Interventions for postnatal depression assessing the mother–infant relationship and child developmental outcomes: a systematic review

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Abstract: Postnatal depression (PND) has negative effects on maternal well-being as well as implications for the mother–infant relationship, subsequent infant development, and family functioning. There is growing evidence demonstrating that PND impacts on a mother's ability to interact with sensitivity and responsiveness as a caregiver, which may have implications for the infant's development of self-regulatory skills, making the infant more vulnerable to later psychopathology. Given the possible intergenerational transmission of risk to the infant, the mother–infant relationship is a focus for treatment and research. However, few studies have assessed the effect of treatment on the mother–infant relationship and child developmental outcomes. The main aim of this paper was to conduct a systematic review and investigate effect sizes of interventions for PND, which assess the quality of the mother–infant dyad relationship and/or child outcomes in addition to maternal mood. Nineteen studies were selected for review, and their methodological quality was evaluated, where possible, effect sizes across maternal mood, quality of dyadic relationship, and child developmental outcomes were calculated. Finally, clinical implications in the treatment of PND are highlighted and recommendations made for further research.

Keywords: postnatal depression, infant development, intervention, dyad, mother–infant relationship, systematic review

Introduction

Approximately one in ten women suffers from postnatal depression (PND).[1–3] Beck[4] reported that the best predictor of PND was depression in the antenatal period. A recent review identified a number of postnatal factors placing women at increased risk to continued depressive symptoms, including younger maternal age, poor education attainment, historical episodes of depression, antidepressant use during pregnancy, child developmental problems, low parental self-efficacy, poor relationship, and the occurrence of stressful life events.[5] Psychosocial factors (ie, poverty, marital discord, life stressors) are thought to be more predictive of vulnerability to PND than biological or hormonal causes.[1]

PND has varied onset, chronicity, clinical presentation, and course relative to major depression and other mood disorders in the postpartum period, including postnatal blues and puerperal psychosis.[6] Biopsychosocial models highlight the complexity and interaction between multiple systems implicated in PND. The model by Milgrom et al[1] details vulnerability factors, precipitating factors (including those factors which may trigger PND onset: stress levels, stress-moderating variables of social support, and coping skills), and biological factors. The model also explains that sociocultural

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factors may play a role in exacerbating and maintaining PND and they account for heterogeneity in vulnerability to experiencing PND across women.

An episode of PND generally lasts from 2 months to 6 months in duration and as long as 1 year in some cases.[2,6,7] According to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), fourth edition, women meet diagnostic criteria for PND if the onset is within the first 4 weeks postpartum, although this onset period has been extended in clinical practice with reports that 50% of cases start within 3 months and 75% of cases within 7 months.[8] The revised criteria in the DSM-V included a new specifier of mood episodes beginning in pregnancy.[9] These criteria make limited reference to the infant, although the need for recognition of symptoms relating specifically to birth, labor, and other aspects of being a new parent has been identified elsewhere.[10]

The estimated cost of care alone between women with PND and those without PND in a British community sample is significant, reaching a mean cost of £505.70 for mothers without PND and £786.20 for mothers with PND – a significant (P=0.01) mean cost difference of £280.50.[11] Petrou et al[11] have recommended that these are conservative estimates and that the excess cost is substantially more for women experiencing extended episodes of PND. Notwithstanding, there are further cost implications in terms of child and adolescent services accessed due to the increased risk associated with having a parent with PND. Treatment is, therefore, a major public health concern and the one which spans both maternal and infant mental health.[12]

Considerable evidence suggests that PND has profound and widespread effects on the mother,[13] the mother–infant relationship,[14,15] and serious implications for subsequent infant development[16–18] and family well-being.[19] Research has established that PND can affect the quality of parenting.[20–22] In the context of PND, difficulties in practical parenting practices related to breastfeeding,[23–25] sleep,[26–28] infant health care,[29] and safety practices[24,25,30,31] have been reported. Following an episode of PND, women are predisposed to future risk of depressive episodes with subsequent children. Crucially, the first year is an important period for infants to develop self-regulatory skills.[32,33] Adaptive development of self-regulatory skills in the infant is promoted by sensitive and responsive caregiving. PND directly impacts on a mother's ability to sensitively respond her baby; thus, the quality of the dyadic relationship is also affected.

Interventions focusing exclusively on maternal depression may not be sufficient alone to buffer against the risks to infant development.[34–36] In many instances, maternal mood may improve, but the intergenerational transmission of risk may continue to manifest. Conceptualizing the depressive episode within the context of the perinatal period may promote adaptive developmental pathways in the infant. It is therefore necessary to measure outcomes in order to understand if interventions for PND exert a protective effect on the mother–infant relationship and infant development in addition to maternal mood.

Intergenerational transmission of risk to children of women with PND

Goodman and Gotlib[37] highlighted the need for a developmental model, which explains the transmission and manifestation of vulnerability in infants. The nature of the association between PND and infant development is especially complicated by limited understanding of the full impact and risk of maternal mood and cognitions on infant developmental pathways.

In their integrated model, Goodman and Gotlib[37] detail how the effects of PND are implicated across the intergenerational gap. The model reflects the complex interplay between quality of parenting and several mechanisms (ie, heritability of depression, neuroregulatory mechanisms, exposure to negative maternal cognitions, behavior and affect, and sociodemographic conditions) and moderating risk factors (ie, paternal health/involvement, course and timing of depression, and individual child characteristics) which influence the developing infant (see Goodman and Gotlib[37] for a description of the model).

Effect of PND on infant development

Evidence suggests that PND in the parent may contribute to serious effects on infant cognitive and emotional development and is associated with later psychopathology and atypical development.[38–40,44]

Grace et al[41] highlighted that the most significant effects of PND were on cognitive development including language development and intelligence. However, effects varied with characteristics of children involved, including sex and contextual factors as indicated by the aforementioned model. They also suggested that timing and course of PND were more pervasive in their effects on child development.

Research using the face-to-face video interaction paradigm has demonstrated that mothers with PND are more negative and their infants less positive than nondepressed mother–infant dyads.[42]

Longitudinal studies have also shown a predictive link between early PND and problems much later in

development.[17,43] Milgrom et al[44] demonstrated the role of maternal responsiveness in atypical developmental patterns and increased temperamental difficulties in infants of mothers with PND at 48 months postpartum. They also found that full IQ scores were lower in children of mothers with PND, demonstrating the lasting effects of PND occurring early in the postpartum period. Recent systematic reviews by Kingston et al[45] and Kingston and Tough[46] evaluated longitudinal research of the effects of maternal distress, including postnatal distress, on infants and school-aged children. They reported particular effects of postnatal maternal distress on both infant[45] and school-aged child[46] cognitive and socio-emotional development. They also summarized small-to-moderate effects of postnatal maternal distress on the behavior of school-aged children.[46]

The mother–infant relationship

Developmental literature has highlighted the importance of early influence at protecting and promoting development. The infant–caregiver relationship has been widely recognized to play an important role in child development.[47] Murray and Cooper[39,40] suggested that the effects of PND on infant development were mediated through an association with maternal cognitions and maladaptive parenting practices. Research by Stein et al[48] demonstrated that disturbances in maternal cognitions of women with PND may play a causal role in the negative effects on the mother–infant relationship.

Parental ability to regulate an infant's emotional state plays a key role in helping children to develop strategies for self-regulation.[22,49–51] Gerhardt[50] summarized that the implications of failure of the caregiver to respond appropriately or "good enough" to her infant's needs had an impact at the neurochemical level of prolonged increase of cortisol levels on the infant. Gerhardt[50] reviewed evidence that prolonged levels of cortisol in early infancy have consequences for neural systems implicated in how infants tolerate stress later in life, namely the prefrontal cortex and Hypothalamic-pituitary-adrenal axis.

