63]. The only study which is focused on pharmacological treatments was Eldar-Lissai et al. [17] which investigated brexanolone's effectiveness.

3.3.6. *Screening and treatment*

Howard et al. [27] investigated screening during pregnancy with Whooley questions and EPDS, treatment of mild to moderate PPD via guided self-help, and treatment of severe PPD at mother and baby units. Both the Whooley questions and the EPDS standing alone were more cost effective than the Whooley questions followed by the EPDS or no screening. Guided self-help had a 50 % probability of being cost effective compared with usual care. Mother and baby units were not found to be cost effective at one-month post discharge because of the costs of care in a mother and baby unit. However, cost-effectiveness advantages may exist if the cost of mother and baby units is offset by savings from reduced readmissions in the longer term.

Wilkinson et al. [68] studied universal screening for PPD and treatment for PPD and psychosis according to standard practice including IPT and medication, prescriptions, and referral to mental healthcare, modelling the cost across two years postpartum. They found that interventions cost about USD 1000 per woman. The ICER was the lower willingness to pay threshold compared with usual care. The results were robust, and the intervention highly cost effective.

Research by Howard et al. [27] and Wilkinson et al. [68] demonstrates the cost-effectiveness of screening and treatment for PPD. Whooley questions or EPDS is more cost effective than sequential screening or no screening. Guided self-help for mild-moderate PPD may be cost effective, while the long-term cost-effectiveness of mother-and-baby units needs further investigation [27]. Universal screening and treatment for PPD and psychosis, including interventions like IPT and medication, is highly cost effective [68].

3.3.7. *Prevention and treatment*

Saing et al. [56] investigated cost-effectiveness of community-based nurse-delivered consultation. The infant sleep consultation was stated to be cost effective and cost saving.

Tomlinson et al. [62] investigated effectiveness of a home visiting intervention comprised of two home visits during pregnancy and weekly visits in the first two months postpartum, aimed at improving mother-infant relationships to improve the infant cognitive development at 13 years of age and maternal mood (assessed using the PHQ). Although the intervention was ineffective on the child's cognitive development, it was effective on the caregiver's distress but not anxiety symptoms.

Community-based nurse-delivered infant sleep consultations were found to be cost effective [56], while the cost-effectiveness of a home visiting intervention during pregnancy and early postpartum was not explicitly addressed in the study by Tomlinson et al. [62].

4. Discussion

The aim of this study is to provide an overview of the extent of the current body of scientific evidence regarding cost-effectiveness of interventions for PPD management, to highlight gaps, and propose further steps through evidence-based research for informed decision-making on maternity and child mental health. This is the first scoping review to report on the cost-effectiveness of interventions from quantitative evidence in order to prevent, screen, and treat PPD [52]. We identified interventions that showed evidence of being cost effective at each of these stages. The main findings in the publications indicated that prevention, screening, and treatment interventions for PPD were likely to be cost effective, and in many cases, such as counselling and health visitor training interventions and peer support, were actually cost saving.

Policymakers and commissioners can use our summary of the evidence to shape the design of cost-effective peripartum mental health services. We identified 38 papers published up to 30 June 2023. This scoping review indicates that there is growing literature on economic evaluation of PPD. Our review identified a significant body (25 out of 38) of literature published after 2017, signalling growing interest in the economic evaluation of PPD. Studies came from various countries including Australia, Canada, India, Nigeria, Portugal, Russia, Singapore, South Africa, Sweden, the UK, and the US. The World Bank divides countries into four categories based upon their Gross National Income (GNI) per capita; low-income countries (GNI per capita of up to USD 1085 in 2021), lower-middle-income countries (GNI per capita of USD 1086 to USD 4255), upper-middle-income economies (GNI per capita of USD 4256 to USD 13,205), and high-income countries (GNI per capita of USD 13,206 or more). According to this classification it was clear that most of the included studies (35 out of 38) stem from high-income countries [69].

Most of the studies (25 out of 38) focused on the postpartum period. In primary studies, the intervention steps that researchers have focused on - prevention, screening, or treatment - are almost equally distributed (12, 10, and 11 studies respectively were conducted for each type of intervention), while the others include mixed intervention stages.

