

Regular Article

A review and analysis of the components of potentially effective perinatal mental health interventions for infant development and mother-infant relationship outcomes

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Abstract

Children of mothers with serious mental health difficulties are at increased risk of developing mental health difficulties themselves in their own lifetime. Specialist interventions delivered in perinatal mental health services offer an opportunity to support the infant's development and long-term mental health. This review aimed to systematically evaluate the shared elements of successful perinatal mental health interventions that underpin improved outcomes for infants whose mothers experience perinatal mental health difficulties. Nine electronic databases were searched comprehensively for relevant controlled studies of perinatal mental health interventions, and a narrative synthesis undertaken to assess whether statistically significant benefits were noted. Sixteen studies, trialing 19 interventions, were analyzed using a narrative approach and grouped according to reported effectiveness. Eight interventions demonstrated significant improvements in infant outcomes and/or mother–infant relationship outcomes and were used to inform the analysis of the included interventions' components. While the interventions identified were diverse, there were common components which potentially underpin successful interventions for infants whose mothers are experiencing mental health difficulties, including: facilitation of positive Mother×Infant interactions; helping mothers to understand their infant's perspective or inner world; and the use of video feedback.

Keywords: infant mental health, mother–infant relationship, parenting, perinatal mental health

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Introduction

Intergenerational transmission of mental health problems is believed to be a substantial contributor to psychiatric morbidity (Netsi, Pearson, Murray, & Cooper, 2018; Stein et al., 2014) with children born to parents with mental health conditions being more likely to develop related psychiatric difficulties (Beardslee, Gladstone, & O'Connor, 2011; van Santvoort, Hosman, van Doesum, Reupert, & van Loon, 2015). In addition, children born to parents with mental health problems are at increased risk of developmental delays and other adverse outcomes such as poor academic performance, impaired cognitive abilities, elevated risks of suicide, and child abuse (Beardslee et al., 2011; Goodman et al., 2011; Hosman, van Doesum, & van Santvoort, 2009; Milgrom, Westley, & Gemmill, 2004; van Santvoort et al., 2015). These risks are largely mediated by the impact of parental mental illness on the Parent×Infant interaction, with the parent–infant relationship quality being a strong predictor of future infant attachment as well as impacting infant emotional and behavioral disorders (Barlow, Bennett, Midgley, Larkin, & Wei, 2015; Skovgaard, 2010). It is thought that parental ability to interpret their infants'

internal emotional state and respond appropriately to this, termed “reflective function” (Beebe et al., 2010) or “mind-mindedness” (Meins, Fernyhough, Fradley, & Tuckey, 2001) is impacted by parental mental illness, and these difficulties mediate the effect of these mental health problems on infant outcomes (Barlow et al., 2015; Madigan et al., 2006).

The perinatal period, defined here as from pregnancy through to the first year postpartum, presents an important opportunity for interventions to protect and improve children's mental health (Stein et al., 2014; van Doesum & Hosman, 2009; Wright et al., 2017) by supporting the parent–infant relationship (Meltzer-Brody et al., 2018; Stein et al., 2014). Maternal mental health problems are associated with reduced parenting sensitivity, hostility, rejection, and low involvement (Hosman et al., 2009), meaning that infants are more likely to develop insecure attachment styles, which consequently places them at risk of low social competence, internalizing and externalizing behaviors, and psychopathology later in childhood and throughout their life (Feldman et al., 2009; Murray, Fiori-Cowley, Hooper, & Cooper, 1996; Velders et al., 2011; Wan & Green, 2009; Korhonen, Luoma, Salmelin, & Tamminen, 2012). The benefits of these targeted early life interventions are thought to be long-lasting, and may prevent the occurrence of mental health difficulties in adolescence and adulthood (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2005; Hosman et al., 2009; Leman, Bremner, Parke, & Gauvain, 2012; Stein et al., 2014; van Doesum & Hosman, 2009; Wright et al., 2015).

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Interventions for mental health currently delivered in perinatal specialist services are diverse, and include group and individual psychotherapies, infant massage, and video feedback interventions, in which Mother×Infant interactions are filmed to provide mothers with feedback on specific moments (Stein *et al.*, 2014). In the UK, service improvements are currently underway with a planned investment that will provide specialist care to 30,000 additional women per year by the end of 2021 (NHS England, 2016) to improve outcomes both for women experiencing perinatal mental health difficulties and for their infants. It is unlikely that a single intervention will be effective in improving infant outcomes for every mother–infant dyad, or be appropriate in all clinical settings. Therefore understanding whether common elements are found in effective perinatal mental health interventions is important to inform perinatal clinical practice, mental health service provision, and future research.

We reviewed studies of interventions carried out in the first year postpartum among women with perinatal mental health problems to identify components that successful interventions had in common. Previous reviews have included studies of mothers and infants at high risk for interaction difficulties for reasons other than mental health, for example low socioeconomic status or preterm birth (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003), mothers with antenatal or postnatal depression (Letourneau, Dennis, Cosic, & Linder, 2017), or mothers with older children than included in this review (Wright & Edginton, 2016). We focused on studies including women with any type of mental health problem, in which the intervention was initiated within the first year of the infant's life, in order to focus specifically on the perinatal period, and studies which included measures of infant development, mental health or wellbeing, or of Mother×Infant interaction quality. Our aim was to comprehensively review and synthesize published evidence of the effectiveness of interventions delivered to mothers experiencing serious perinatal mental health difficulties in improving infant and mother–infant relationship outcomes.

Method

Eligibility criteria

We sought to identify all papers published in the English language investigating the effectiveness of any perinatal intervention for mothers with perinatal mental health difficulties on infant mental health and/or development, and/or Mother×Infant interaction quality. The definition of the intervention was broad, encompassing talking therapies, video feedback on interactions and physical interventions such as infant massage.

Inclusion criteria for studies were:

- features an interventional study design using a control group, although randomization was not a requirement;
- involves mothers experiencing perinatal mental health difficulties, either during pregnancy or with infants with mean age <12 months at study entry;
- assesses any clearly described intervention aimed at improving or protecting Mother×Infant interaction quality and/or infant mental health and development, including dyadic, individual or group therapies, infant massage, or other forms of therapy; and
- includes at least one outcome measure of infant mental health, development or wellbeing, or a measure of mother–infant relationship quality.

Exclusion criteria for studies were:

- absence of control group, or a noninterventional study design (e.g. observational studies, review articles);
- includes infants with mean infant age >12 months at study entry;
- includes mothers without a defined mental health difficulties or focuses exclusively on fathers;
- assesses solely pharmacological treatment of maternal mental health difficulties; and
- does not measure any infant mental health, development or wellbeing outcomes or outcomes assessing mother–infant relationship quality.

Search strategy and data sources

Search strategies included electronic database searches and citation searching of included papers, in addition to hand-searching of reference lists of included studies.

Electronic searches

Nine electronic databases were searched from inception to 2nd January 2019, using three different interfaces: MEDLINE (via OvidSP), EMBASE (via OvidSP), Cumulative Index to Nursing and Allied Health Literature (CINAHL, via EBSCO), PsychINFO (via OvidSP), Education Resource Information Centre (ERIC, via EBSCO), Applied Social Sciences Index and Abstracts (ASSIA, via ProQuest), Sociology and Social Services Abstracts (via ProQuest), Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science. The search strategy was developed with help from an information search specialist at the University of Sheffield. The search terms used were adapted to each database and interface as required, and for some databases included a methodological filter. The searches made use of MeSH and other subject headings, adjacent word searching (e.g. adj3) and specific field searching where available (e.g. .ti,ab to search in only the titles and abstracts). Full search strategies are available in online Supplementary tables.

Additional searches

For all included papers, both reference list and citation searching were performed. Reference list searching was performed by hand, checking for potentially relevant titles. Citation searching was performed using the citation search function on Google Scholar.

Procedures

Retrieved records were downloaded into bibliographic software Mendeley Desktop Reference Manager (version 1.18, Mac 2012) and compiled into a Microsoft Excel (version 14.7.7, Mac 2011) spreadsheet. A single reviewer assessed all titles and then abstracts for potentially eligible papers, before discussing all decisions made at the full-text stage of study selection with a second reviewer.

Data extraction and quality assessment

An adaptation of the Cochrane Collaboration data extraction form for randomized controlled trials (RCTs) (The Cochrane Collaboration, 2012) was piloted using two eligible studies before being used across all eligible studies. Quality assessment was conducted using the Cochrane Collaboration's Risk of Bias Tool (The Cochrane Collaboration, Higgins & Green, 2011). The computer

software Review Manager (version 5.3) was then used to create summary charts of the quality assessment results.