Emerging imaging research completed with adult children of women with PND captured a significant association between their attachment security at 18 months and neural responding at 22 years of age.[52] Specifically, the research found increased activation in prefrontal areas and decrease in activation of neural regulation of positive affect. Further research identified that compared with controls, women with PND are less able to identify happy faces potentially leading to decreased responsiveness toward their infants.[53]

Van Den Boom[54] reported that educating vulnerable parents on how to respond appropriately and "optimally" to their temperamentally reactive infants was central to forming secure attachment bonds with their infants. This secure attachment, which develops between the mother and infant, also illustrates that the care the infant receives can impact in a protective manner on the developing child. Consequently, it seems that at least optimal parenting is a key feature in a parent's (namely the mother's) ability to regulate and soothe his/her infant during periods of distress.[50]

Interventions focusing on the mother–infant relationship

There is a body of research investigating various treatment approaches for PND. Within the available literature, several approaches have been identified and have demonstrated variable levels of efficacy, including various antidepressant treatments,[55,56] antenatal group interventions,[57] psychoeducation,[58,59] cognitive behavior therapy (CBT),[60,61] interpersonal psychotherapy (IPT),[34,62,63] and interventions focusing on the mother–infant relationship[64–66] and baby massage.[67,68] Indeed, there are several comprehensive literature reviews on the evidence base of different interventions.[12,69–73]

However, within this literature, a poverty of interventions measuring outcomes relating to the mother, her relationship with the infant, and infant development has been identified. The majority of reviews on the subject have explored efficacy in relation to maternal mood. Furthermore, there is emerging evidence that the treatment of PND alone is not sufficient to improve the mother–infant relationship as well as child development.[34,69] Given that PND affects the mother, her relationship with the infant, as well as the infant's development and well-being, a systematic review exploring the impact of interventions on these outcomes was clearly indicated.

Assessment of child outcomes and dyadic relationship in interventions for PND

A significant proportion of PND treatment literature has focused on the mother's depression in isolation, with few studies assessing the quality of the dyadic relationship as well as child developmental outcomes. They do not reflect mechanisms or moderators proposed by Goodman and Gotlib.[37] Therefore, it is difficult to determine what impact treatment has beyond outcomes associated with maternal mood.

While there is an extensive literature of evaluation studies on various interventions for PND, little is known about the benefit of interventions to the quality of the mother–infant relationship and moreover, child developmental outcomes. Poobalan et al[74] addressed this issue through an earlier review

of treatments for PND, which focused on the mother–infant dyad relationship. Outcomes were discussed in terms of child outcomes. They noted some support for dyadic-focused interventions in improving child outcomes; however, the evidence was equivocal. In addition, Poobalan et al's review[74] did not calculate effect sizes. In contrast, the present review extends the review by Poobalan et al[74] by reporting on effect sizes, updating the search period from 1999 to 2014, inclusion of other therapies (antidepressant medication), and rigorous quality assessment, using the Clinical Tool for Assessment of Methodology (CTAM)[75] categories including allocation, assessment, control groups, analysis, and treatment. Most importantly, the present review considers the impact of treatments on maternal depression symptoms in addition to child outcomes.

The aims of the present systematic review were to evaluate all trials reported in the literature since 1999 and to evaluate intervention research, which has included outcomes measuring the quality of the mother–infant relationship and/or child developmental outcomes in addition to maternal mood.

Method
Search strategy
The literature search included publications from 1999 to 2014, since an earlier review by Poobalan et al[74] reviewed studies from the 1990s to 2005, using a standard assessment adapted from the Cochrane Collaboration and Jadad Scale.[76] The following databases were searched: PsycINFO, Medline, Embase, Web of Science, and Maternity and Infant Care. Additional searches were run using the aforementioned databases and PubMed for the dates between 2012 and 2014. Boolean searches on MeSH were conducted using combinations of the following (and related) terms: ("depression, postpartum" [MeSH Terms] OR "depression, postpartum" [MeSH Terms]) AND (("therapy" [Subheading] OR "therapy" [All Fields] OR "treatment" [All Fields] OR "therapeutics" [MeSH Terms] OR "therapeutics" [All Fields]) OR ("Intervention (Amstelveen)" [Journal] OR "intervention" [All Fields] OR "Interv Sch Clin" [Journal] OR "intervention" [All Fields])) AND (("mother–child relations" [MeSH Terms] OR ("mother–child" [All Fields] AND "relations" [All Fields]) OR "mother–child relations" [All Fields] OR ("mother" [All Fields] AND "child" [All Fields] AND "relations" [All Fields]) OR "mother child relations" [All Fields]) OR ("child development" [MeSH Terms] OR ("child" [All Fields] AND "development" [All Fields]) OR "child development" [All Fields] OR ("infant" [All Fields] AND "development" [All Fields]) OR "infant development"

[All Fields])) AND ("1999/01/01" [PDAT]: "2014/12/31" [PDAT]), Filters: Journal Article, From January 1, 2012 to December 31, 2015, Humans). All titles and abstracts were initially scanned for relevance.

Inclusion criteria
Studies were considered if they included a treatment or intervention which was delivered in the postnatal period, and if the primary outcomes assessed maternal depression and mother–infant interaction and/or child outcomes. Both single-group and randomized controlled trial (RCT) designs were considered for inclusion. A further inclusion criterion was that participants were experiencing low mood as indicated by a screening tool (ie, Edinburgh Postnatal Depression Scale [EPDS]) or a professional diagnosis of depression.

Exclusion criteria
Studies were excluded if they were single-case designs, reviews, book chapters, and/or discussion papers, not in the English language, and not peer reviewed.

Evaluation of quality of trial methodology
The CTAM, an assessment tool used to evaluate the quality of psychotherapeutic trials,[75] was used in the present study because of its comprehensiveness in covering the six main areas of trial design, including sample size and recruitment method, allocation to treatment, assessment of outcomes, control groups, description of interventions, and analysis of data. There are a total of 15 items. Scores range from 0 to 100; scores over 65 are regarded as good quality.

Effect sizes indicate the magnitude of difference between two groups. In this review, they were also calculated separately for maternal mood, quality of dyadic relationship, and child developmental outcomes.

Effect sizes (Cohen's d) were considered as small if between 0.2 and 0.3, medium if between 0.4 and 0.7, and as large if equal to or greater than 0.8. As suggested by Cohen,[77] effect sizes were calculated individually given the heterogeneity of outcome measures and interventions. Effect sizes have only been calculated in studies where means and standard deviations were reported. Effect sizes have not been calculated in previous reviews of this literature.

Results
The initial search returned 862 articles. Six hundred and seventy-two articles did not meet inclusion criteria on the

basis of a review of the title and/or abstract. A further 143 articles were excluded after more detailed examination of the title and abstract. Twenty-eight articles were removed for being duplicates or triplicates leaving 19 studies to be evaluated (Figure 1) for a schematic diagram of the literature search. Only three studies[34,61,64] assessed both the quality of the dyad relationship and child outcomes. Although there was a high degree of heterogeneity across studies and measures used for assessment, effect sizes for different outcomes (maternal mood, mother–infant relationship, child developmental outcomes) were calculated where possible.

Location and sample

From the 19 studies included in the review, nine were carried out in the USA, five in the UK, two in the Netherlands, two in Australia, and one in Canada.