When looking at preventive interventions for PPD, the results were heterogeneous. Preventive interventions demonstrate high cost-effectiveness and scalability, with innovative approaches yielding significant outcomes. Studies highlight the value of clinician-shared savings models [15] and telephone-based peer support for high-risk women [16]. Counselling for adolescents [20] and IPT combined with exercise classes [32] were not only cost effective but also cost saving when delivered by trained professionals. Web-based platforms, such as "Be a Mom" [37] and postpartum support interventions [71], showcased strong accessibility and return on investment. However, evidence supporting community group interventions was less conclusive [67]. Collectively, these findings emphasise the importance of targeted, technology-driven, and professional-led prevention strategies in reducing PPD incidence effectively.

The results of the HTA report by Morrell et al. [39] were also used by Mallender et al. [35] to examine the return on investment made by the public. The results confirmed each other, and it was determined that midwifery-redesigned postpartum care, peer-support interventions and group physical therapy exercises could be cost effective. Outcomes from prevention of PPD were identified as postpartum depression averted, reduction in prevalence of depression, QALY gained, reduced children's education sector costs and increased HRQOL during the primary school years.

One key finding is that prevention interventions delivered by midwives or health visitors tend to be more cost effective than those requiring specialist doctors. This approach leverages existing resources in healthcare systems and aligns with the need for scalable interventions in resource-constrained settings. Additionally, the long-term perspective is critical, as prevention interventions often yield greater societal

benefits when evaluated over extended time horizons. For instance, Ride [54] highlighted that including intergenerational effects significantly enhances the cost-effectiveness of preventative measures over longer evaluation periods.

Screening studies can be divided into two sections, evaluation of alternative screening tools and evaluation of risk-stratified screening (e.g., high-risk or low-risk). Not all study results were homogeneous in terms of cost-effectiveness of screening tools. While in one study [26] EPDS was the most cost-effective alternative, in another study [33] EPDS was not deemed a cost-effective alternative because it produced too many false positive results. While one-time screening strategies [53] require high compliance to maximise value, tailored approaches are necessary to improve PPD screening outcomes across diverse settings. Therefore Littlewood et al. [33] recommended two-stage screening (Whooley questions followed by the PHQ) to reduce the false positive rate and for a more cost-effective screening.

Similar to the screening tools, heterogeneity was observed in terms of results in cost-effectiveness studies on which groups the screening should be performed on. For instance, Camacho et al. [10] demonstrated that universal screening with EPDS-10 yields an ICER of GBP 2945/QALY gained, while targeted screening in high-risk groups results in GBP 8146/QALY gained which means intervention is cost effective. However Paulden et al. [46] found screening not to be cost effective. Asper et al. [2] found that screening fathers who have a partner with PPD with the EPDS not only increased QALYs (0.03) but also reduced costs, with screening costing EUR 28,494 compared to EUR 29,561 for no screening, resulting in a negative ICER of -EUR 35,567. These findings indicate that while doing nothing avoids initial costs, it results in higher long-term societal and healthcare expenses due to untreated PPD. Screening, therefore, emerges as a cost-effective or cost-saving strategy when accounting for both healthcare and broader societal benefits. Routine PHQ screening at postpartum stages [11] and integrated psychosocial assessments [12] are also cost-effective. Treatment interventions for PPD demonstrate varied cost-effectiveness based on delivery methods, intensity, and target populations. When given CBT for low-income women at home [1] and delivered by trained peers [21] showed strong cost-effectiveness by tailoring interventions to mothers' needs. Comprehensive psychological support programmes [3] and psychiatric parent-and-baby day units [8] dominated routine care, reducing costs and improving outcomes through multidisciplinary, intensive approaches. High-intensity psychological interventions [23] and video-conferencing psychotherapy combined with usual care [70] further highlighted the value of integrating new technologies and intensive strategies. Modified guided self-help programmes [63] also emerged as cost effective for managing PPD during pregnancy. However, findings suggest that more intensive treatments may not always yield proportionally better outcomes compared to light-intensity approaches. Overall, treatment strategies benefit from personalisation, technological integration, and multidisciplinary support, ensuring both cost-effectiveness and improved maternal health. Regarding type of treatment, non-pharmacological treatment programmes were the most researched element of PPD. For example, Morrell et al. [40] reported that CBT tended to be the most cost effective across all analyses. This can be explained as in the prepartum period pregnant women cannot have most medications due to intrauterine effects, and often in the postpartum period due to breastfeeding. In these time periods, non-pharmacological treatment strategies can be cost-effective alternatives to medicinal therapy. The only study comparing two pharmacological interventions compared brexanolone injection and SSRIs, with brexanolone injection being the dominant intervention at the USD 150,000/QALY threshold with a 58 % probability [17]. However, this result should be interpreted with caution because brexanolone is a new FDA-approved treatment for moderate to severe postpartum depression. It is currently unclear whether brexanolone provides sustained relief of depressive symptoms at or beyond 30 days after administration [14]. Outcomes from treatment of PPD were identified as remission achieved, reduced healthcare, time and productivity costs, and reduced normal new-born readmission.

