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**Effectiveness of Social-psychological Interventions at Promoting Breastfeeding
Initiation, Duration and Exclusivity: A Systematic Review and Meta-analysis**

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Abstract

Evidence for the health benefits of breastfeeding is well substantiated but breastfeeding uptake and duration remains low worldwide. Individual level breastfeeding promotion programmes are behavioural interventions, targeting malleable social-psychological processes to change behaviour. This systematic review aimed to investigate whether such interventions are effective at improving breastfeeding initiation, duration and exclusivity, and breastfeeding support. A three-stage search strategy identified eligible articles from six databases. Nine controlled-clinical trials and 11 quasi-experimental trials were included. Random-effects meta-analyses identified significant improvements in rates of breastfeeding initiation ($N = 2,213$; $OR = 2.32$, 95% CI [1.33, 4.03], $p = .003$; $I^2 = 0\%$, $p = .966$) and suggested improved exclusive breastfeeding rates up to six months postpartum ($N = 3,671$; $OR = 1.84$, 95% CI [1.38, 2.45], $p < .001$; $I^2 = 68.7\%$, $p < .001$). After considering small-sample effects, estimates for exclusive breastfeeding across the postpartum period were non-significant. There were no improvements in women maintaining any (i.e. non-exclusive) breastfeeding to one, two, three, four or six months postpartum ($N = 4,153$; $OR = 0.88$, 95% CI [0.72, 1.09], $p = .253$). Evidence for improvements in perceived and actual breastfeeding support was limited. Sub-group analyses suggest standalone postnatal interventions targeting first-time mothers may support breastfeeding uptake. Findings should be interpreted cautiously as the quality of evidence for each outcome was low with a high risk of bias. Future efforts to support women to breastfeed should assimilate behaviour change research, with process evaluation to identify effective processes to inform a high-quality evidence-base for implementation in practice.

Keywords: breastfeeding; infant feeding; psychological; intervention; behaviour change; child health

Effectiveness of Social-Psychological Interventions to Promote Breastfeeding Initiation,
Duration and Exclusivity: A Systematic Review and Meta-analysis

The ‘Global Strategy for Infant and Young Child Feeding’ (World Health Organisation, [WHO], 2003) recommends infants worldwide should be breastfed exclusively for the first six months of life. Although evidence for the health benefits of breastfeeding is well substantiated (Horta, Bahl, Martines, & Victora, 2007; Victora et al., 2016), breastfeeding rates worldwide remain low particularly among higher-income and developed countries (Victora et al., 2016; WHO, 2011). Global prevalence rates from latest data indicate less than 40% of infants are being exclusively breastfed to six months (Victora et al., 2016; United Nations International Children’s Emergency Fund [UNICEF], 2011; WHO, 2011). In light of this, initiatives to support and encourage the uptake and continuity of breastfeeding have been adopted internationally.

Public health interventions promoting breastfeeding behaviour among healthy infants have been extensively evaluated over time to inform best practice. In research to date, breastfeeding behaviour has been investigated through three behaviours: how many women start (initiation), the duration of breastfeeding, and the exclusivity of breastfeeding (feeding breastmilk as the only food source; WHO, 2003). Initial reviews focused on the efficacy of public policy and health service initiatives (including the Breastfeeding Friendly Hospital Initiative), education interventions, and healthcare professional training in the promotion of breastfeeding initiation and duration (Balogun et al., 2016; Dyson, McCormick & Renfrew, 2005; Fairbank et al., 2000). Overall, education-based interventions (including peer support programmes) are understood to be effective in increasing the proportion of women who start breastfeeding (Balogun et al., 2016; Fairbank et al. 2000) and to some extent the exclusivity with which women breastfeed (Haroon, Das, Salam, Imdad & Bhutta, 2013), but are less

effective at improving the duration of breastfeeding. For breastfeeding duration and exclusivity, additional support appears essential. Evidence suggests interventions offering consistent lay and healthcare professional-based, face-to-face support in the postpartum period are effective, particularly when initiation rates are high (McFadden et al., 2017; Renfrew, McCormick, Wade, Quinn & Dowswell, 2012). However, evidence is lacking for best-practice support or the effectiveness of interventions at improving the availability and receipt of maternal support, perceived or actual (McFadden et al., 2017). Despite evidence for effective promotion strategies, there remain wide variations in breastfeeding rates that fluctuate as a function of the availability of care, public health policies, and demographic and socio-cultural factors.