Participant characteristics

Of the 19 studies, ten were carried out with a multiparous sample and three with a primiparous sample, and six of the studies did not report parity. There was high variability across study client inclusion criteria regarding how depressive diagnosis was determined. Thirteen studies included participants with a professional diagnosis of PND, and six
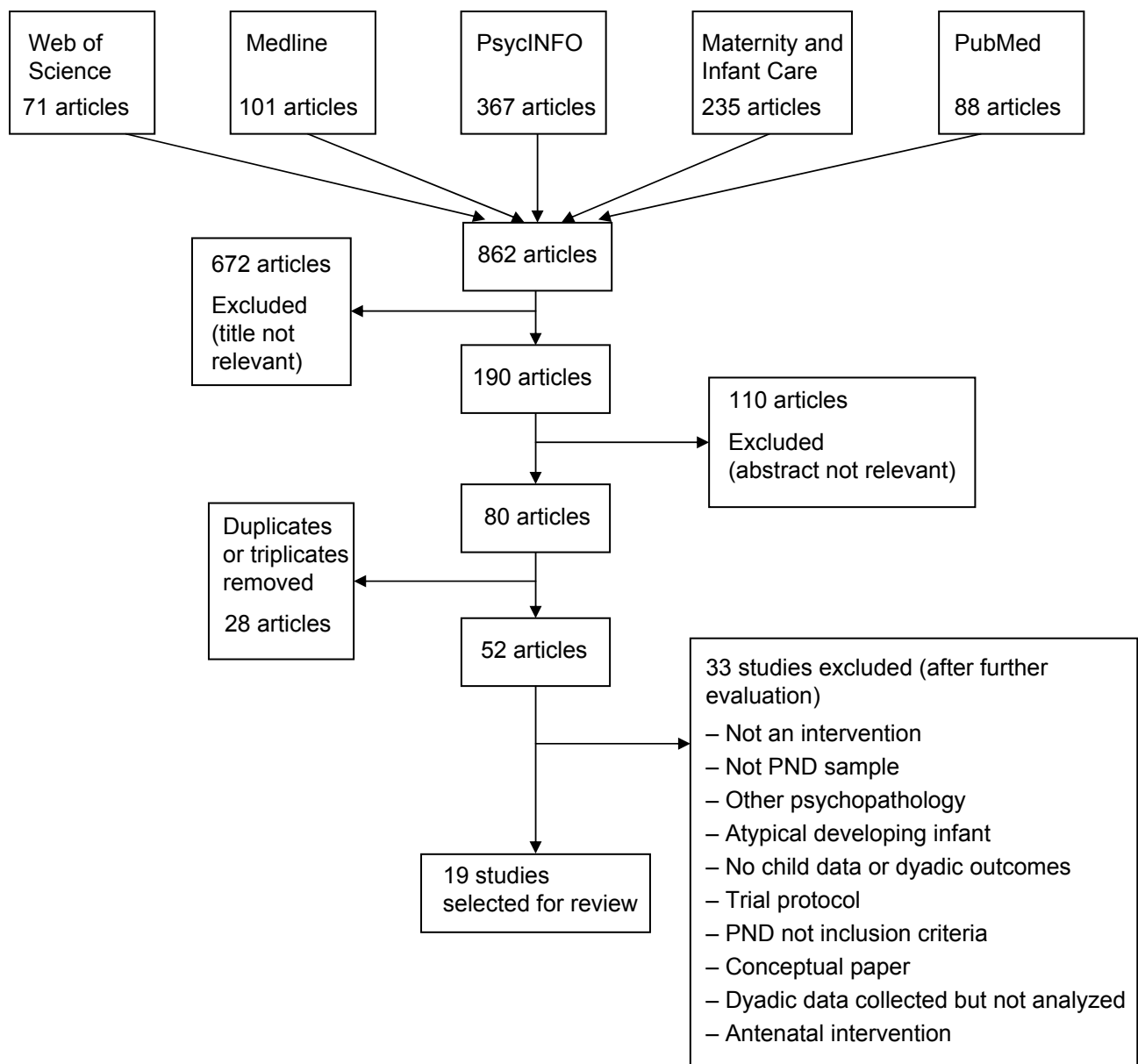
Figure 1 Schematic diagram of literature search for studies on treatment for PND with outcomes assessing mother–infant interaction and/or child outcomes.
Abbreviation: PND, postnatal depression.

studies included participants with probable diagnosis through public health screening. There were also differences across characteristics of participants in terms of severity of depression, marital status, and age of baby (Table 1).

Treatment type, session length, and total duration

The types of interventions evaluated in this review varied greatly with respect to their focus. For example, some interventions focused on the dyadic interaction, whereas others focused on maternal depression. Clark et al[65,78] evaluated mother–infant therapy group (M-ITG), a relationship-focused intervention grounded in interpersonal, psychodynamic, and family system approaches. The M-ITG intervention focuses on a) providing therapeutic intervention and peer support, b) addressing infant emotional regulation and social engagement, and c) promoting sensitive interaction in the dyad. In their 2003 study, Clark et al[65] compared M-ITG with IPT, which involves identifying interpersonal patterns contributing to symptoms of PND.

Forman et al[34] and Mulcahy et al[62] also examined IPT and described it as focusing on social role transitions (ie, transition to parenthood) as well as loss and grief in addition to focusing on individual interpersonal aspects. Infant massage, which involves administering various massage techniques to an infant's body while adjusting strokes according to infant responses, was also evaluated.[67,68,79]

A further intervention focusing on the dyad relationship, called interaction coaching intervention, was evaluated by Horowitz et al.[80] The intervention is designed to strengthen the dyadic relationship and focuses on a) promoting maternal responsiveness, b) guiding mother to make eye contact with infant, c) responding to pauses (ie, imitation, facial expression, and tone), d) practicing through trial and error, e) reinforcing maternal-sensitive responsiveness, and f) praising success.

Kersten-Alvarez et al[81] also evaluated a mother–infant intervention focusing on enhancing quality of dyadic interaction, through improving maternal sensitivity using video feedback and where needed, using modeling behavior,

Table 1 Participant characteristics including marital status, age of baby and mother, and level of depression (at baseline) across all studies

Study	Marital status	Age of baby	Level of depression (baseline)	Mean age of mother
Field et al[79]	Single parents only	1–3 months (range)	Not reported	17.3 years (range =14–19)
Horowitz et al[80]	Not reported	4–18 weeks (range)	14.4 (mean BDI)	31 years (range =17–41)
Onozawa et al[68]	91% married/cohabiting	8.6–9.0 months (median range)	Baseline EPDS (median scores)	18–45 years (range)
Clark et al[78]	84.6% married/cohabiting	8.9 months (range 1–24 months)	>16 (BDI)	31.4 years (range =19–44)
*Murray et al[61] *Cooper et al[82]	88% married/cohabiting	8 weeks	>12 (EPDS)	27.7 years (range =17–42)
Milgrom et al[60]	79.6% with partner	18.13 weeks (mean)	17.0 (mean BDI)	29.9 years
Jung et al[66]	100% married/cohabiting	3.5 months (range =3–4 months)	>10 (BDI/EPDS)	33 years (range =21–41)
Forman et al[34]	100% married/cohabiting	6.1 months (mean)	Not reported	30.6 years
Clark et al[65]	Not reported	6.4 months (range =1.00–24.26 months)	22.3 (mean BDI)	31.3 years
O'Higgins et al[67]	87% married/cohabiting	19 weeks	13.5 (mean EPDS)	Not reported
**Van Doesum et al[64]	91.3% cohabiting	5.5 months (mean)	23.9 (mean BDI)	30.1 years
Logsdon et al[55]	55.5% single 40.7% married 3.7% divorced/separated	10 months (mean)	18.1 (mean HRSD)	24.5 years
**Kersten-Alvarez et al[81]	85% married/cohabiting 16% single	6 months (mean)	23.8 (mean)	35.7 years (range =25–43)
Beeber et al[83]	37% cohabiting	24.9 months (mean)	16.2 (HRSD)	26 years
Horowitz et al[84]	83% cohabiting	7.4 weeks (mean)	12.34 (EPDS)	31 years
Tsivos et al[86]	89% married/cohabiting 11% separated/divorced	6.2 months (mean)	32.4 (BDI-II)	28.4 years
Goodman et al[85]	59.5% married/cohabiting 16.6% single	6 weeks	12.3 (EPDS)	30.7 years