At this stage, we would like to highlight web-based interventions due to their inevitable use and importance. In our study, two studies were identified that specifically examined the cost-effectiveness of such strategies. Monteiro et al. [37] found that web-based cognitive behavioural therapy was cost effective for low-risk mothers. Similarly, Zheng et al. [71] showed that a web-based psychopedagogical intervention programme was more cost effective, dominating both home-based programmes and routine primary care by bringing the lowest cost. Web-based strategies can be considered cost effective due to their potential to reduce therapy dropout rates and travel-related expenses. However, it is important to consider the costs associated with the provision and maintenance of web-based platforms.

The COVID-19 pandemic has highlighted the need to adopt online solutions in various areas, including healthcare delivery. Even in the post-pandemic era, online applications remain prevalent due to their convenience and accessibility. It is also anticipated that online solutions will continue to evolve and play an important role in addressing future pandemics or epidemics. In this context, web-based cost-effective approaches are expected to become increasingly important. In particular, technology continues to play an increasing role in the delivery of healthcare services, highlighting the need to integrate innovative technological solutions into healthcare systems.

We did not find any evidence for cost-effectiveness of interventions at the individual level compared with the population level. Whether treatment strategies or service models at a population level rather than any intervention at an individual level can also be cost saving should be a focus for future studies.

This scoping review looked at the population of pregnant women or women during the postpartum period with live and term births, and fathers and families, regardless of a previous history of depression. Thus, interventions could be individualised based on patient profile for the prevention, screening, and treatment of PPD. While not without possible ethical concerns, incorporating medical patient health records could give us some clues that can be used throughout the peripartum period for screening intervention.

The impact of time horizons on the cost-effectiveness of PPD interventions is critical and warrants detailed consideration. Studies have shown that short time horizons often fail to capture the full benefits of PPD interventions, particularly those with long-term societal and intergenerational effects. For example, extending the time horizon in evaluations has highlighted the additional value of interventions such as in-home CBT and brexanolone injections, which demonstrate greater cost-effectiveness when long-term outcomes, including partner benefits and reduced societal costs, are considered [1,17,54]. These findings underscore the importance of incorporating longer time horizons to provide a more comprehensive understanding of the long-term benefits and sustainability of PPD interventions, which is essential for informed decision-making by policymakers and healthcare stakeholders.

From a health economics perspective, the variability in economic evaluation methods (e.g., CEA, CUA) and time horizons used in PPD research hinders cross-study comparisons and limits the ability to draw robust conclusions about the most cost-effective interventions. To address this, a standardised framework could be adopted. This framework should define a consistent time horizon (e.g., lifetime or minimum 10 years), employ a societal perspective, utilise validated quality-of-life measures like the EuroQol-5 Dimensions (EQ-5D), and consider a consistent set of comparator interventions. By adhering to such a framework, researchers can enhance the comparability and generalisability of economic evaluations for peripartum depression interventions, ultimately informing more effective and efficient resource allocation decisions.

Rather than relying solely on a single threshold value, cost-effectiveness information should be integrated into a broader, transparent decision-making framework that also considers other critical

factors, such as budget impact and feasibility. Although cost-effectiveness ratios offer essential insights into value for money, countries are encouraged to establish decision-making processes tailored to their specific contexts. These processes should be supported by legislation, include diverse stakeholder input - such as civil society organisations and patient groups - and adhere to principles of transparency, consistency, and equity [7].

Another point of the study is cost-effective interventions for PPD in high-income countries, such as CBT delivered by trained professionals, could be adapted for LMICs through task-shifting and community-based approaches. For instance, the Thinking Healthy Program (THP), which trains peer counsellors to deliver CBT-based care, has demonstrated efficacy and scalability in LMICs, with significant improvements in maternal mental health outcomes [21]. Similarly, web-based interventions, which include self-guided modules with facilitator support, offer low-cost solutions but require adaptations to address technological access and literacy challenges prevalent in LMICs [37]. The successful implementation of such strategies in LMICs hinges on cultural tailoring, non-specialist provider training, and leveraging community resources to sustain cost-effectiveness and impact [36].