Analysis

Data on the components of the interventions were extracted and tabulated from all included papers, in order to develop a matrix mapping the key components of the studies against the study results, highlighting those that were most prevalent in the group of interventions that led to significant positive differences in infant or mother–infant relationship outcomes. Outcome data were assessed for the possibility of pooling quantitative measures via meta-analysis, where suitably homogenous. Two authors worked collaboratively to identify and agree the key components of the interventions. This analysis was based on the description of the interventions given in the papers, and was restricted to the information supplied therein.

Results

Search results

Searches retrieved 7,102 unique results, of which 7,011 were excluded after title and abstract screening (Figure 1). Ninety-one full-text publications were retrieved, of which 75 were excluded. Of these, 32 were excluded due to including children over 12 months old, 19 featured an ineligible study design (for example, lack of control group), 13 only assessed maternal outcomes, nine did not specifically include mothers with mental health difficulties and two were not available in English. A full table of reasons for exclusion for each study has been included in the online Supplementary.

Characteristics of included studies

A total of 16 studies involving 1,075 participants were included in the review (see Table 1). Studies were published between 2001 (Onozawa, Glover, Adams, Modi, & Kumar, 2001) and 2018 (Ericksen, Loughlin, Holt, & Gemmill, 2018) and were conducted in the UK (Challacombe et al., 2017; Fonagy, Slead, & Baradon, 2016; Kenny, Conroy, Pariante, Seneviratne, & Pawlby, 2013; Murray, Cooper, Wilson, & Romaniuk, 2003; Onozawa et al., 2001; O'Higgins, 2006; Puckering, Mcintosh, Hickey, & Longford, 2010; Schacht et al., 2017), the Netherlands (van Doesum, Riksen-Walraven, Hosman, & Hoefnagels, 2008), Italy (Tambelli, Cerniglia, Cimino, & Ballarotto, 2015), Canada (Letourneau et al., 2011), the USA (Clark, Tluczek, & Brown, 2008), and Australia (Ericksen et al., 2018).

Inclusion criteria and definitions of maternal mental health difficulties varied between papers. Eight studies included mothers with postnatal depression (PND; Goodman, Prager, Goldstein, & Freeman, 2015; Letourneau et al., 2011; Murray et al., 2003; Onozawa et al., 2001; O'Higgins, 2006; Puckering et al., 2010; Tambelli et al., 2015; Tsivos, Calam, Sanders, & Wittkowski, 2015), two studies recruited participants from inpatient mother–baby units (MBUs; Kenny et al., 2013; Schacht et al., 2017), a further two recruited participants with a diagnosis of major depressive disorder based on *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (DSM-IV) criteria (Clark et al., 2008; van Doesum et al., 2008), and one included mothers with any “mental health problems” (Fonagy et al., 2016). Finally, one study included mothers diagnosed with

obsessive compulsive disorder (OCD; Challacombe et al., 2017), and another mothers with bulimia nervosa (Stein et al., 2006). Of the three studies that did not specify a single diagnosis in their participant inclusion criteria (Fonagy et al., 2016; Kenny et al., 2013; Schacht et al., 2017), only Kenny et al. (2013) reported their outcomes as a function of the maternal diagnoses.

Included studies investigated a range of interventions and used 34 different outcome measures to evaluate the effects on infant mental health or development, and/or mother–infant relationship quality. Maternal outcomes were included in most studies but such outcomes, other than mother–infant relationship, were beyond the scope of this review. The methodological heterogeneity of studies that were frequently assessing similar outcomes using different measures prevented the use of meta-analytical techniques to synthesize data and compare the results of the included studies. Furthermore, many of the studies involved complex, multifaceted intervention programs with different formats, which meant it was not possible to group studies according to intervention type. While the methodological heterogeneity of included studies precluded formal synthesis of study outcome data, a narrative synthesis of the study results was conducted, drawing out the common components of interventions that were most associated with significant improvements in the outcomes of interest.

Quality assessment

Figure 2 presents an overview of the quality of included studies. Twelve of the sixteen included studies reported the use of a RCT design (Challacombe et al., 2017; Ericksen et al., 2018; Fonagy et al., 2016; Goodman et al., 2015; Letourneau et al., 2011; Murray et al., 2003; Onozawa et al., 2001; Puckering et al., 2010; Stein et al., 2006; Tambelli et al., 2015; Tsivos et al., 2015; van Doesum et al., 2008), although four of these studies did not include adequate concealment of the allocation process in their design (Letourneau et al., 2011; Murray et al., 2003; Onozawa et al., 2001; Tambelli et al., 2015). Trials of psychological therapies are by nature at high risk of bias because it is not usually possible to blind participants and personnel to the nature of the intervention delivered (Skapinakis et al., 2016), which can result in performance bias or the placebo effect due to participants awareness of being allocated to the active treatment, as opposed to the control group. In addition, the included studies had high rates of attrition.

Study outcomes

Table 1 gives a brief summary of the interventions used in the included studies.

Interventions were classified into three groups:

- Group A:** Interventions demonstrating statistically significant improvements in infant or mother–infant outcomes.
- Group B:** Interventions demonstrating directional improvements in infant or mother–infant outcomes but the improvements did not reach statistical significance.
- Group C:** Interventions that did not identify improvements to infant or mother–infant outcomes.

Group A

The following studies all identified significant improvements in infant or mother–infant relationship outcomes: four studies

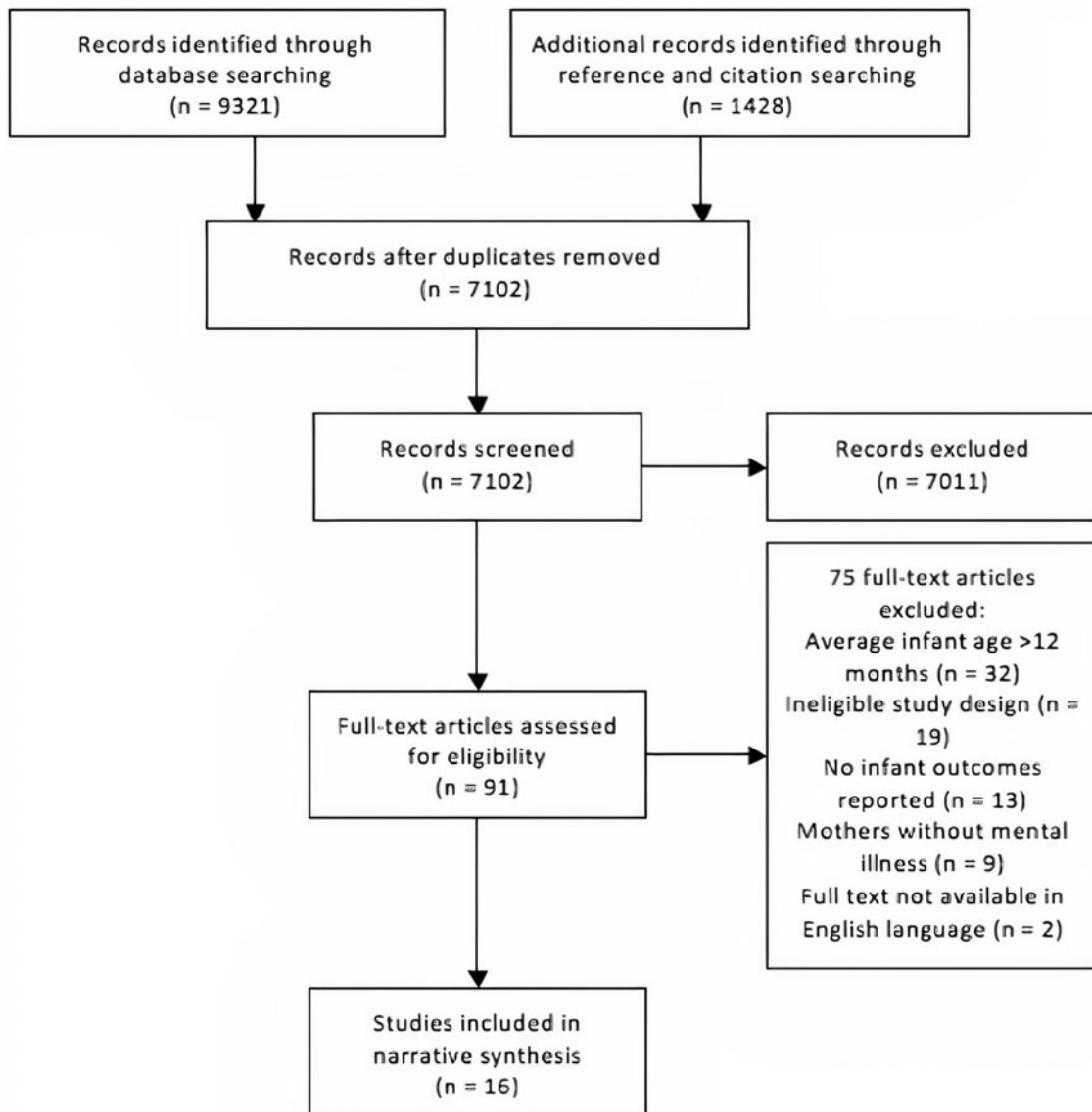


Figure 1. Flow diagram displaying search results.