Notes: *Cooper et al[82] report the maternal mood data, and Murray et al[61] report dyad and child outcome. **Kersten-Alvarez et al[81] report the dyad and child developmental outcomes of Van Doesum et al.[64]
Abbreviations: BDI, Beck Depression Inventory; EPDS, Edinburgh Postnatal Depression Scale; HRSD, Hamilton Rating Scale for Depression.

cognitive restructuring, support, and baby massage. Jung et al[66] investigated the efficacy of a further dyadic-focused intervention. Keys to Caregiving, aims to facilitate sensitive responding to infant behaviors through enhancing understanding of the meaning of different infant behaviors. The intervention involved practice with the infant during the session and at home. Keys to (caregiving) Capital sessions included understanding of infant states, infant behaviors, infant cues, modulation, and feeding.

In their RCT, Cooper et al[82] compared routine care (health visiting with no additional input) with CBT, nondirective counseling, and psychodynamic therapy. Nondirective counseling provided women with the opportunity to discuss feelings of current concerns (ie, financial, relational – partner/infant). CBT was tailored toward the mother's management of her infant (ie, feeding, sleep) and the quality of the dyadic interaction. Within the CBT sessions, a woman was also encouraged to problem solve in a systematic way, and examine patterns of thinking about her infant and herself as mother. Psychodynamic therapy utilizes techniques aimed at understanding mother's representation of infant and relationship with infant promoted by exploring aspects of mother's early attachment history. Two antidepressant medications (nortriptyline and sertraline) were also evaluated.[55]

The review of all studies also showed that session lengths ranged from 15 minutes to 2 hours, and total treatment duration ranged from three to 12 sessions. Mode of delivery included both individual and group delivery as well as mixed individual and group. A summary of type of treatment, session length, and treatment duration, CTAM scores, and domains of assessment (maternal affect, dyad relationship, and child development) across all studies is presented in Table 2.

Methodological quality

A summary of CTAM scores across all studies assessed is presented in Table 2. Overall, most studies (eleven of the 19 studies) included in the review had a CTAM score below 65, which is described as inadequate by the authors of the CTAM.[75]

Sample

Most studies (12/19) used a convenience sample. Nine of the 19 studies had a sample size greater than 27 in each treatment group.[34,61,64,67,80–84] Numbers of less than 27 in each group are regarded as inadequate and do not score on the CTAM. Small sample sizes are a long-standing limitation within the PND literature. A large proportion of studies with PND populations failed to recruit to target, and as such they were underpowered. This is a difficulty experienced across trials.

Allocation

While most studies described whether there was true random allocation or minimization allocation across treatment groups, only ten studies described the process of randomization.[55,61,62,64,67,80,82,83,85,86] Furthermore, four studies also indicated that the process of randomization was carried out independently of the research team.[55,62,83,85]

Assessment

All of the studies used standardized assessments to measure outcomes. All but three studies[66,68,86] had assessors who were independent of treatment delivery (ie, they were not the therapist on the trial). Eight studies reported that assessments were carried out blind to treatment group allocation.[34,61,67,80–83,85] However, only two studies[68,80] described the method of rater blinding, while only one study[68] reported verification of rater blinding.

Control groups

While most studies utilized a RCT design, three studies[34,67,83] reported using both, no treatment or waitlist control (WLC) group and a control group that controlled for nonspecific effects (ie, nondepressed comparison group).

Analysis

All studies conducted appropriate analyses given their design and sample sizes. One study[34] employed an intention-to-treat analysis (including all participants as randomized), and six studies had attrition of less than 15%.[61,62,80,82,84,85] The remaining studies did not handle drop-outs appropriately, and had attrition of greater than 15% or inappropriate sample sizes (ie, less than 27 participants in each group).

Active treatment

All interventions employed were psychotherapy or psychosocial interventions with the exception of one study,[55] which was an evaluation of two types of antidepressant medications. Nine of the studies provided an adequate description of the treatment, reported the use of a protocol or manual, as well as an assessment of adherence to the protocol.[62,64,65,78,81–83,85,86]

Maternal mood, dyadic relationship, and developmental outcomes
Outcome measures

Various outcome measures were used across the studies to evaluate the efficacy of interventions in the domains of

Table 2 Characteristics of studies assessing interventions for PND which include either dyad or child developmental outcomes

Study	Country	N	Study design	PND diagnosis	Maternal mood	Dyad assess	Child assess	Follow-up	Treatment/target	TX length	CTAM score	Format	Key findings
Beeber et al[83]	USA	226	RCT	Y	Y	Y	N	Y	IPT (D) TAU	10 weekly sessions +1 month of booster telephone calls		Individual	Both IPT and TAU reported significant reductions in depressed scores (HRSD) IPT associated with significant increases in positive attunement (closeness, positive affect, affection, and warm touch)
Clark et al[78]	USA	39	SGA	Y	Y	Y	Y	N	M-ITG (D) IPT (M) WLC	1–1.5 hours 12 weeks	30	Individual	Both M-ITG and IPT groups reported significantly fewer depression symptoms (CES-D) than WLC. No significant differences in BDI scores between any of the groups. Significant differences were also reported on parenting stress M-ITG and IPT both showed significant improvements in perception of child adaptability and more reinforcement from their children M-ITG and IPT groups both scored significantly higher on Maternal Positive Affective Involvement and Verbalization than WLC No differences were found across any groups on infant development
Clark et al[65]	USA	32	SGA	Y	Y	Y	N	N	M-ITG (D)	Part 1: 1.5 hours (therapy group for mums, developmental therapy for infants) Part 2: 30-minute dyadic group therapy	40	Group	M-ITG showed significant fewer depressive symptoms, and mothers experienced their infants as reinforcing their efforts and parenting more rewarding. M-ITG also exhibited significantly more positive affective involvement and communication after treatment
*Cooper et al[82]	UK	193	RCT	Y	Y	N	N	Y	TAU (M) Nondirective counseling (M) CBT (D) Psychodynamic therapy (D)	Weekly from 8 weeks to 18 weeks postpartum	72	Individual	All treatments had significant impact on mood at 4.5 months. Psychodynamic therapy rate of reduction of depression was significantly greater than TAU. Benefit of treatment was not maintained at 9 months. Treatment did not reduce subsequent episodes
Field et al[79]	USA	40	RCT	Y	N	N	Y	N	Baby massage (D)	15 minutes 2 days/week 6 weeks	46	Group	Babies in massage therapy group were observed to be more awake and alert and less drowsy and sleepy than comparison group. Crying and cortisol levels in the baby massage group also decreased compared with rocking group