Several limitations of the current study should be noted. Firstly, evaluation-method heterogeneity in the literature may obstruct the comparison of value for money in different healthcare system contexts. Secondly, scoping reviews generally exclude formal quality assessments because their aim is to present a broad overview rather than conduct a detailed critical analysis [47]. This study's motivation was not to seek the best available evidence to a specific question, but rather to map the economic evaluation of PPD management in different health policy contexts. To enhance the methodological rigour of future studies, formal quality appraisal could be incorporated, guided by the methodological tools and frameworks outlined by Pollock et al. [51], which emphasise the importance of quality assessment in the context of scoping reviews, as well as formally following PRISMA-ScR guidelines [64]. Thirdly, the varying quality of economic evaluations across the studies limits the robustness of the cost-effectiveness findings. Fourthly, the inclusion of family effects and long-term follow-up periods remains an area of uncertainty. Several studies failed to account for the broader societal impacts, including the effects on children and partners, which could have influenced the overall cost-effectiveness. The overrepresentation of high-income countries in the included studies and the limited discussion of challenges and cost-effectiveness in the LMICs may limit the generalisability of findings. Finally, only papers written in English were included, which could potentially exclude relevant studies published in non-English-language journals.

On the other hand, the authors believe a key strength of this review is the broad scope of the study covering PPD interventions, from prevention to screening and treatment, which offers policymakers a global perspective of the costs associated with perinatal mental healthcare.

5. Conclusion and policy implications

Peripartum depression is a prevalent mental health disorder that impacts not only women but also children and families, with significant economic and social implications. This review identified several cost-effective interventions for preventing or treating PPD, highlighting those approaches such as preventive counselling, peer support, CBT, IPT, and midwifery-led care were consistently associated with positive cost-effectiveness outcomes. However, the cost-effectiveness of interventions varied depending on the target population and the duration of their effects. Studies highlighted that preventive interventions were especially cost-effective when delivered by trained health professionals, with significant benefits from integrating mental health services into routine postpartum care. These findings emphasise the importance of considering long-term outcomes, societal savings, and the broader impact on families when evaluating the cost-effectiveness of PPD interventions.

A growing literature on economic evaluation of peripartum depression is being conducted in high-income countries. On the other hand, there is little evidence from low- and middle-income countries. This could be due to lacking alternative interventions, constrained human resources, and administrative capacity. Despite sound treatment evidence, preventive strategies and interventions still need further development. Even though screening interventions may detect the target population, most of the population have still remained undiagnosed.

The cost-effectiveness of an intervention can vary across health systems due to differences in resource availability, healthcare infrastructure, and cultural factors that influence implementation. This review underscores these variations by analysing interventions in diverse settings, highlighting the need to contextualise findings within specific health system contexts. By examining a range of interventions across different countries and healthcare systems, the review provides valuable insights into how system-level factors can shape cost-effectiveness outcomes, emphasising the importance of tailored policy recommendations. Additionally, while many studies have evaluated PPD prevention, screening, and treatment interventions from the perspective of third-party payers or healthcare providers, there is a notable gap in considering the broader social perspective.

If we summarise our recommendations for policymakers:

- It is important to prioritise prevention-based interventions. Therefore, training the first point of contact for women in the peripartum period (community health workers, midwives or nurses, etc.) may yield greater benefits at lower costs.
- Universal or targeted screening strategies for mother and father together using tools such as the EPDS or integrated psychosocial assessments to identify women at risk should be implemented by trained healthcare professionals. In addition, screening should be complemented by urgent referral pathways for confirmed cases.
- Accessible, evidence-based treatment options, including CBT, in-home therapies, and guided self-help programmes should be promoted.
- Web-based platforms for PPD prevention and treatment, such as self-guided CBT and psychoeducational modules, should be developed and integrated to routine care. These interventions are scalable and particularly beneficial in remote or underserved areas and even cost effective.
- Collaboration among general practitioners, midwives, and mental health professionals to create integrated care pathways for PPD should be fostered. This ensures comprehensive support while maximising resource efficiency.
- Establishing mechanisms for ongoing evaluation of PPD interventions to ensure their relevance and cost-effectiveness is important. Insights to refine policies and reallocate resources where they can have the greatest impact should be used.
- Disparities in PPD care should be addressed by targeting interventions to underserved populations and ensuring equitable access to screening and treatment, and tailoring services to cultural and socioeconomic contexts should be take into consideration.
- Research should be supported on the long-term benefits and intergenerational effects of PPD interventions. For this aim robust data systems to monitor outcomes and identify gaps in care should be developed.

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Declaration of competing interest

We have no known conflict of interest to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.healthpol.2025.105264.

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