In attempts to distribute resources more efficiently and target women in need of most support, research has focused on prevalent sociodemographic predictors of breastfeeding behaviours. For example, in developed countries women are more likely to initiate breastfeeding and continue for a longer duration if they are older, have higher socioeconomic status, greater educational attainment and are in professional and managerial occupations (Dennis, 2002; McAndrew, Thompson, Fellows, Large, Speed & Renfrew, 2012; Meedya, Fahy & Kable, 2010). While the identification of socio-demographic predictors of breastfeeding behaviour are useful in recognising women likely to benefit from extra support, these determinants cannot be modified in promoting behaviour change.

Conceptualising breastfeeding as a health behaviour, demographic, clinical and societal factors have been investigated alongside lay health behaviour representations (e.g. attitudes, appraisals and beliefs) to understand key malleable factors that guide the performance and maintenance of behaviour. To date, evidence suggests that women who have higher intentions to breastfeed (Bai, Middlestadt, Peng & Fly, 2010; Bartle & Harvey, 2017; Martinez-Brockman, Shebl, Harari, & Pérez-Escamilla, 2017; McMillan et al., 2008),

higher breastfeeding self-efficacy/perceived control (Ismail, Muda & Bakar, 2016; Martinez-Brockman et al., 2017), and more positive attitudes and beliefs about breastfeeding (Dodgson, Henly, Duckett & Tarrent, 2003; Lawton, Ashley, Dawson, Waiblinger & Connor, 2012; McMillan et al., 2008; Swanson & Power, 2005; Wan Tiansawad, Yimyam & Sriaporn, 2015) are more likely to start and continue breastfeeding. More negative attitudes to formula feeding (Richetin, Conner & Perugini, 2011), greater 'faith in breastmilk' (O'Brien, Buikstra & Hegney, 2008), and more positive emotions about breastfeeding (Shepherd, Walbey & Lovell, 2017) also positively predict breastfeeding behaviour. Conversely, women with more positive beliefs about formula feeding (Swanson & Power, 2005), stronger intentions to formula feed (Richetin et al., 2011), more vicarious experience of formula feeding (Bartle & Harvey, 2017) and greater fears of inadequate nutrition (Shepherd et al., 2017) are less likely to breastfeed.

While public health initiatives implemented at institutional level help to create environments that support breastfeeding, they cannot guarantee individual level engagement and uptake of behaviour. Whether the mechanisms of such interventions are intended or not, breastfeeding promotion interventions implemented at an individual level are forms of behaviour change intervention. These interventions use a combination of observable and replicable techniques and activities to induce behaviour change i.e. increase rates of breastfeeding (Michie, Wood, Johnston, Abraham, Francis & Hardeman, 2015; National Institute for Health and Care Excellence [NICE], 2014). Interventions using psychological therapies and/or behaviour change techniques aimed at altering breastfeeding behaviours and associated psychological mechanisms of action, have been defined in this context as 'social-psychological'. Identifying behaviour change techniques currently used throughout health interventions has been key in understanding effective social-psychological and behavioural interventions for numerous health behaviours (Michie et al., 2013; NICE, 2014). However,

the extent to which such social-psychological interventions are effective at improving breastfeeding outcomes has yet to be systematically examined. By aggregating available data to estimate the effectiveness of these interventions, it may be possible to make more informed decisions regarding newer, efficient and theory-based approaches for promoting and supporting women's breastfeeding behaviour to optimise maternal and infant health outcomes.

Aims and Objectives

This systematic review and meta-analysis investigated the effectiveness of social-psychological interventions at promoting breastfeeding behaviour among women delivering healthy, term, singletons. As evidence for the impact of interventions on maternal breastfeeding support (perceived or actual) is lacking (McFadden et al., 2017; Renfrew et al., 2012), this was also investigated.

Objectives

To examine the extent to which social-psychological interventions are effective at improving: breastfeeding initiation (the proportion of women who start breastfeeding), breastfeeding duration (the length of time women continue breastfeeding), breastfeeding exclusivity (degree to which infants are offered breastmilk alone, or combination fed with other foods/milks), and the perceived or actual breastfeeding support available to women and/or their significant others.