Author	Country	N	Design						Intervention	Duration	Sample	Individual/Group	Findings
Forman et al[34]	USA	176	RCT	Y	N	Y	Y	Y	IPT (M) / WLC	12 weekly sessions	80	Individual	Treatment was reported to only affect parenting stress. Women receiving IPT had significant improvements in parenting stress compared with WLC but not the nondepressed comparison sample. At 18-month follow-up, women who received IPT continued to rate their children lower in attachment security, higher in behavioral problems, and more negative in their temperament compared with nondepressed comparison sample
Goodman et al[85]	USA	42	RCT	Y	Y	Y	N	Y	PDP (D) Usual care + telephone depression monitoring	1 hour, 8 sessions	79	Individual	There were significant decreases in symptoms of anxiety and depression and increases in maternal self-esteem across both groups. There were no significant differences between the groups across parenting stress or dyadic interaction
Horowitz et al[80]	USA	117	RCT	N	Y	Y	N	N	Interactive coaching (D) support group	15 minutes, 3 time points	77	Individual	Treatment group showed significantly higher level of responsiveness at posttreatment. Both groups demonstrated significant reduction in depression scores
**Horowitz et al[84]	USA	134	RCT	Y	Y	Y	N	Y	Interactive coaching (D) control group	1 hour, 5 time points	65	Individual	Both treatment and control groups showed significant increases in quality of mother–infant interaction and decreases in symptoms of depression
Jung et al[66]	Canada	11	SGA	N	N	Y	N	N	Keys to Caregiving (D)	5 weekly sessions	19	Group	Post-intervention infants displayed marked increase in interest and joy during interaction with mothers
**Kersten-Alvarez et al[81]	Netherlands	58	RCT	Y	N	Y	Y	Y	Mother–infant pairs videotaped and provided with feedback. Control group – minimum 3 phone calls (15 minutes maximum) providing practical parenting advice (D)	60–90 minutes, 8–10 sessions. Initially weekly, then reduced to every 2 weeks	69	Individual	No lasting effects of the intervention at 5-year follow-up. However, the authors reported an effect for child-externalizing behavior problems associated with family stressful life events. Children in the intervention group had fewer instances of externalizing behavior problems associated with family stressful life events
Logsdon et al[55]	USA	27	RCT	Y	Y	Y	N	N	Antidepressant medication (M)	8 weeks of treatment	42	Individual	Improved gratification of maternal role but not self-efficacy or mother–infant interaction
Milgrom et al[60]	Australia	117	RCT	N	Y	Y	N	N	CBT (D)	12 weekly sessions	29	Individual	There was a statistically significant decrease in overall parenting stress scores

(Continued)

Table 2 (*Continued*)

Study	Country	N	Study design	PND diagnosis	Maternal mood	Dyad assess	Child assess	Follow-up	Treatment/target	TX length	CTAM score	Format	Key findings
*Murray et al[61]	UK	193	RCT	Y	N	Y	Y	Y	Nondirective counseling (M) CBT (D) Psychodynamic therapy (M) TAU	Weekly from 8 weeks to 18 weeks postpartum	72	Individual	All three treatments were associated with significant improvements in maternal reports of relationships with their infants. Counseling gave better infant emotional ratings at 18 months and sensitive early dyad interactions. No significant benefit on maternal management of infant behavior problems, security of dyad attachment, infant cognitive development, or any child outcomes at 5 years
Mulcahy et al[62]	Australia	50	RCT	N	Y	Y	N	Y	IPT-G	2 hours and 1×2 hour partner evening	54	Individual (2 sessions) and group (8 sessions)	IPT-G showed significant improvement in depression scores compared with TAU. Improvement maintained at follow-up IPT-G showed significant improvement in perception of infant caregiving, marital functioning, and social support. IPT-G showed nonsignificant improvements at follow-up
O'Higgins et al[67]	UK	62	RCT	N	Y	Y	N	Y	Baby massage (D) support group	1 hour, 6 sessions	70	Group	Post treatment, both control and baby massage groups obtained higher scores on the EPDS than nondepressed group. The massage group showed nonsignificant reductions on depression scales At 12-month follow-up, depressed group was still scoring significantly higher on the EPDS scale than nondepressed controls. Although, significantly more of the massage group achieved clinical reductions in EPDS scores and nondepressed levels of sensitivity in interactions with their babies compared with support group
Onazowa et al[68]	UK	34	RCT	N	Y	Y	N	N	Baby massage (D)	1 hour, 5 weekly sessions	45	Group	Significant improvement in mother–infant interaction only in massage group
Tsivos et al[86]	UK	27	RCT	Y	Y	Y	N	Y	Baby Triple P (D)	60–90 minutes, 8 weekly home sessions	51	Individual	Significant improvements were reported across both treatment and TAU groups. There were no between-group differences
Van Doesum et al[64]	Netherlands	71	RCT	Y	Y	Y	Y	Y	Mother–baby intervention (quality of dyad relationship) (D)	60–90 minutes, 8–10 home visits over 3–4 months	62	Individual	At (T3), treatment group had significantly higher AQS scores than controls. Treatment group was significantly more competent (ITSEA subscale) than control group, but no differences were seen on other subscales. Increase in maternal sensitivity in treatment group was seen

Notes: *Report different outcomes from same study. **Reports dyad and child developmental outcomes of Van Doesum et al.[64]

Abbreviations: AQS, Attachment Q-Set; BDI, Beck Depression Inventory; CES-D, Centre for Epidemiological Studies Depression Scale; CBT, cognitive behavior therapy; CTAM, Clinical Tool for Assessment of Methodology; D, dyadic focus; EPDS, Edinburgh Postnatal Depression Scale; HRSD, Hamilton Rating Scale for Depression; IPT, interpersonal psychotherapy; IPT-G, interpersonal psychotherapy group; ITSEA, Infant Toddler Social Emotional Assessment; M, maternal depression focus; M-ITG, mother–infant therapy group; N, no; PDP, perinatal dyadic psychotherapy; PND, postnatal depression; RCT, randomized controlled trial; SGA, Single Group Assignment; TAU, treatment as usual; TX, treatment; WLC, waitlist control; Y, yes.

maternal affect, dyad relationship, and child development (Table 2).

Maternal mood
Studies used either the Beck Depression Inventory or the EPDS to assess maternal mood, with the exception of three studies, which used the Hamilton Rating Depression Scale.[55,62,83] The largest effect sizes, though moderate in terms of effectiveness of treatment on improvement in maternal mood, were reported by Horowitz et al[80] and Clark et al[65] (Table 3 presents the effect sizes). In their evaluation of the efficacy of a behavioral intervention delivered by advanced practice nurses and research assistants, which involved coaching designed to promote maternal responsiveness, Horowitz et al[80] reported that women who had received the behavioral coaching showed a significantly higher level of responsiveness posttreatment. Clark et al[65] investigated the efficacy of a 12-week, manualized M-ITG compared with WLC: women allocated to the M-ITG showed significantly fewer depressive symptoms, and experienced their infants as more reinforcing and parenting more rewarding.

Smaller effect sizes (Table 3) were calculated across several other studies.[62,64,67,78,82] Three studies reported on evaluations of IPT: Mulcahy et al[62] in an RCT comparing group IPT with treatment as usual (TAU), Clark et al[65] in an RCT comparing M-ITG and IPT with WLC, and Beeber et al[83] in an RCT comparing IPT + parental enhancement (PE) with an attention control health education condition. While a greater effect size was calculated for M-ITG compared to IPT in Clark et al's[65] study, an overall greater effect size was reported by Mulcahy et al.[62]

Cooper et al[82] compared counseling, psychodynamic therapy, and CBT with TAU. The largest effect size was calculated for psychodynamic therapy. Psychodynamic therapy was associated with significantly greater reductions in depressive symptoms compared with TAU; however, the effects were not maintained at 9-month follow-up. No significant differences were found in symptoms of depression between women who took part in an intervention working on the quality of the dyadic relationship compared with mothers receiving telephone parenting support only.[64]

Goodman et al[85] evaluated the efficacy of perinatal dyadic psychotherapy (PDP), designed to reduce symptoms of depression and improve the mother–infant relationship. Using an RCT design, they compared PDP with a control condition receiving telephone monitoring of symptoms. Both groups reported significant improvements in their depressive symptoms.