using video feedback to guide positive Mother×Infant interactions (Kenny *et al.*, 2013; Schacht *et al.*, 2017; van Doesum *et al.*, 2008 and Stein *et al.*, 2006), an infant massage study (Onozawa *et al.*, 2001), a study of a mother–infant group therapy model (Clark *et al.*, 2008), and Puckering *et al.* (2010), which evaluated the Mellow Babies group intervention. In addition, one arm of the Tambelli *et al.* (2015) study, in which both parents received a supportive, relationship-based, parent–infant intervention aiming to promote positive Parent×Infant interactions, showed significant improvements. However, the arm in which only the mother received treatment showed no significant improvements.

The four video feedback studies used different outcome measures to assess the impact of the interventions on the infants and the mother–infant relationship. Schacht *et al.* (2017) used Ainsworth’s strange situation procedure (SSP; Ainsworth, Blehar, Waters, & Wall, 1978) and found that significantly more infants in the intervention group were classed as securely attached at 15 months compared with the control group. Kenny *et al.* (2013) used the CARE index (Crittenden, 2003) and

found that following the video feedback intervention there were significant improvements in the domains of maternal sensitivity and maternal unresponsiveness, while infants were significantly more cooperative and significantly less passive. Kenny *et al.* (2013) was the only study included in this review to report infant outcomes as a function of maternal diagnoses, stratifying study participants according to three diagnostic groups: depression, schizophrenia, and mania. However, the study did not identify any significant effect of diagnostic group on the included outcomes, reporting similar significant improvements in the above domains across all three groups (Kenny *et al.*, 2013). Stein *et al.* (2006) used scales developed specifically for their own study, and identified significant improvements in rates of marked or severe mealtime conflict for the video feedback group, compared to the supportive counselling control group, as well as a significant improvement in infant autonomy. van Doesum *et al.* (2008) made use of the Emotional Availability Scales (EAS; Biringen, Robinson, & Emde, 1998), identifying significant improvements in maternal sensitivity and structuring, and infant

Table 1. Characteristics of included studies and relevant effect sizes where reported

Study author & year Study Design Country	Participants N = overall number	Intervention details (n = number of participants per group)	Assessment time point outcome(s)	Effect sizes (ES) reported
Challacombe 2017 Randomized controlled trial (RCT) UK	New mothers diagnosed via Structured Clinical Interview with obsessive compulsive disorder (OCD) and an infant <6 months of age, plus a group of healthy control mothers. Average age of mothers in intervention group = 32.4 years, in treatment as usual group = 32.7 years and in healthy control group = 34.6 years. All infants aged 6 months at baseline. N = 71	2 weeks of time-intensive cognitive behavioral therapy (CBT) involving four sessions of 3 hours (n = 17) Treatment as usual (n = 17) Healthy control mothers (n = 37)	Assessed via videotaped interaction at baseline (6 months) and follow-up (12 months): 1. Ainsworth sensitivity scale, scored 1–9 2. Ainsworth cooperation-interference scale, scored 1–9 3. Maternal warmth, scored 1–9 4. Maternal vocalizations during nappy change (% of interactions) 5. Overconscientiousness –dichotomous, expressed as number of mothers in which this occurred 6. Dyadic synchrony, scored 1–5 Assessed at 12 months of infant age: 7. Attachment via Ainsworth's strange situation procedure (SSP)	Not reported for included outcomes.
Clark (2008) Nonrandomized waitlist controlled trial. USA	New mothers diagnosed with major depression according to symptoms in the DSM-IV. Participants allocated in sequential blocks of 5–8. Mean maternal age in treatment group = 28.06 years, and in control group = 34.46 years. This imbalance was significant to the $p < 0.05$ level. Average infant age at baseline = 7.86 months in treatment group, 11.71 months in control group. N = 32	12 weeks of mother–infant group therapy sessions. 1.5 hours of each session was split into group therapy for the mothers, and a developmental group for the infants. Final half an hour of each session was dyadic group therapy. Dyadic therapy involved various games, songs, infant massage, and other activities (n = 18) Participants randomized to control group were placed on a waiting list to receive the same therapy sessions after 12 weeks (n = 14)	Assessed postintervention: 1. Parent–Child Early Relationship Assessment (PCERA) scales. 2. Bayley Mental Development Index (MDI)	1. PCERA: significant main effect for group on PCERA Factor I, ES = 1.084. Reported “moderate to large effect sizes” for Factors II, VI, and VII; noted Factor II's effect size was in “opposite direction” to predicted. 2. Bayley MDI: no significant differences reported at 12-week data point, ES = 0.07.
Ericksen (2018) RCT Australia	Mothers with a child less than 1 year old who have consulted a health professional about their mental health since the birth of their child. Mean maternal age in treatment group = 32.31 years, and in control group = 33.00 years. Average infant age at baseline = 4.94 months in treatment group, 4.87 months in control group. N = 31	Intervention group – CHUGS program, a weekly playgroup program lasting 10 weeks, delivered to groups of 4–8 dyads. Included play activities, stress busters, infant massage, interaction coaching, music and dance play, education on CBT techniques and parenting skills (n = 16) Control group – waitlist control (n = 15)	Assessed at baseline, postintervention and at 6-month follow-up: 1. Parenting Stress Index Short Form (PSI/SF) 2. Paediatric Infant Parent Exam (PIPE)	Not reported for included outcomes.

(Continued)

Table 1. (Continued.)

Study author & year Study Design Country	Participants <i>N</i> = overall number	Intervention details (<i>n</i> = number of participants per group)	Assessment time point outcome(s)	Effect sizes (ES) reported
Fonagy (2016) RCT UK	Parents with mental health problems, a child under 12 months of age, and at least one additional indicator of social exclusion (e.g. low-income household, long-term unemployment). Average maternal age = 31.2 years (control group), 31.0 years (intervention group). Average infant age at baseline = 3.8 months (control group), 3.9 months (intervention group). <i>N</i> = 76	Parent–infant psychotherapy involving discussions of issues on the parents' minds (<i>n</i> = 38) Control group – received usual secondary and primary care. (<i>n</i> = 38)	Three assessment points – baseline, 6 and 12 month follow up. Assessed at all three time points: 1. Bayley MDI 2. Emotional Availability Scale (EAS) 3. Coding Infant Behavior (CIB) scale 4. Ages and Stages Questionnaire: Socio-Emotional (ASQ:SE) Assessed at 12 month follow up only: 5. Attachment – using Ainsworth's SSP.	Not reported for included outcomes.
Goodman (2015) RCT USA	First-time mums of healthy infants scoring >9 and <20 on the EPDS on two consecutive screens. <i>N</i> = 42	Perinatal dyadic-psychotherapy – 8 × 1 h sessions over 3-month treatment period (<i>n</i> = 21) Control group – received usual care. (<i>n</i> = 21)	Assessed postintervention and at 3-month follow up. 1. Parenting Stress Index (PSI) 2. Video assessment of interaction using CIB.	Discussed “lower than expected effect sizes” as part of study limitations, but not explicitly reported in the text.
Kenny (2013) Controlled before and after study UK	Mothers admitted to a mother–baby unit (MBU), plus those living with mental illness in the community to act as controls. Also featured a healthy control group. Average maternal age in MBU group = 31.4 years. In community group = 30.6 years. In healthy control group = 22.3 years. Average infant age at baseline in MBU group = 12.4 weeks. In community group = 8.9 weeks. In healthy control group = 22.3 weeks. <i>N</i> = 138	Video feedback intervention conducted as part of usual MBU care (<i>n</i> = 49) Community control = convenience sample from a previous study (<i>n</i> = 67) Healthy control mothers = randomly selected from control group of another trial (<i>n</i> = 22)	CARE index used to code videotaped interactions on admission to the MBU and pre-discharge. Control groups were also videotaped and coded at one time point.	CARE index effect sizes from admission to discharge reported according to the following domains: Maternal sensitivity = 0.291 Maternal unresponsiveness = 0.368 Infant cooperativeness = 0.394 Infant passiveness = 0.334 They also reported no significant effect of diagnostic group on the change in maternal sensitivity or unresponsiveness scores from admission to discharge (respectively 0.04 and 0.01). In addition reported effect sizes comparing the intervention group to both community control and health control mothers at discharge as follows: Maternal unresponsiveness = 0.06 Infant cooperativeness = 0.06 Infant passiveness = 0.08