Methodology

This systematic review and meta-analysis were conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) agenda (Liberati et al., 2009) and registered on PROSPERO International Prospective Register of Systematic Reviews on 09-March-2017 (ID: CRD42017058725).

Eligibility Criteria

The eligibility criteria are listed in detail in Table 1. Only full text articles available in English language, empirical, peer-reviewed papers were included to enable critical appraisal of the data. As guidelines for recommended maternal and infant postnatal feeding care and support were revised following the WHO's (2003) publication, studies published or recruiting women prior to 2004 were excluded to reduce variability in infant feeding policies, available care and healthcare-provided information and recommendations. To be eligible for inclusion, interventions had to be social-psychological in nature by employing either a psychological therapy or method (cognitive behavioural therapies; acceptance and commitment therapy; psychoanalytic, psychodynamic, systemic, mindfulness and/or art therapies), and/or behaviour change techniques defined by Abraham and Michie's (2008) taxonomy of behaviour change techniques, or explicitly described by study authors (see Table 1). Eligible behaviour change techniques included observable, replicable techniques and activities used individually or in combination to target social-psychological processes and causal mechanisms of behaviour, in attempts to induce behaviour change (Abraham & Michie, 2008; Michie et al., 2015).

Information Sources

Studies were identified via the following electronic databases: PsycINFO on Ovid (2002-present); EMBASE on Ovid (1974-present); Maternity and Infant Care Database (MIDRIS) on Ovid (1971-present); Cumulative Index to Nursing and Allied Health Literature (CINAHL; 1981-present); Web of Science (all databases; 2004-present); Cochrane Central Register of Controlled Trials (CENTRAL; 2004-present); and Cochrane Pregnancy and Childbirth Group Specialized Register of Controlled Trials (2004-present). Hand searching of eligible full text articles and relevant systematic reviews was also carried out.

Search Strategy

A three-stage strategy was used to identify eligible articles. First, electronic databases noted above were searched (27 April 2017) using relevant search terms and keywords (see online Appendix A). Second, systematic reviews and meta-analyses of breastfeeding interventions identified in the database search were pooled, and each reference list was screened for relevant articles based on titles. Any relevant titles were then screened on abstract and full text for eligibility. Finally, the reference lists of each eligible full text article included in the review were manually searched for relevant titles to identify any articles missed during the first two stages. The search was updated on 01 June 2018 to include any new eligible articles.

Study Selection

Study citations (including title and abstract) identified during stage one of the search strategy were exported offline (Microsoft Excel, 2010) and duplicates manually removed (see online Appendix B). Remaining articles were then screened (PD) on title and then abstract according to the pre-defined eligibility criteria. An additional independent reviewer (YSC) partially screened up to 10% of titles and abstracts to ensure the study selection process was valid. The full texts of all remaining citations were then retrieved (where possible) and screened by two independent reviewers (PD and YSC) for eligibility (see online Appendix E). Study authors were contacted directly for any additional information required to assess article eligibility. Citations of relevant systematic reviews and meta-analyses eligible for reference list screening were pooled (see online Appendix C). Reference lists were screened for eligible articles based on title, then abstract, then full text. Finally, the reference lists of all eligible full text articles identified thus far was carried out (see online Appendix D). All reference list screening was carried out by one author independently (PD) and reviewed in full for accuracy (YSC).

Data Collection

Data were extracted from all included studies using a pre-defined data extraction table. Data extracted included: Study citation; country; sample demographic characteristics; intervention characteristics (timing, structure, content, psychological method(s) used, mode of delivery); comparison characteristics; outcomes (initiation, rates of any or exclusive breastfeeding, support); results, and study design. Data were extracted by one author independently (PD) and verified separately on two occasions (YSC and SN) to reduce bias and error.

Outcome Data

The primary outcome of interest was breastfeeding initiation defined as the number or proportion of women classified as starting breastfeeding. Where initiation was not defined or explicitly reported by study authors, rates of any (i.e. non-exclusive) and exclusive breastfeeding measured in the first week postpartum were accepted as indicating initiation. The secondary outcomes of interest were duration of any and exclusive breastfeeding (separately), defined as the number or proportion of women feeding at set timepoints in the postpartum period, and support received by women or their significant others. Exclusive breastfeeding was accepted as study authors defining infants being fed breastmilk as the only food source (with the exception of vitamins, minerals, medicines), incorporating definitions of *exclusive* from both WHO (2001) and Labbok and Krasovec's (1990) criteria. Any breastfeeding (i.e. non-exclusive breastfeeding) was therefore accepted as infants being fed breastmilk alongside other foods and liquids, synonymous to WHO (2001) criteria of *partial* or *predominant* breastfeeding, and Labbok and Krasovec's (1990) definitions of *partial* and *token*. Any self-report, quantitative, or qualitative measure of perceived or actual support from women or their significant others (i.e. partners, family or friends) were eligible for inclusion.