Three studies evaluated different delivery modalities of baby massage.[67,68,79] No significant differences were found across measures of maternal mood between comparison groups and women receiving baby massage in the studies by O'Higgins et al.[67] Onozawa et al[68] and Field et al[79] did measure developmental but not maternal outcomes (but included women on the basis of formal diagnoses of major depression).

CBT supplemented with a mother–infant module Happiness Understanding, Giving and Sharing (HUGS) was evaluated by Milgrom et al.[60] The authors reported significant reductions in symptoms of depression following CBT and further significant drops in parenting stress following the mother–infant module. Due to missing information, effect sizes for this study could not be calculated. Logsdon et al[55] also reported significant reductions in symptoms of depression following 8 weeks of antidepressant treatment (nortriptyline and sertraline).

Mother–infant relationship
Of the 19 studies, 17 assessed dyadic relationship outcomes (Table 2). The measures used to assess the dyadic relationship varied widely. The largest effect size on dyadic outcome was calculated for the study by Kersten-Alvarez et al.[81] The intervention (video feedback) had a medium effect on index of the quality of interactive behavior.

Clark et al' study[78] had the second largest effect size calculated in the group that received IPT but only for factor one (Maternal Positive Affect Involvement and Verbalization) of the Parent-Child Early Relational Assessment (PCERA).[87] A later study carried out by Clark et al[65] found comparable findings using the PCERA, with the largest effect size calculated for factor one (as above), followed by factor two (Maternal Negative Affect and Behavior), six (Infant Dysregulation and Irritability), and seven (Dyadic Mutuality and Reciprocity).

Beeber et al[83] also reported significant outcomes in their investigation of IPT + PE. They reported significant increases in positive involvement in the mothers who received IPT + PE only.

In their uncontrolled study, Jung et al[66] reported that postintervention, infants displayed a marked increase in interest and joy during interaction with their mothers.

In another RCT, mother–infant dyads were either videotaped and given feedback using one of four techniques during eight to ten sessions, including (1) modeling, (2) cognitive restructuring, (3) practical support, and (4) baby massage, or provided with three sessions of practical parenting advice via telephone calls.[64] The authors reported that at 6-month

Table 3 Means, SDs, Cohen's *d*, and effect sizes on measures of maternal depression and dyad measures across studies

Study	Maternal depression	Mean TX	Mean TAU	SD TX	SD TAU	Cohen's *d*	Effect size *r*	Dyad measure	Mean TX	Mean TAU	SD TX	SD TAU	Cohen's *d*	Effect size *r*
Field et al[79]	Not measured							Not measured						
Horowitz et al[80]	BDI	10.99	10.10	0.96	0.84	0.99	0.44	DMC	9.73	8.77	1.65	1.72	0.57	0.27
Onazowa et al[68]	Insufficient information							Insufficient information						
Clark et al[78]	BDI M-ITG	15.9	20.6	8.5	9.2	0.53	0.26	PCERA M-ITG (F1)	3.7	3.1	0.6	0.6	1.0	0.45
	BDI IPT	16.4	20.6	10.2	9.2	0.43	0.21	PCERA M-ITG (F2)	4.6	5.0	0.7	0.1	−0.8	−0.37
								PCERA IPT (F1)	4.2	3.1	0.6	0.6	1.83	0.66
*Murray et al[61]	See Notes							Insufficient information						
*Cooper et al[82]	EPDS counseling	9.9	11.3	5.9	4.8	0.26	0.13							
	EPDS psychodynamic	8.9	11.3	4.2	4.8	0.53	0.26							
	EPDS CBT	9.2	11.3	4.8	4.8	0.44	0.21							
Milgrom et al[60]	Insufficient information							Insufficient information						
Jung et al[66]	Not reported							N/A single-group design						
Forman et al[34]	Not reported							Negative emotion	0.01	−0.04	0.59	0.67	0.08	0.03
								Positive emotion	−0.11	0.10	0.59	0.77	−0.31	−0.15
								AQS	0.44	0.48	0.17	0.14	−0.26	−0.13
Clark et al[65]	BDI	12.42	20.50	7.08	7.27	1.13	0.50	PCERA (F1)	3.67	3.10	0.52	0.54	1.08	0.47
								PCERA (F2)	4.65	5.02	0.46	0.48	−0.79	−0.37
								PCERA (F6)	4.41	4.83	0.78	0.80	−0.53	−0.26
								PCERA (F7)	3.38	3.03	0.59	0.60	0.59	0.28
O'Higgins et al[67]	EPDS	13.19	13.81	3.84	4.98	0.14	0.07	Global ratings	3.27	3.26	0.7	0.91	0.01	0.01
**Van Doesum et al[64]	BDI	18.9	17.2	11.0	9.3	0.17	0.08	EAS (Mat sensitivity)	4.28	3.79	1.78	1.86	0.27	0.13
								EAS (Mat structuring)	3.12	2.71	1.09	1.06	0.38	0.19
								EAS (child responsiveness)	4.26	3.18	1.48	1.74	0.67	0.32
								EAS (child involvement)	3.74	2.79	1.83	1.91	0.51	0.25
								AQS	0.41	0.26	0.30	0.35	0.46	0.22
Logsdon et al[55]	Insufficient information							Insufficient information						
**Kersten-Alvarez et al[81]	Not reported, see Notes							Quality of interactive bhvr	0.24	−0.24	0.26	0.26	1.85	0.68
Mulcahy et al[62]	BDI	16.95	23.11	8.14	10.64	0.65	0.31	Attachment to mother	12.98	13.29	0.72	0.72	−0.43	−0.21
								MAI	97.18	92.28	5.35	10.14	0.60	0.29
Beeber et al[83]	HRSD	Means and standard deviations not reported						HOME subscales	Means and standard deviations not reported					
Horowitz et al[84]	EPDS	7.19	6.40	3.8	3.8	0.21	0.10	NCATS	53.16	53.71	8.3	7.0	−0.07	−0.04
								Responsiveness subscale	7.44	7.03	3.1	3.1	0.13	0.06
Tsivos et al[86]	BDI	Data not suitable for analysis						CARE Index scales	Data not suitable for analysis					
Goodman et al[85]	EPDS	6.19	6.35	3.64	5.45	−0.03	−0.01	CIB (maternal sensitivity)	3.69	3.95	0.59	0.55	−0.46	−0.22
								CIB (infant involvement)	3.20	3.34	0.69	0.78	−0.20	−0.09
								CIB (dyadic reciprocity)	3.46	3.60	0.68	0.83	−0.18	−0.09

Notes: *Cooper et al[82] report the maternal mood data, and Murray et al[61] report dyad and child outcome. **Kersten-Alvarez et al[81] report the maternal mood data, and Murray et al[61] report dyad and child developmental outcomes of Van Doesum et al.[64]

Abbreviations: AQS, Attachment Question-Set; BDI, Beck Depression Inventory; bhvr, behavior; CBT, cognitive behavior therapy; CIB, Coding Interactive Behavior; DMC, Dyadic Mutuality Code; EAS, Emotional Availability Scale; EPDS, Edinburgh Postnatal Depression Scale; F, factor; HRSD, Hamilton Rating Scale for Depression; IPT, interpersonal psychotherapy; MAI, Maternal Attachment Inventory; Mat, maternal; M-ITG, mother-infant therapy group; N/A, not applicable; NCATS, Nursing Child Assessment Teaching Scale; PCERA, Parent-Child Early Relational Assessment; SD, standard deviation; TAU, treatment as usual; TX, treatment.

follow-up, the treatment group had higher Attachment Q-Set (AQS) scores and maternal sensitivity (on the Emotional Availability Scale [EAS] subscale) than controls. Small effect sizes were calculated for the video feedback intervention on child responsiveness and involvement, as well as maternal structuring and sensitivity EAS subscales. A small effect size was also calculated for the intervention on the AQS. A small effect of IPT on the Maternal Attachment Inventory was also found in Mulcahy et al's[62] RCT investigating the effectiveness of group IPT.