<p>Letourneau (2011) RCT Canada</p> <p>New mothers with infants less than 9 months of age and an EPDS score >12. Maternal age in control group = 43.6% 31–35 years. In treatment group = 29.6% 31–35 years. Mean infant age at baseline = 5.58 months in control group, 4.80 months in treatment group. N = 60</p> <p>Intervention group – 12 weeks of home visits and telephone contacts focused on peer support and Mother–Infant interaction interventions (n = 27) Control group received peer support intervention after end of follow-up period (n = 33)</p> <p>Assessed at baseline (prior to randomization), 6 and 12 weeks postrandomization: 1. Nursing child assessment satellite training (NCAST) feeding and teaching scales 2. Bayley MDI 3. Bates' Infant Characteristics Questionnaire (ICQ) 4. Salivary cortisol (maternal and infant)</p> <p>Reported the following effect sizes comparing baseline and final scores: 1. NCAST: Feeding scale = 0.01; Teaching scale = 0.08 2. Bayley MDI = 0.05 3. ICQ = 0.04 4. Salivary cortisol: Maternal = 0.0; Infant = 0.02</p>	<p>Murray (2003) RCT UK</p> <p>New mothers with EPDS >12. Mean age of mothers: Counselling = 28.4 years CBT = 27.9 years Psychodynamic therapy = 28.1 years Control = 26.5 years Mean infant age not reported, but first outcome assessment occurred at 4.5 months of infant age. N = 193</p> <p>Routine primary care (n = 52) CBT – weekly individual sessions from 8–18 weeks postpartum (n = 43) Psychodynamic therapy – weekly individual sessions from 8–18 weeks postpartum (n = 50) Counselling – weekly nondirective counselling sessions from 8–18 weeks (n = 48)</p> <p>Assessed at 4 months postpartum: 1. Checklist (developed for this trial) covering early maternal management of infant behavior and problems in the mother–infant relationship, completed by mother. Assessed pre- and posttreatment (at 8 and 18 weeks postpartum): 2. Maternal sensitivity, assessed via videotaped interaction (no detail given of specific scale used) Assessed at 18 months postpartum: 3. Behavioral Screening Questionnaire (BSQ) 4. Attachment via Ainsworth SSP 5. Bayley MDI Assessed at 5 years of infant age: 6. Rutter A² Scale – maternal reports of child emotional and behavioral problems. 7. McCarthy Scales of Children's Abilities – investigator assessment of children's cognitive development.</p> <p>Not reported for included outcomes.</p>	<p>O'Higgins (2006) Block controlled trial UK</p> <p>New mothers recruited from a postnatal ward, with an EPDS score of 13 or above. Blocks allocated according to month of birth. Maternal age = 65.62% aged 31–40 years. Infant age was 9 weeks at baseline for massage group, 10 weeks for support group and 11 weeks for healthy control group. N = 95</p> <p>Infant massage – regular infant massage classes taught in groups by trained instructors (n = 44) Support group – weekly 1 hour long sessions led by research team (n = 51) Healthy controls – a group of new mothers that consented to participate but scored 1–8 on EPDS. No intervention given (n = 45)</p> <p>Assessed at 9–12 weeks, 17–20 weeks and 1 year: 1. Bates' ICQ 2. Murray and Fiori Global Ratings of Mother–Infant interactions – rating system for videotaped interactions. 3. Maternal-reported Bonding Questionnaire Assessed at 1 year only: 4. Attachment via Ainsworth's SSP 5. Infant distractibility test</p> <p>Not reported for included outcomes.</p>
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(Continued)

Table 1. (Continued.)

Study author & year Study Design Country	Participants N = overall number	Intervention details (n = number of participants per group)	Assessment time point outcome(s)	Effect sizes (ES) reported
Onozawa (2001) RCT UK	New mothers scoring 13 or above on the EPDS. Median maternal age = 32.0 years in massage group, 33.0 years in control group. Median infant age = 9.0 weeks in massage group, 8.9 weeks in control group. N = 34	Massage group = weekly infant massage classes for 5 weeks (n = 19) Control group = weekly 30 min support group (also attended by mothers in massage group, but separately) (n = 15)	Assessed immediately pre- and postintervention: 1. Interaction rating of videotaped interactions (no detail given on scale used)	Not reported for included outcomes.
Puckering (2010) RCT UK	New mothers scoring above 10 on the EPDS. No demographic data reported. N = 20	Mellow Babies group – attend 10 a.m. to 3 p.m. once a week for 14 weeks. Mix of group psychotherapy for mothers (infants in crèche) and interaction coaching, baby massage and video feedback intervention (n = 12) Control – waitlist control group (n = 8)	Assessed immediately pre- and postintervention period: 1. Mellow parenting video observation – coding of videotaped interaction.	Effect sizes comparing intervention and control group at the postintervention ratings: Positive anticipation = -2.042 Positive autonomy = 1.417 Positive responsiveness = -2.097 Positive co-operation = -1.536 Positive distress = -0.117 Negative anticipation = -1.308 Negative autonomy = -2.078 Negative responsiveness = -0.474 Negative co-operation = -1.304 Negative distress = -1.565 Negative control = -1.043
Schacht (2017) Nonrandomized controlled trial UK	New mothers on a MBU. Mean maternal age = 33.84 years. Mean infant age = 2.7 months on admission to MBU. N = 9 (plus 30 in control group).	Mind-mindedness video feedback – video feedback intervention focusing on maternal perception of infant's mental state (n = 9) Standard care – control group from the MBU, received one session of video feedback focused on their own self-confidence instead of mind-mindedness (n = 30)	Assessed at 15 months of infant age: 1. Attachment via Ainsworth SSP	Reported the following effect sizes in the intervention group over time: 1. Change in appropriate mind-related comments = 0.188 2. Change in nonattuned mind-related comments = 0.653 Intervention versus control at admission: 1. Appropriate mind-related comments = 0.41 = 1.121 2. Nonattuned mind-related comments = 0.15 At discharge: 1. Appropriate mind-related comments = 0.15 2. Nonattuned mind-related comments = 0.17