Risk of Bias and Quality Assessment

Methodological quality and risk of bias was assessed using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach (GRADE Working Group, 2004). As per the GRADE guidelines, within-study risk of bias was assessed by two independent authors (PD and YSC) using the Cochrane risk of bias assessment tool (The Cochrane Collaboration, 2011). Risk was rated across six domains (Selection; Performance; Detection; Attrition; Reporting, and Other) as 'low', 'unclear' or 'high'. Inter-rater reliability for coding risk of bias was assessed by Cohen's kappa (κ) and Krippendorff's alpha (α). Discrepancies in ratings were resolved through discussion between raters (PD and YSC), review of reasons provided for ratings, and consensus based on guidance from GRADE Handbook (Chapters 5.2 – 5.2.1; GRADE Working Group, 2004) corresponding to Cochrane guidance (Section 8.7; Higgins & Green, 2011). In cases where raters could not reach consensus, additional study author(s) were consulted.

Quality of evidence was assessed according to GRADE guidelines (GRADE Working Group, 2004) where an overall rating per outcome is given considering risk of bias (within and across studies); limitations in design; indirectness of evidence; heterogeneity; imprecision of results, and publication bias. Overall quality of evidence for each outcome is rated as High, Moderate, Low, or Very Low by upgrading or downgrading evidence based on these criteria (see Cochrane Handbook for Systematic Reviews of Interventions Chapter 12; Higgins & Green, 2011). Quality of Evidence was rated by two reviewers (PD and YSC). Following GRADE recommendations (GRADE Working Group, 2004), no studies were excluded on the basis of quality alone. Publication bias was assessed using a selection methods approach (Hedges, 1984; McShane, Bockenholt & Hansen, 2016), with analyses of funnel plot asymmetry (FAT; Sterne & Egger, 2011), precision effect test and precision effect estimate with standard error (PET-PEESE) test, to provide adjusted effect estimates (Hedges

& Vevea, 1996; Stanley & Doucouliagos, 2012; Vevea & Hedges, 1996).

Data Analysis and Synthesis

A random-effect meta-analysis was conducted to assess the effect of social-psychological interventions on: i) breastfeeding initiation; ii) overall duration of any breastfeeding; and iii) overall duration of exclusive breastfeeding. Random-effects models were used as a conservative estimate under the assumption there would be heterogeneous variation in the underlying effect for each intervention study (Field, 2003). Data available for each outcome were dichotomous so effect size estimates for each outcome of interest were expressed as Odds Ratios (*OR*) with 95% confidence intervals (*CI*), and inverse variance weighting was used to pool effect estimates. Where necessary, data were augmented to allow for effect estimations to be calculated. The I^2 index was used to estimate the degree of statistical heterogeneity (variability due to heterogeneity in effects sizes between studies as opposed to random error) and interpreted using Cochrane guidelines (Higgins & Green, 2011). Thresholds of acceptable heterogeneity were set at: 0-30% (low heterogeneity; low between-study variation in effect estimates); 31-60% (moderate heterogeneity); and 61-100% (considerable between-study heterogeneity in effect estimates). All analyses were conducted using Stata (Version 13.0).

Where studies reported on rates of breastfeeding across multiple timepoints, data were pooled to provide an overall estimate for any and exclusive breastfeeding separately by taking the median timepoint across studies i.e. three months. Where breastfeeding data were not available at three months, outcome data from the closest timepoint were used. For studies with more than one level of intervention, estimates were pooled for overall effect. Where only one study reported on an outcome of interest, data were synthesized narratively.

Sub-group analyses.