In the study by Horowitz et al[80] the relationship-focused behavioral coaching invention (CARE) was found to have a small effect on the quality of the mother–infant relationship, as measured by the Dyadic Mutuality Code. In a recent RCT of the CARE intervention, despite significant reductions in both symptoms of depression and improvements to the mother–infant relationship, there were no significant differences between women receiving the CARE intervention and those allocated to a control group.[84]

In an RCT examining the effectiveness of baby massage in the treatment of PND, no differences in the quality of the mother–infant relationship (measured by global ratings) were found between women receiving baby massage and those receiving support only at posttreatment.[67] However, at 1-year follow-up, depressed dyads who had participated in baby massage had comparable scores of maternal sensitivity with nondepressed dyads, whereas women who had received only support performed significantly less well.

In a double-blind RCT of two antidepressants (nortriptyline and sertraline), the authors reported no significant differences in the improvement in the quality of the dyadic interaction on the Child and Caregiver Mutual Regulation Coding Scale.[55]

With respect to the remaining studies, it was not possible to calculate the effect size of interventions on the mother–infant relationship. In another trial of baby massage, the authors reported significant improvements in mother–infant interaction (assessed by global ratings for mother–infant interactions) in women who received baby massage compared with women who attended a support group only.[68]

In their RCT, Murray et al[61] reported limited short- and long-term improvements in the mother–infant interactive quality following treatment in nondirective counseling, CBT, psychodynamic therapy, or TAU. They reported improvements across all groups in face-to-face mother–infant interactions but no significant differences between groups. However, they did report that women allocated to the control group had higher levels of maternal sensitivity at baseline compared

with the other groups. Interestingly, they also reported that women with high levels of social adversity who received counseling were found to have higher levels of maternal sensitivity. No other differences in treatment with respect to the quality of the mother–infant relationship were found.

In the study by Milgrom et al[60] which investigated CBT and the adjunct mother–infant intervention, significant marked (self-reported) improvements in the function of mother–infant relationship following the mother–infant adjunct module were reported.

In a pilot RCT comparing Baby Positive Parenting Programme (Baby Triple P), in addition to TAU with TAU only, there were significant improvements in depressive symptoms.[86] There was, however, no significant additive effect of Baby Triple P demonstrated across outcomes of maternal mood or dyadic outcomes, measured by the CARE index.[86]

Finally, Goodman et al[85] found no differences in dyadic-related outcomes between women allocated to PDP and those in a control group.

Child development
Four studies measured child developmental outcomes.[34,61,64,79] Measures used to assess child development varied making it difficult to compare effect sizes between studies. Across studies, it was reported that infants improved on some subscales but not others (Table 4).

Van Doesum et al[64] reported that infants in the treatment group (video feedback) were significantly more competent (measured by Infant Toddler Social Emotional Assessment [ITSEA] subscale scores) compared with infants in the control group.

In an RCT investigating the efficacy of IPT treatment in women with PND, a small effect size was calculated for IPT on Child Behaviour Checklist subscales of internalizing and externalizing.[34] No differences in any of the other ITSEA subscales were found. Insufficient data meant that it was not possible to calculate effect sizes for the remaining studies.[61,79]

In their RCT comparing group baby massage with a rocking group, Field et al[79] reported several outcomes related to infant behaviors, including Thoman's system of sleep recording, salivary cortisol, weight, formula intake, temperament ratings, and urine assays to measure hormones associated with stress. Babies in the massage group were observed to be significantly more awake and less drowsy compared with the rocking group. Crying and cortisol level in the baby massage group also decreased significantly compared with the rocking

Table 4 Means, SDs, Cohen's *d*, and effect sizes on measures of child development across studies

Study	Measure	Mean TX	Mean TAU	SD TX	SD TAU	Cohen's *d*	Effect size *r*
Field et al[79]	Emotionality	12.2	13.0	4.0	5.0	−0.12	**−0.08**
	Sociability	19.9	18.4	4.0	4.0	0.36	**0.18**
	Soothability	18.5	15.6	4.0	5.0	0.64	**0.31**
	Serotonin	1,427.9	1,132.4	779.0	517.0	0.45	**0.22**
	Cortisol	656.4	1,016.8	340.0	523.0	−0.82	**−0.34**
Murray et al[61]	Insufficient information						
Forman et al[34] (compared treated	CBC internalizing	46.14	49.06	7.23	7.49	−0.40	−0.20
recovered with treated non-recovered)	CBC externalizing	47.34	46.50	9.05	10.10	0.09	0.04
Van Doesum et al[64]	ITSEA (competence)	1.40	1.22	0.28	0.30	**0.64**	**0.30**

Abbreviations: CBC, Child Behaviour Checklist; ITSEA, Infant Toddler Social Emotional Assessment; SD, standard deviation; TAU, treatment as usual; TX, treatment.

group. There were also significant changes in temperament. Babies in the massage group were observed to be significantly more sociable, more easily soothed, and less emotional compared with babies who were in the rocking group.

Several child developmental and behavioral outcomes were measured at three time points by Murray et al.[61] There was no significant effect of treatment group on early management of infant behavior following treatment (4.5 months). At 18-month follow-up, there was a significant effect of counseling (after controlling for maternal age) on infant emotional and behavioral problems (measured by the Behavioural Screening Questionnaire).[88] Five years later, a nonsignificant effect of CBT treatment was found on infant emotional and behavioral problems (measured by Rutter A2 Scale), but there were no differences across interventions in teacher-reported child behavioral difficulties (measured by Preschool Behavior Checklist). There were also no differences across the treatment groups in measures of cognitive development at 18-month (Mental Development Index of the Bayley scales) and 5-year (General Cognitive Index of McCarthey Scales) follow-ups.

Discussion

This is the first review to date to rigorously evaluate the methodological quality of studies using the CTAM, calculate effect sizes (where possible), and compare outcomes related to both maternal mood and child development and/or the dyadic relationship.

Of the interventions reviewed here, those which have focused on the dyad relationship, namely mother–infant therapy[78] and a coaching intervention, designed to promote maternal responsiveness,[80] had the greatest efficacy at reducing symptoms of PND (where data were available to calculate effect sizes). However, effect sizes of the aforementioned studies for improvements in the quality of the mother–infant relationship were more modest by comparison.