Stein (2006) RCT UK	New mothers attending routine postnatal baby clinics, with infants between 4 and 6 months meeting DSM-IV criteria for bulimia nervosa. Median maternal age in video feedback group = 31 years. In counselling group = 29 years. Infant age = all aged 4–6 months on study entry. N = 80	Video feedback intervention – mealtime interaction videotaped, positive and critical feedback given. 13 x 1 h sessions given weekly, focusing first on the infant's perspective, then the mother's perspective, and finally on identifying and addressing potential triggers of mealtime conflict (n = 40). Counselling group – 13 x 1 h sessions using empathetic listening techniques (n = 40)	Assessed immediately pre- and postintervention: 1. Mealtime conflict – assessed via videotaped interaction, rated on conflict versus harmony according to a tool developed for this trial 2. Mother x infant interaction – also assessed via videotaped interaction, using a tool developed for this trial	Not reported for included outcomes.
Tambelli (2015) RCT Italy	New mothers diagnosed with postnatal depression in Central Italy. Mean maternal age = 31.2–31.9 years across intervention groups. Mean infant age at entry to study = 3.1–3.4 months across intervention groups. N = 52	Mothers and fathers treated together – supportive, relationship-based parent–infant intervention consisting of 2 sessions a month for 15 sessions. Delivered by psychologists (n = 22) Mothers only treatment group – received identical intervention to above, but only treating the mothers (n = 22) Control – healthy control group, no intervention given (n = 22)	Assessed at 3 and 12 months of infant age: 1. QUIT – Questionari Italiani Temperamento – an Italian maternal-reported infant temperament questionnaire 2. SVIA – Scala di Valutazione Interazioni Alimentari – Italian adaptation of the Infant Feeding Scale	Reported partial η^2 for 4 subscales of the SVIA and 6 subscales of the QUIT, comparing scores across time for each intervention group. For the SVIA this was reported separately for the mother and father. No overall effect sizes reported for either of the included outcome measures, and no discussion of effect size within the text. For details of each partial η^2 see the full paper (Tambelli et al., 2015).
Tsivos (2015) RCT UK	New mothers with postnatal depression. Mean maternal age in control group = 26.7 years, and in intervention group = 30.7 years. Mean infant age at baseline in control group = 5.7 months, and in intervention group = 6.7 months. N = 27	Baby Triple P – strengths-based intervention involving 8 weeks of manualized sessions (n = 14) Treatment as usual group (n = 13)	Assessed pre- and postintervention and at follow-up: 1. CARE index – observer rated videotaped interaction. 2. Postpartum Bonding Questionnaire (PBQ).	Not reported for included outcomes.
Van Doesum (2008) RCT Netherlands	New mothers meeting DSM-IV criteria for either: major depressive episode, dysthymia or scoring >14 on Beck Depression Index. Mean maternal age in control group = 30.4 years and in intervention group = 29.6 years. Mean infant age at study entry in control group = 5.4 months, and in intervention = 6.0 months. N = 85	Intervention group – video feedback intervention involving 8–10 home visits over 3–4 months. Both positive and critical feedback given (n = 43) Control group – received three telephone calls giving practical parenting advice (n = 42)	Assessed pre- and postintervention and at follow-up 3 months later: 1. EAS – used to rate videotaped interaction. Assessed only at follow-up: 2. Attachment security assessed using Attachment Q Sort (AQS) – observer rating of Mother x infant interaction. 3. ITSEA – Infant Toddler Social and Emotional Assessment – parent-reported assessment of child socioemotional functioning.	Reported the following significant effects of Group x Time on these dimensions of the Mother x Child interaction: Maternal sensitivity = 0.28 Maternal structuring = 0.16 Child responsiveness = 0.10 Child involvement = 0.13

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Challacombe 2017	+	+	-	+	+	-
Clark 2008	-	-	-	?	?	+
Ericksen 2018	+	+	-	+	?	-
Fonagy 2016	+	+	-	+	-	+
Goodman 2015	+	+	-	+	+	+
Kenny 2013	-	-	-	+	+	+
Letourneau 2011	+	?	-	+	+	+
Murray 2003	+	-	-	?	-	+
O'Higgins 2006	-	-	-	+	+	+
Onozawa 2001	?	?	-	?	-	+
Puckering 2010	+	+	-	+	+	+
Schacht 2017	-	-	-	+	+	+
Stein 2006	+	+	-	+	-	+
Tambelli 2015	+	?	-	-	-	+
Tsivos 2015	+	+	-	+	+	+
van Doesum 2008	+	-	-	+	+	+

Figure 2. Chart displaying risk of bias per outcome for each included studies. + symbol denotes low risk of bias, - symbol denotes high risk of bias, and ? denotes unclear risk of bias.

responsiveness and involvement. The attachment assessment, conducted using the Attachment Q-Sort (AQS; Waters & Deane, 1985), found that infants in the experimental group had

significantly higher scores for attachment security than the control group (van Doesum *et al.*, 2008).

Onozawa *et al.* (2001) reported outcomes using the Fiori Global Rating system for video assessment of Mother×Infant interaction quality (Murray *et al.*, 1996), and found statistically significant improvements in the massage group compared to baseline, with no improvement seen in the support group used as a control. Clark *et al.* (2008) identified a statistically significant improvement using the Parent–Child Early Relationship Assessment (PCERA) scale (Clark, 1985), indicating that mothers exhibited significantly more positive affective involvement (including: maternal warmth, pleasure in her child, eye contact, and mirroring of the infant’s internal state [Clark, 1999]) than the waitlist control group at 12 weeks. Puckering *et al.* (2010) assessed outcomes via their own video coding system developed for this trial. Dyads taking part in the intervention were showed a statistically significant improvement in positive interactions, and a reduction in negative interactions. Tambelli *et al.* (2015) used two Italian outcome measures, with the QUIT questionnaire (Axia, 2002) assessing ratings of perceived infant behavior and demonstrating significant time effects across all treatment and control groups in the QUIT domains of social orientation, motor activity, negative emotionality and attention. The SVIA (Lucarelli *et al.*, 2002), an adaptation of the Infant Feeding Scale, found that for the mother and father treatment group only, there was a significant improvement compared to the other groups and across time, and it is this treatment group that has been included in Group A.

The quality of the Group A studies was largely poor (see Figure 2), with five of these studies reporting use of an RCT design (Onozawa *et al.*, 2001; Puckering *et al.*, 2010; Stein *et al.*, 2006; Tambelli *et al.*, 2015; van Doesum *et al.*, 2008), but only two studies including both adequate randomization and allocation concealment (Puckering *et al.*, 2010; Stein *et al.*, 2006).

Group B

Studies reporting directional improvements in infant or mother–infant relationship outcomes but which did not demonstrate statistical significance, included the infant massage study by O’Higgins (2006), all three treatment arms of Murray *et al.* (2003) (investigating cognitive behavioral therapy [CBT], psychodynamic therapy and nondirective counselling), a study of a parent–infant psychotherapy program (Fonagy *et al.*, 2016) and the study of the Baby Triple P program (Tsivos *et al.*, 2015).

O’Higgins (2006) assessed outcomes using the same Fiori Global Rating system as used by Onozawa *et al.* (2001). This study found no significant difference in Mother×Infant interaction quality between study groups at each outcome assessment point; however, it is notable that O’Higgins (2006) found no difference at baseline interaction quality between the depressed study groups (massage and support groups) and the healthy control group. O’Higgins (2006) cited a possible “ceiling effect” of investigating mothers with mental health problems that had normal baseline interaction quality as a confounder of their results. Murray *et al.* (2003) saw a significant improvement in maternally reported infant outcomes, using a checklist devised specifically for the study, regarding infant behavior at 4.5 months for all three intervention groups and at 18 months for the CBT group alone. Murray *et al.* (2003) also assessed attachment via Ainsworth’s SSP (Ainsworth *et al.*, 1978) but found no significant differences in attachment status between study groups.

Fonagy et al. (2016) used the Bayley Mental Development Index (MDI) score (Bayley, 2006), and identified a marginal effect of time on the cognitive scale for both intervention and control groups, indicating a small, nonsignificant improvement in cognitive development between time points for the infants included in the study, but found no difference in development according to treatment group. Fonagy et al. (2016) also identified a greater proportion of securely attached infants as assessed via Ainsworth's SSP (Ainsworth et al., 1978) at 12 months of infant age, but this was not statistically significant. Tsivos et al. (2015) assessed outcomes with the postpartum bonding questionnaire (PBQ; Brockington et al., 2001) and the CARE Index (Crittenden, 2003). The study identified nonsignificant improvements across various domains in each of these, but found no statistically significant results.

The quality of studies included in Group B was mixed (see Figure 2), including three RCTs (Fonagy et al., 2016; Murray et al., 2003; Tsivos et al., 2015). Tsivos et al. (2015) was one of the higher quality papers included in this review, failing the Risk of Bias assessment only on the blinding of participants and personnel domain; however, with a sample size of only 27 participants, the authors of this pilot RCT themselves acknowledged the need for a larger scale study.

Group C

Studies reporting no significant improvements to infant or mother–infant relationship outcomes were: the mothers-only treatment group of Tambelli et al. (2015) the time-intensive CBT intervention evaluated by Challacombe et al. (2017) the peer support home-visiting intervention studied by Letourneau et al. (2011) the study of the “Community HUGS” therapeutic playgroup (Ericksen et al., 2018) and the perinatal dyadic psychotherapy intervention evaluated by Goodman et al. (2015).

As discussed in Group A, Tambelli et al. (2015) found some significant improvements for the infants in the QUIT questionnaire (Axia, 2002) domains of social orientation, motor activity, negative emotionality and attention, across all treatment groups. However, this improvement was found to be an effect of time rather than intervention. There were no significant treatment effects using either the SVIA (Lucarelli et al., 2002) or the QUIT (Axia, 2002) for the mothers-only treatment group. Challacombe et al. (2017) assessed outcomes using the Ainsworth SSP (Ainsworth et al., 1978) and Bates' Infant Characteristic Questionnaire (ICQ; Bates, Freeland, & Lounsbury, 1979), reporting no significant treatment effects.