Duration: Any and exclusive breastfeeding over time. Where two or more studies

reported on the outcome, data for any and exclusive breastfeeding were assessed (separately) at one month intervals up to six months postpartum. Effect estimates for each month were pooled across studies to observe the effect of social-psychological interventions on the likelihood of women continuing any or exclusive breastfeeding up to monthly milestones across the postpartum period. Effect size estimates for each timepoint were expressed as *OR* with 95% CI using random effect models with inverse variance weighting. For timepoints where only one study reported outcome data, results were synthesized narratively. Where studies reported on more than one level of eligible intervention (i.e. three-armed intervention), the effect of each level of intervention on outcomes of interest were assessed separately. Analyses were decided *a-priori*.

Intervention characteristics. To assess the impact of between-study heterogeneity on the overall effect size estimates, post-hoc sub-group analyses were performed according to key intervention characteristics: timing of intervention delivery (combined antenatal and postnatal interventions vs. postnatal only intervention); maternal parity (interventions targeting first time mothers only vs. interventions targeting all mothers); and the number of behaviour change techniques used (five or fewer vs. six or more).

Sensitivity analyses. Sensitivity analyses were performed to assess the extent to which overall effect estimates were impacted by including studies with high risk of bias. Given the interventions of interest were social-psychological, the majority of studies were assessed as having high risk of bias in the domains of performance (blinding of participants and personnel), detection bias (blinding of outcome assessment; flaws in outcome measurement; controlling for confounding) and *other* bias. Therefore, thresholds for high and low risk of bias were set according to majority rule on the domains of selection bias (random sequence generation; allocation concealment; adequate and appropriate eligibility criteria), attrition bias (incomplete outcome data), and reporting bias (selective reporting) only. As per

Cochrane guidance (Higgins & Green, 2011), domains rated as unclear were assessed as high for the purpose of generating an overall rating. Meta-regressions were performed to explore whether study quality rating (i.e. higher risk of bias vs. lower risk of bias) and study type (i.e. randomised controlled trials vs. quasi-experimental controlled trials) impacted pooled effect estimates (see online Appendix I).

Results

Study Selection

A total of 3,081 references were identified through electronic database searches (search strategy stage one). After removing duplicate references and completing title and abstract screening, 108 citations remained for retrieval and full-text screening (see Figure 1. for PRISMA flow-chart diagram). Full-text articles were retrieved ($n = 82$) and assessed for eligibility by PD and YSC. A total of 12 articles were eligible for inclusion. Following reference list screening of relevant systematic reviews and meta-analyses (search strategy stage two), four additional articles were identified for inclusion. Manual reference list screening of all eligible articles identified (stage three) retrieved no additional articles. Database searches were re-run on 01 June 2018 and identified four additional articles for inclusion. A total of 20 studies were included in the review and subjected to meta-analysis.

Study Characteristics

The twenty studies included a total of $N = 5,730$ women, where $n = 3,032$ women were allocated to intervention arms and $n = 2,666$ women were allocated to control conditions. A summary of study characteristics is presented in Table 2. Studies are listed numerically and are referenced according to this number for the remainder of this review. Nine studies were randomised controlled trials (RCT), including one cluster RCT (4), and 11 studies were quasi-experimental controlled trials. Studies were conducted across 11 countries: Australia (13, 14); Canada (1); China (6, 11, 12, 17, 19, 20); Finland (5); France

(10); Hong Kong (4); Jordan (8); Malaysia (16, 18); Republic of Korea (7); Thailand (9); and USA (2, 3, 15). The majority of interventions targeted and included women only, although four interventions also included women's partners or a significant other (1, 13, 17, 20). Two interventions targeted women with specific demographics: low-income women (3) and women with obesity (15).

Intervention Characteristics

Interventions generally focused on breastfeeding behaviour holistically by examining at least two of the three sub-constructs (initiation, duration of any and/or exclusive breastfeeding): 14 studies reported or provided sufficient data for more than one outcome of interest, although six studies only reported on breastfeeding initiation (5) or duration of any or exclusive breastfeeding (3, 7, 8, 10, 19). Given the wide scope of interventions eligible for inclusion by the definition of social-psychological, it is of interest that no interventions used any formal psychological therapies. The majority of the interventions fell into the general category of Education and Support (1-6, 8, 10, 11, 13-18), two were empowerment focused interventions (7, 9), and three targeted women's self-efficacy (12, 19, 20). Across all included studies, 20 different behaviour change techniques were used, but only 13 were techniques as defined by Abraham and Michie's (2008) taxonomy (see Table 3 for full description). Nine studies (2, 8, 12, 13, 14, 15, 17, 19, 20) made use of explicit behaviour change techniques not included in the taxonomy namely: providing tailored information (2, 8, 20); providing continuous professional support (14, 15, 20); providing materials to facilitate the behaviour (13); using verbal persuasion (17); using reflective listening (19); reinforcing self-persuasion (19); and reattributing negative thoughts and/or experiences (12, 19). The number of behaviour change techniques used per intervention ranged from one to 11, and the median average across all studies was five (see Figure 2).