The intervention, which focused on the quality of the dyad relationship, demonstrated the largest effect size with respect to improvement in the quality of the mother–infant relationship. However, this finding was not consistent across all outcomes. While the majority (18/19) of studies measured mother–infant interaction outcomes, only four studies measured child developmental outcomes, and the resulting effect sizes were small. This highlights a limited therapeutic effect across child outcomes, despite overwhelming research evidencing the impact of PND on short- and long-term developmental patterns. In terms of intergenerational transmission of risk to children, it is difficult to determine whether reported improvements in mother–infant relationships were due to improvements in developmental outcomes or improvements in PND, or whether there is a bidirectional link.[34,69,74]

The findings from this review are consistent with those reported by Poobalan et al,[74] an earlier review of eight RCTs aimed at treating PND through targeting the mother–infant relationship. For example, improvements in dyadic interaction do not necessarily lead to an improvement in child developmental outcomes. Interestingly, the size of the intervention effect on maternal outcomes was discrepant with those calculated on measures of infant development and the quality of the mother–infant interaction. These findings suggest that improvements in maternal mood may be necessary but not sufficient to improve additional dyadic and/or child developmental outcomes alone. In line with the mechanisms implicated in the intergenerational model of risk,[37] there may be multiple mediating and moderating factors implicated in the transmission of psychopathological risk from mother to infant.

The findings from this review have implications for the psychological treatment of PND and future research. While certain interventions have been shown to be effective for treating PND, the benefits for child development and the quality of the dyadic relationship are less clear, as evidenced

by the discrepancy between effect sizes for improvements in maternal mood and dyad and developmental outcomes. Indeed, an improvement in maternal mood did not necessitate an improvement in developmental outcomes[35] as illustrated by the disparity in maternal, dyadic, and child outcomes reported in the present review. However, the incongruence between early outcomes may also be the result of a time delay between improvements in maternal mood and expectations from the infant resulting in the observed discrepancy. There may be a period of adjustment for the infant following improvements in maternal mood resulting in an observed dis-synchrony between the dyad.[33] In order to investigate this, long-term assessments of the mother–infant relationship are warranted.

The findings from the present review suggest that a developmental perspective into the conceptualization of how PND affects the mother and infant is needed. The role parents play in regulating their infants' emotional states may be a key element in improving treatment efficacy and promoting long-term effectiveness.[89] There is a strong impetus for focusing on parenting skills and strategies as a medium for strengthening and protecting the mother–infant relationship, given the difficulties they experience with parenting. Despite significant reductions in depressive symptomatology, effect sizes were generally modest. While improvements to maternal mental health have been assessed, it remains important to also assess both short- and long-term benefits, to the mother's ability to respond sensitively to her infant.

Quality of evidence

The impact of PND interventions on child development requires further research because it remains difficult to draw conclusions from the research or compare studies as a result of study limitations. A large proportion of the studies obtained inadequate scores on the CTAM. Many of the studies were characterized by small, biased sample sizes, which increases reporting of false-negative findings and the rejection of potentially effective treatments. Many also failed to describe the allocation and randomization process, thereby reducing methodological rigor. Furthermore, while most studies employed the use of blind assessors, the process of blinding was not described. Although the majority of the studies used an RCT design, many did not address drop-out appropriately (ie, only analyzing treatment completers). Fewer than half of the included studies described intervention protocol and/or methods to ensure treatment fidelity; this highlights a limitation regarding quality assurance. The methodological observations are comparable with the extant literature.[90,91]

The correlation between direction of effect size and strength of methodological quality is comparable to previous studies using the CTAM for assessment of trial methodological quality, which may be explained by the standard of reporting or length constraints of the journal in which they were published. One method for improving the quality of reporting RCTs is to implicate the use of Consolidated Standards of Reporting Trials, which outlines the gold standard for conducting RCTs. Alternately, as suggested by Cuijpers et al[70] quality assurance may be achieved by adherence to the Cochrane Handbook which outlines four criteria in ensuring quality assurance. Only four studies in this review presented Consolidated Standards of Reporting Trials or participant flow diagrams.

There were also several observations with regard to participant characteristics, which warrant attention. Firstly, there was wide heterogeneity across study client inclusion criteria. Specifically, some studies included clients with a diagnosis of PND made by a professional, while others relied on screening measures alone, such as the EPDS. Although probable diagnosis is cost- and time-effective, there is a limitation that researchers who rely exclusively on screening questionnaires for eligibility are including participants who are experiencing comorbid diagnoses, which may invariably influence treatment efficacy. Secondly, we observed homogeneity in marital status, with a large proportion of women being in married/cohabiting relationships. Thirdly, there was a large degree of variability with regard to variables including age of the infant and severity and course of the depressive episode.

An additional observation is the impact that parity has on outcomes. For example, difficulties experienced may vary depending on whether mothers are primiparous or multiparous. Indeed, research has shown that primiparous and multiparous mothers experience different mother–infant relationship problems at 3 months postpartum.[92] This variance may be explained by differences between multiparous and primiparous mothers in adjustment to parenthood.[93]

These methodological observations make it difficult to determine what to target in treatment, how long to do it for, and what delivery modality should be used. McLennan and Offord[35] have suggested that further research is needed to establish the role of PND as a risk factor to determine whether it should be targeted for improving developmental outcomes.

Recommendations for future research

Future research should include developmental and predictive measures of vulnerability toward future developmental

psychopathology because these measures provide an index of long-term effectiveness.[94] There is also a need to acknowledge fathers when administering treatment.[19] According to the Goodman and Gotlib model,[37] fathers may moderate the transmission of risk.[95,96] Since it is a period of adjustment, fathers face challenges in becoming new parents, including redefining their relationship and roles with their spouse and importantly learning to respond adaptively to their babies.[97] Research will need to consider the dyadic relationship and interactions between both parents and the developing infant. Risk factors (ie, sociodemographics) associated with PND as well as the concept of sensitive periods in development and resilience to adversity (infants are particularly vulnerable to PND, due in part to development of neuroregulatory mechanisms) need to be kept in mind.[22,37]

Research with clients from underrepresented groups with PND, including black and ethnic minority populations, is also needed. We found no studies which investigated effectiveness of interventions for PND in low-income or developing nations' populations.

A further consideration for future research is the revisions to the diagnostic criteria which have altered the conceptualization of PND to include mood disorders with an onset in pregnancy. Sharma and Mazmanian[98] highlighted that the inclusion of the prepartum and mixed feature specifiers would lead to increased awareness, monitoring, and appropriate timely treatment of women who are at risk of mood difficulties during their pregnancy, including mania, hypomania, and mixed episodes. However, they cautioned that the inclusion of the prepartum specifier may obscure etiological, clinical, and treatment differences between those with prepartum and postnatal onsets.

Limitations

The findings from this review are subject to some limitations. Firstly, strict search terms were used due to the volume of papers returned in initial searches. Hence, it is possible that some studies were excluded. Secondly, it was not possible to calculate effect sizes across all domains of assessment (maternal mood, mother–infant relationship, child developmental) due to missing data. Thirdly, there was a degree of variability regarding how a diagnosis of PND was established. For example, the inclusion of studies assessing participant eligibility through the use of screening measures (ie, the EPDS) and not formal diagnosis may have affected the reliability with which the results were interpreted.

Despite the evidence for the benefits, the review literature on the subject has highlighted that there is insufficient evidence to recommend a specific treatment, and therefore, further research is warranted.[70,74,91]

Conclusion

Maternal well-being and child development are inextricably linked. Our review has highlighted the poverty of interventions assessing outcomes relevant to both mother and infant. These findings highlight the need for further research to continue to measure the quality of the mother–infant relationship but also to add measurements of child development and long-term outcomes to their research programs. Further research addressing the highlighted methodological limitations is warranted. Until then, we can make no recommendation for any intervention in particular.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agree to be accountable for all aspects of the work. ZLT conducted the systematic literature search and initial analysis. The first draft was prepared by ZLT and finalized by AW. All authors contributed to and have approved the final manuscript.

Disclosure

No author has any share or ownership in Triple P International Pty Ltd. Matthew Sanders is the founder and an author of various Triple P programs and a consultant to Triple P International Pty Ltd. The authors report no other conflicts of interest in this work.

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