Letourneau et al. (2011) assessed outcomes using the Nursing Child Assessment Satellite Training (NCAST) feeding and teaching scales (Sumner & Spietz, 1994a, 1994b), Bayley's MDI (Bayley, 2006), Bates' ICQ (Bates et al., 1979) and maternal and infant salivary cortisol. The ICQ indicated a highly statistically significant time effect in both the intervention and the control groups, demonstrating that mothers in the study tended to view their infants as less difficult over time. There was a statistically significant moderate effect size in favor of the control group seen in the NCAST teaching scales; however, there were no other significant results found.

Ericksen et al. (2018) used the Paediatric Infant Parent Exam (PIPE; Fiese, Poehlmann, Irwin, Gordon, & Curry-Bleggi, 2001) to evaluate Mother×Infant interaction quality, finding no significant differences between treatment groups at follow up. Ericksen et al. (2018) also used the Parenting Stress Index Short Form (PSI-SF; Abidin, Flens, & Austin, 2006). This found no significant

posttreatment differences between groups, apart from on the difficult child domain, which remained higher in the intervention group than control, opposite to the intended treatment effect (Ericksen et al., 2018). Goodman et al. (2015) also used the PSI-SF (Abidin et al., 2006), reporting no improvements in the treatment group. This study also assessed, with no treatment effect noted, was maternal sensitivity, infant engagement, and dyadic reciprocity, using these domains of the Coding Infant Behaviors (CIB; Feldman, 1998) video-assessment scales (Goodman et al., 2015).

The quality of studies included in Group C was also mixed (see Figure 2), although it is notable that they were all RCTs. Group C included the only two studies of this review with elements of reporting bias (Challacombe et al., 2017; Ericksen et al., 2018).

Key components

In addition to classifying the interventions into three groups according to their impact on infant or mother–infant relationship outcomes, the descriptions of the interventions were also analyzed to identify key components. A matrix was then created, mapping the key components of the studies against the study results (See Table 2). The components identified and their prevalence in the different groups are discussed below.

Component 1: Guiding and facilitating positive Mother×Infant interactions

Of the eight interventions in Group A, seven had facilitation of positive Mother×Infant interactions as a key component (Clark et al., 2008; Kenny et al., 2013; Onozawa et al., 2001; Puckering et al., 2010; Schacht et al., 2017; Stein et al., 2006; van Doesum et al., 2008). Techniques included interaction guidance or coaching to increase sensitivity to infant cues, and infant massage to encourage increased use of positive touch.

Guiding of maternal interactions was a key component of many interventions in Group A, but was also featured in some interventions in Groups B and C. In these groups the guidance appeared less likely to be a core component.

Guiding and facilitating positive Mother×Infant interactions is the main focus of infant massage interventions. Two studies were included in this review that investigated infant massage; however, they found conflicting results (O'Higgins, 2006; Onozawa et al., 2001). Onozawa et al. (2001) reported statistically significant improvements in interaction quality for mother–infant dyads in the infant massage group compared to the control, while O'Higgins (2006) noted no such improvement, although this may have been due to the cited “ceiling effect,” as there was no difference at baseline in interaction quality between the depressed study groups and the healthy control group (O'Higgins, 2006).

Component 2: Helping the mother to understand the infant's internal world, needs, and unique perspective

Six of the interventions in Group A aimed to help the mother understand her infant's internal world and unique perspective, with increased awareness of the infant's needs (Clark et al., 2008; Kenny et al., 2013; Puckering et al., 2010; Schacht et al., 2017; Stein et al., 2006; van Doesum et al., 2008). For example, Schacht et al. (2017) trialed a “mind-mindedness” focused intervention designed to encourage mothers to comment on their infants internal thoughts, feelings and states. The study found that significantly more infants in the intervention group were

Table 2. Analysis of components of potentially effective interventions

Component	Kenny (2013)	Schacht (2017)	Van Doosum (2008)	Van Stein (2006)	Onozawa (2001)	Clark (2008)	Puckering (2010)	Tambelli (2015) (TxMF ^a)	O'Higgins (2006)	Murray (2003) (ND ^b)	Murray (2003) (PD ^b)	Murray (2003) (CBT ^b)	Fonagy (2016)	Tsivos (2015)	Tambelli (2015) (TxM ^a)	Challacombe (2017)	Letourneau (2011)	Ericksen (2018)	Goodman (2015)
Guiding or facilitating positive Mother-infant interactions (for example, responding to infant cues or increasing positive touch)	x	x	x	x	x	x	x		x				x				x	x	x
Increasing awareness and understanding of the infant's internal world, needs, and unique perspective	x	x	x	x	x	x	x			x							x	x	x
Video feedback	x	x	x	x			x												
Cognitive behavioral strategies			x	x	x	x	x				x					x		x	
Psychoeducation or pedagogical support (focused for example on parenting, child development, perinatal mental health problems)			x	x	x	x	x	x	x	x	x	x	x	x			x	x	x
Increasing awareness and understanding of mother's interpersonal relationships with infant and others					x	x	x	x		x	x	x	x	x					
Psychodynamic approach including a focus on mother's internal world						x		x		x	x								
Delivered by peers																	x		
Group format				x	x	x	x	x	x									x	
Individual or dyadic format	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Involvement of partner			x				x	x											

Key:

Group A: Interventions demonstrating statistically significant improvements in infant or mother-infant outcomes.

Group B: Interventions demonstrating directional improvements in infant or mother-infant outcomes but the improvements did not reach statistical significance.

Group C: Interventions demonstrating statistically significant improvements in infant or mother-infant outcomes.

^aTambelli 2015 examined the impact of psychodynamic therapy delivered to either both parents (TxMF), or to the mother alone (TxM), compared to a control. These groups have been reported on separately due to their different findings.

^bMurray 2003 examined three different approaches to maternal psychotherapy, with an additional routine care control group. The three treatment groups have been reported on separately in the below table to reflect their differing approaches. ND = nondirective counselling, PD = psychodynamic therapy, CBT = cognitive behavioral therapy.

classified as securely attached at 15 months compared with the control group ($p = .008$) (Schacht et al., 2017).

Other interventions in Group A that shared this focus included another four that made use of video feedback (discussed further below) to aid interaction guidance and improve maternal sensitivity to the infant's needs and perspective (Kenny et al., 2013; Puckering et al., 2010; Stein et al., 2006; van Doesum et al., 2008). In addition, Clark et al. (2008) investigated the use of a mother–infant therapy group that identified a statistically significant improvement in maternal positive affective involvement compared to the waitlist control group, as well as a significant main effect seen on mother's perception of how her infant reinforces positive interactions (PSI) "child reinforces" domain, $p < .05$ indicating that mothers in the treatment group found parenting their infants to be more rewarding compared to those in control group (Clark et al., 2008).

There were less successful interventions, in terms of infant or mother infant relationship outcomes, that shared this focus. These included the psychodynamic therapy treatment group from Murray et al. (2003) and the dyadic psychotherapy approach investigated by Goodman et al. (2015). In addition, Ericksen et al. (2018) included a focus on the infant's internal world as part of their therapeutic playgroup program (CHUGS). No significant posttreatment differences were identified in the CHUGS pilot RCT between intervention and the waitlist control groups, apart from in the average scores on the difficult child domain of the PSI, which remained higher in the intervention group, a statistically significant difference ($p = .01$) in the opposite direction to hypothesized. Mother–infant relationship outcomes had shown significant improvements in the feasibility study of CHUGS; however, due to the lack of control group the feasibility results have not been included in this review.

Component 3: Use of video feedback

Five of the interventions in Group A used videos of Mother×Infant interactions as a prompt for discussions with mothers focusing on moments of attunement and sensitivity to infant cues (Kenny et al., 2013; Puckering et al., 2010; Schacht et al., 2017; Stein et al., 2006; van Doesum et al., 2008), and sometimes also highlighting missed opportunities for positive interactions (van Doesum et al., 2008).