Meta-analysis

Breastfeeding initiation. A random-effects meta-analysis of nine studies reporting on the outcome of breastfeeding initiation (2, 4, 5, 9, 12, 15, 16, 17, 20), defined as any and exclusive breastfeeding measured within the first week postpartum, revealed social-psychological interventions significantly improved rates of initiation with low statistical heterogeneity ($N = 2,213$; $OR = 2.32$, 95% CI [1.33, 4.03], $p = .003$; $I^2 = 0\%$, $p = .966$). Data on initiation rates were analysed as exclusive and non-exclusive breastfeeding summed, but data were captured at different timepoints defined by study authors: Four studies captured breastfeeding initiation rates “at hospital discharge” (2, 5, 12, 17), one as breastfeeding within 24 hours postpartum (4), at three days postpartum (20), and at four days postpartum (15) respectively, and two studies captured initiation rates at seven days postpartum (9, 16). Women in the intervention groups were over twice as likely to start breastfeeding than women in control groups receiving care as usual. However, as observed in Figure 3, despite none of the individual studies revealing any significant effects, the overall pooled effect was significant. Given the quality of the evidence for breastfeeding initiation is rated as low with high risk of bias, this should be interpreted with caution as the true effect is likely to vary considerably from the effects observed here. No significant influence of publication bias was detected (see online Appendix H).

Sub-group analysis: Sensitivity analysis for impact of risk of bias. To examine the extent to which risk of bias was confounding estimates, overall effect estimates were compared between studies with higher risk of bias (3, 5-7, 10-13, 15-19) and studies with lower risk of bias (1, 2, 4, 8, 9, 14, 20; see online Appendix I). This revealed the effect of social-psychological interventions on breastfeeding initiation was larger among studies with lower risk of bias ($k = 4$, $OR = 2.65$, 95% CI [1.29, 5.44], $p = .008$; $I^2 = 0\%$, $p = .838$) compared to studies with higher risk of bias, where the impact of intervention was no longer significant ($k = 5$, $OR = 1.92$, 95% CI [0.81, 4.55], $p = .140$; $I^2 = 0\%$, $p = .873$). Meta-

regression analysis confirmed effect estimates and indicated effects did not differ significantly between studies based on study risk of bias rating ($OR = 0.72$, 95% CI [0.19, 2.81], $p = .590$), or study type ($OR = 1.13$, 95% CI [0.24, 5.34], $p = .861$).

Duration of any breastfeeding. Meta-analysis of the pooled effect for any breastfeeding found social-psychological interventions had no significant effect on the duration of any breastfeeding overall with moderate statistical heterogeneity ($N = 4,153$; $OR = 0.88$, 95% CI [0.72, 1.09], $p = .253$; $I^2 = 48.1\%$, $p = .016$; see Figure 4). Sixteen studies reported on the outcome of any breastfeeding across time and the pooled effect estimate was calculated using the median timepoint of assessment across all studies (i.e. three months). Four studies (5, 7, 8, 12) not included in this analysis did not report on the outcome of any breastfeeding at any timepoint. Sensitivity analysis for the impact of risk of bias (see online Appendix I) on estimates revealed marginal differences in pooled effect estimates between studies with higher risk ($k = 10$, $OR = 0.92$, 95% CI [0.72, 1.19], $p = .530$; $I^2 = 41.6\%$, $p = .080$) and lower risk of bias ($k = 6$, $OR = 0.84$, 95% CI [0.57, 1.23], $p = .362$; $I^2 = 61.5\%$, $p = .024$). Meta-regression analyses confirmed the influence of risk of bias on effect estimates and indicated no statistically significant differences in estimates based on study quality rating ($OR = 1.09$, 95% CI [0.65, 1.82], $p = .726$) and study type ($OR = 1.22$, 95% CI [0.75, 1.96], $p = .394$). The overall impact of social-psychological interventions remained non-significant.