Four interventions (Kenny et al., 2013; Schacht et al., 2017; Stein et al., 2006; van Doesum et al., 2008) had video feedback discussions as a core component, of which two were delivered within inpatient perinatal mental health services in MBUs (Kenny et al., 2013; Schacht et al., 2017), and two within the community in the mothers' homes (Stein et al., 2006; van Doesum et al., 2008). Although video feedback is highlighted as a core component of these interventions, it should be clarified that the selection of interactions to highlight and discuss is the critical factor, rather than the use of video per se. All of the video feedback interventions included in this review focused on highlighting and reinforcing attuned maternal responses and maternal sensitivity (Kenny et al., 2013; van Doesum et al., 2008). In the case of Schacht et al. (2017), one particular kind of attuned maternal response ("mind-minded" comments relating to internal states) was the sole focus of the intervention.

Puckering et al. (2010) investigated a multicomponent group program that included an element of video feedback. The intervention comprised a weekly group with dyadic and individual components, involving many of the key components identified in Table 2. Dyads taking part in the intervention showed a

statistically significant improvement in positive interactions ($p = .015$), and nonsignificant reduction in negative interactions (Puckering et al., 2010).

Component 4: Cognitive behavioral strategies

Four studies from Group A included some use of cognitive behavioral strategies; however, this was not a core component of any of these interventions. One study in Group B had maternal CBT as a core component. Murray et al. (2003) evaluated CBT in one arm of their study (the other arms being psychodynamic psychotherapy and nondirective counselling for mothers with PND, each of which are considered separately in this analysis). Murray et al. (2003) identified scarce improvements for the CBT arm, with the exception of a significant improvement in maternal perception of relationship problems at 4.5 months that was seen for all three interventions trialed, all other outcomes and time points found no significant differences. A further study (Challacombe et al., 2017) investigating the effects of iCBT (time-intensive CBT) in new mothers with OCD was classified into Group C and found no treatment effect for infant attachment or Mother×Infant interaction quality (Challacombe et al., 2017).

Component 5: Psychoeducation/pedagogical support

Just over half of the interventions trialed involved some element of psychoeducation or pedagogical support (Clark et al., 2008; Ericksen et al., 2018; Goodman et al., 2015; Letourneau et al., 2011; O'Higgins, 2006; Puckering et al., 2010; Stein et al., 2006; Tsivos et al., 2015; van Doesum et al., 2008). For some, such as the peer support intervention delivered in Letourneau et al. (2011), this was a key focus. For others, such as Puckering et al. (2010), Tsivos et al. (2015) or Ericksen et al. (2018), this was just one component of a complex, multi-focused intervention program. The use of psychoeducation or pedagogical support was seen in interventions spread across Groups A, B, and C, and so its association with improvements in infant or mother–infant relationship outcomes is unclear.

Component 6: Exploration and understanding of interpersonal relationships with infant and others

Exploring and understanding the mother's interpersonal relationships either with their infant, or with other individuals, was also identified as a core component in a number of interventions. Interventions from Group A that reported this focus were: the mother–infant therapy group model explored in Clark et al. (2008); the Mellow Babies multicomponent group intervention in Puckering et al. (2010); and the arm of the Tambelli et al. (2015) study in which both parents received a supportive, relationship-based, parent–infant intervention in the first year of infant life. Significant results found by Tambelli et al. (2015) included improvements in the domains of motor activity, attention capacity, social orientation, and negative emotionality. They also found that parental interactions with the infant were significantly less maladaptive in this treatment group at follow up. Neither of these treatment effects were seen for the mothers-only treatment group, which is why this arm of the study has been placed in Group C (Tambelli et al., 2015).

Other studies which had a focus on exploring the mother's interpersonal relationships included three from Group B: Murray et al. (2003), Tsivos et al. (2015) and Fonagy et al. (2016). Tsivos et al. (2015) investigated the Baby Positive Parenting Program (Triple P), a multicomponent intervention that focuses on maternal strengths in parenting, aiming to

promote healthy infant development and improve maternal psychopathology symptoms by educating parents and encouraging a low-conflict environment for the infant. The study identified nonsignificant improvements across various outcomes, but found no statistically significant results. Only one intervention from the Murray *et al.* (2003) paper included this component, and this was their investigation of maternal psychodynamic psychotherapy. This intervention was placed in Group B because, apart from the improvement in maternal perception of relationship problems seen at 4.5 months for all three interventions trialed in the paper, the psychodynamic therapy group saw no other statistically significant improvements.

Fonagy *et al.* (2016) investigated a parent–infant psychotherapy (PIP) that took a psychoanalytic approach. They identified a small, nonsignificant improvement ($p = .07$) in the cognitive development subscale of their primary outcome measure and also found that a greater proportion of infants in the treatment group were securely attached at 12 months of infant age, but this was not statistically significant ($p = .61$) (Fonagy *et al.*, 2016). In addition, mothers in the PIP group reported lower overall levels of parenting stress over time relative to the mothers in the control group ($p = .018$) but no other treatment effects were identified (Fonagy *et al.*, 2016).

Component 7: Psychodynamic

Four studies investigated the use of psychodynamic therapy: Clark *et al.* (2008), Tambelli *et al.* (2015), Fonagy *et al.* (2016) and Murray *et al.* (2003). Clark *et al.* (2008) and the mother and father treatment group of Tambelli *et al.* (2015) were the only two psychodynamic interventions placed in Group A. The psychodynamic treatment arm of Murray *et al.* (2003) and the psychoanalytic PIP intervention investigated by Fonagy *et al.* (2016) were both associated with only directional, but not statistically significant improvements, as mentioned above, while the mothers-only group from Tambelli *et al.* (2015) was associated with no treatment effects.

Component 8: Mode of delivery

In addition to analyzing the interventions according to their key components, we also considered the mode of delivery used. As can be seen in Table 2, group and individual delivery were spread across Groups A, B, and C. Most studies were delivered by trained professionals, with the exception of one study (Letourneau *et al.*, 2011), which investigated an intervention delivered by peers. This study identified no significant improvements in the treatment group when compared to control, instead they reported a statistically significant ($p = .05$) change in favor of the control group seen in the Teaching scale of the NCAST assessment, suggesting that the intervention was associated with worsened interaction quality between mother and infant during the teaching situations assessed (Letourneau *et al.*, 2011). However, with only one study investigating peer delivery, no significant conclusions can be drawn.

Of note, three studies included some involvement of the infants' fathers in their interventions, and all of these reported significant improvements. The degree of involvement varied. Tambelli *et al.* (2015) found significant results for the use of psychodynamic treatment in the first year of infant life, but only when this was delivered to both the mother and the father. The Mellow Babies intervention from Puckering *et al.* (2010) involved the fathers by inviting them to group sessions that delivered psychoeducation on PND and included activities focused on

strengthening Father×Infant interactions. van Doesum *et al.* (2008) was the only paper to describe involving the father and mother together in their intervention; they described how the fathers were involved in reviewing the mother and infant's videotaped interactions as part of the video feedback sessions, although this was only when the father was available rather than a consistent feature of the intervention.

Discussion

The link between perinatal mental health difficulties and adverse outcomes for the child from infancy through to adulthood is well established (Feldman *et al.*, 2009; Hosman *et al.*, 2009; Johnson, Cohen, Kasen, Smailes, & Brook, 2001; Korhonen *et al.*, 2012; Murray *et al.*, 1996; Netsi *et al.*, 2018; Stein *et al.*, 2014; van Doesum & Hosman, 2009; Velders *et al.*, 2011; Wan & Green, 2009). We undertook a review of interventions to support mothers with mental health difficulties that were designed to improve infant outcomes and mother–infant relationship outcomes in the first year postpartum, with no restriction on maternal diagnosis (Bakermans-Kranenburg *et al.*, 2003; Leman *et al.*, 2012; Letourneau *et al.*, 2017; Wright & Edginton, 2016). The 16 systematically identified included studies varied in terms of the content of the interventions, duration of intervention, specific perinatal mental health difficulties, and outcome measures. The resulting heterogeneity due to differences in participant diagnoses, study methods, and outcome measures meant that meta-analysis was not possible and therefore analysis of effectiveness was limited to reporting from the original studies. However, the key components of the diverse interventions highlight which of the particular elements may be associated with significant improvements in infant or mother–infant relationship outcomes. The analysis we undertook was a pragmatic attempt to identify the “active ingredients” that will help guide the planning of future interventions.

The aim of the review was to inform the design and implementation of parenting pathways within perinatal mental healthcare services, and as such the focus was specifically on infant and mother–infant relationship outcomes. The importance, however, for both mother and infant, of good maternal mental health is also paramount but has been considered elsewhere (Barlow *et al.*, 2010, 2015; Dennis, Ross, & Grigoriadis, 2007).

This review indicated that interventions that focus on facilitating or guiding Mother×Infant interactions and maternal behavior, and interventions that focus on helping the mother to understand the child's internal world, were linked with significant improvements in infant or mother–infant outcomes (Clark *et al.*, 2008; Kenny *et al.*, 2013; Onozawa *et al.*, 2001; Puckering *et al.*, 2010; Schacht *et al.*, 2017; Stein *et al.*, 2006; Tambelli *et al.*, 2015; van Doesum *et al.*, 2008). Five studies were identified that included the use of video feedback, all of which produced significant improvements in infant outcomes or mother–infant relationship outcomes (Kenny *et al.*, 2013; Puckering *et al.*, 2010; Schacht *et al.*, 2017; Stein *et al.*, 2006; van Doesum *et al.*, 2008). Two community-based studies were RCTs of relatively high quality (Stein *et al.*, 2006; van Doesum *et al.*, 2008), while those conducted in an MBU used nonrandomized designs and thus scored less well in the risk of bias assessment (Kenny *et al.*, 2013; Schacht *et al.*, 2017). However, the inpatient studies of video feedback interventions demonstrated the most robust positive findings of the entire review.

Significant change was also reported in studies that addressed mothers' understanding of their infant's internal world. Four of

the video feedback intervention studies included a focus on this (Kenny et al., 2013; Schacht et al., 2017; Stein et al., 2006; van Doesum et al., 2008), in addition to the mother–infant therapy group model described in Clark et al. (2008) and the Mellow Babies intervention investigated in Puckering et al. (2010).

Strengths and limitations

This review employed a comprehensive search strategy that identified over 7,000 unique citations. The search was broad, including nine relevant bibliographic databases covering medical, nursing, and social science disciplines, consistent with previous literature on a similar topic (Barlow et al., 2010). The diverse approaches of the included papers allowed this review to encompass a full range of perinatal mental health difficulties, and to examine different forms of interventions designed to improve infant outcomes. Final study selection and data extraction for the review was completed according to good practice in systematic reviews, involving double-scoring from two researchers to ensure accuracy and consistency; however, titles and abstracts were assessed by one reviewer only.

Time constraints limited the use of supplementary literature searching beyond the electronic databases searches. Citation and reference-list searching was performed; however, contacting of authors and hand searching of relevant journals was not. In addition, searches and inclusion of studies were limited to those published in the English language, possibly introducing an element of publication bias.

Heterogeneity of the studies in terms of methods and the variety of outcome measures used, limited this review. The included studies used 34 different outcome measures, frequently assessing similar outcomes but using different methods. This prevented the use of meta-analytical techniques to synthesize data and compare the results of the included studies. Furthermore, many of the studies involved complex, multifaceted intervention programmes with different formats, which meant it was not possible to group studies according to intervention type. The interventions under investigation in the included studies varied in their timescales and there remains uncertainty therefore as to how timescale may potentially impact effectiveness, with previous research suggesting that briefer interventions may be more effective (Bakermans-Kranenburg et al., 2003). The analysis we therefore undertook was a pragmatic attempt to identify the key components of the most effective interventions. We constructed a matrix (shown in Table 2) to facilitate the analysis, our hope being that identifying the “active ingredients” will help guide the planning of future interventions.

Twelve of the included studies were described as RCTs (Challacombe et al., 2017; Erickson et al., 2018; Fonagy et al., 2016; Goodman et al., 2015; Letourneau et al., 2011; Murray et al., 2003; Onozawa et al., 2001; Puckering et al., 2010; Stein et al., 2006; Tambelli et al., 2015; Tsivos et al., 2015; van Doesum et al., 2008). The majority of these used computer-generated randomization, although some less robust methods were used including the researcher choosing a colored ball (Murray et al., 2003) or tossing a coin (Puckering et al., 2010), introducing significant opportunity for selection bias given the researcher was aware of the implication of which color/coin result was linked to which allocation. Four studies made no attempt at randomization (Clark et al., 2008; Kenny et al., 2013; O’Higgins, 2006; Schacht et al., 2017). All included studies were deemed to be at high risk of performance bias due to a lack of blinding of participants and personnel. This was likely due to the

impracticality of attempting to blind participants when the interventions under investigation varied so greatly (O’Higgins, 2006). Blinding is challenging in the field of psychological research, and in the case of waitlist controls it can be impossible, which opens these studies to an increased risk of performance bias (Skapinakis et al., 2016) and in the case of studies with waitlist control groups, the placebo effect.

In trials of psychological therapies, researcher allegiance is often prevalent with the primary author of the studies frequently being a proponent, or even the psychotherapist in the active treatment arm (for example, Challacombe et al., 2017). Some studies also fail to disclose or discuss details on the psychotherapist(s) that delivered the intervention (for example, Schacht et al., 2017). The statistical analyses for the study may also be undertaken by the practicing psychotherapist (for example, Kenny et al., 2013). The included studies were often describing pilot interventions developed by the study authors and therefore the conception of study design, delivery, interpretation, and reporting of such studies are prone to selection, detection, and reporting bias. This review’s reliance on the reported statistical benefits of these emerging interventions without further formal validation with high-quality, adequately powered trials means that these findings must therefore be interpreted with caution.

Implications for practice

Given the strong association between a mother’s mental health and child outcomes (Hosman et al., 2009; Netsi et al., 2018; Stein et al., 2014), it is essential that perinatal mental health services continue to deliver well-researched evidence-based interventions to support and improve the mental health of mothers experiencing complex perinatal mental health problems. However, it is also imperative that perinatal services deliver interventions that support Infant×Mother interactions which affect infant and mother–infant outcomes. Guidance produced in the UK states that parent–infant services are an important part of a perinatal mental healthcare strategy, and should consist of “a variety of psychotherapeutic, psychological and psychosocial treatments and parenting interventions” (Royal College of Psychiatrists, 2015), a recommendation that is mirrored in the focus on treating mother and infant together in the World Health Organisation’s “Thinking Healthy” guidelines for treatment of perinatal depression (World Health Organization, 2015). This review highlights that future investment in parenting interventions should include a focus on guiding maternal behavior and interactions with her infant, and increasing mothers’ understanding of their infant’s internal world. The use of video feedback in guiding attuned and sensitive interaction demonstrated the most robust evidence, and the greatest success for this was seen in an inpatient MBU setting. There was also promising evidence for the involvement of fathers in perinatal mental health interventions.

Implications for future research

The present review has highlighted a lack of high-quality, RCTs investigating the effectiveness of different perinatal interventions on infant outcomes. While 16 studies were identified and included in this review, due to the variety of interventions assessed there were only a small number of studies for each form of intervention. In addition, the studies in this review often assessed infant attachment and other outcomes in tandem

with assessments of the mother–infant relationship or maternal sensitivity, with only one study following the infants up later in childhood (Murray *et al.*, 2003, followed participants up to 5 years of age). It is thought that this may underestimate the treatment effect of parenting interventions, as the change in the relationship or maternal sensitivity has not had time to significantly impact the infant (Bakermans-Kranenburg *et al.*, 2003). Previous research has also highlighted that attachment security and other infant outcomes are more difficult to change than maternal outcomes, likely due to the long-term nature of such changes (Bakermans-Kranenburg *et al.*, 2003). This review has purposefully included studies that investigated interventions conducted in the first year of infant life, to maintain focus on perinatal mental health problems; however, the lack of long-term follow up in these studies means that the potential to capture the long-term benefits of the interventions has not been evidenced. Therefore, rigorous controlled studies are needed for different types of intervention, ideally with a focus on infant and mother–infant relationship outcomes with long-term follow up into childhood and later life.

Further controlled studies of infant massage are also needed to clarify the conflicting results found by Onozawa *et al.* (2001) and O’Higgins (2006). In addition, three included studies involved fathers in varying degrees and all reported significant improvements. Previous reviews have highlighted the potential positive impact of engaging fathers in perinatal mental health interventions; however, there is a lack of robust evidence for the impact of this on infant outcomes specifically (Panter-Brick *et al.*, 2014; Rominov, Pilkington, Giallo, & Whelan, 2016).

Future research into perinatal interventions should ensure sufficient attention is given to infant and mother–infant relationship outcomes, rather than focusing solely on evaluating maternal outcomes. In addition selection and pre-specification of such infant outcome measures should be considered in future primary studies of perinatal health so that more robust conclusions regarding their effectiveness in improving infant wellbeing, mental health, and development can be drawn from future systematic reviews.

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