Sub-group analysis: Duration of any breastfeeding over time. Overall, meta-analyses across the individual timepoints (one, two, three, four and six months) revealed social-psychological interventions had no significant effect on the likelihood of women continuing any breastfeeding across the postpartum period with effect estimates ranging from $OR = 0.79$, 95% CI [0.57, 1.08], $p = .137$, at one month postpartum to $OR = 1.05$, 95% CI [0.59, 1.88], $p = .859$, at six months postpartum with high heterogeneity throughout. Individual effect estimates for each timepoint are displayed in Figure 5. Effect estimates for

three armed interventions (Fu et al., 2014 [4]) differed marginally between intervention groups (see online Appendix F), but none significantly increased the likelihood of any breastfeeding at any timepoint. Pooled effect estimates could not be calculated for the outcome at five months postpartum because only one study observed the effect at this timepoint (Kupratakul et al., 2010 [9]). Jiang et al. (2014) (6) observed the effect of intervention on any breastfeeding at 12 months postpartum and found women who received weekly SMS messages up to one year postpartum were no more likely to continue any breastfeeding than women in the control group who did not receive the intervention ($N = 519$, $OR = 1.07$, 95% CI [0.69, 1.64], $p = .770$).

Duration of Exclusive Breastfeeding. Meta-analyses initially indicated social-psychological interventions significantly increased the odds of women exclusively breastfeeding across the postpartum period with moderate statistical heterogeneity ($k = 16$; $N = 3,671$; $OR = 1.84$, 95% CI [1.38, 2.45], $p < .001$; $I^2 = 68.7\%$, $p = < .001$; see Figure 6). Four studies were excluded from analysis because they did not measure exclusive breastfeeding (3, 5) or did not provide sufficient detail or data to pool an effect estimate (10, 19). Sensitivity analysis suggested the impact of interventions was slightly larger among studies with lower risk of bias ($k = 7$, $OR = 1.93$, 95% CI [1.30, 2.86], $p = .001$; $I^2 = 63.7\%$, $p = .011$) than studies with higher risk of bias ($k = 9$, $OR = 1.78$, 95% CI [1.18, 2.70], $p = .006$; $I^2 = 70.8\%$, $p = .001$), but the effect of interventions remained significant throughout. Meta-regression analysis confirmed the influence of risk of bias on effect estimates and indicated no statistically significant difference in effect estimates between studies based on study quality ($OR = 0.93$, 95% CI [0.42, 2.02], $p = .837$). Notably, the threshold for lower risk of bias represented a high risk of bias overall (see online Appendix I).

Meta-regression analysis indicated effect estimates were larger among quasi-experimental controlled trials ($k = 8$, $OR = 2.59$, 95% CI [1.62, 4.13], $p < .001$; $I^2 = 69.5\%$, p

= .002) compared to randomised controlled trials ($k = 8$, $OR = 1.38$, 95% CI [1.00, 1.91], $p = .047$; $I^2 = 56.1\%$, $p = .026$), but there was no statistically significant difference between effect estimates based on study type ($OR = 0.56$, 95% CI [0.28, 1.11], $p = 0.91$). When performing selection method analyses (Hedges & Vevea, 1996; Stanley & Doucouliagos, 2012; Vevea & Hedges, 1996) to detect and adjust for the influence of publication bias, PET-PEESE estimates revealed that after accounting for overestimation of small-sample effects the impact of social-psychological interventions was non-significant (PET adjusted $OR = 0.85$, 95% CI [0.53, 1.36], $p = .469$; see online Appendix H). Social-psychological interventions did not significantly increase the likelihood of women exclusively breastfeeding across the postpartum period.

Sub-group analysis: Duration of exclusive breastfeeding over time. Meta-analyses of available data initially suggested social-psychological interventions significantly improved the likelihood of women exclusively breastfeeding at monthly intervals up to six months postpartum (see Figure 7). The smallest effect estimate was observed at four months postpartum with moderate heterogeneity ($k = 6$; $OR = 1.66$, 95% CI [1.14, 2.43], $p = .009$; $I^2 = 52.2\%$, $p = .063$). The largest effect estimate was observed at two months postpartum with substantial heterogeneity ($k = 10$; $OR = 2.50$, 95% CI [1.61, 3.87], $p = <.001$; $I^2 = 77.3\%$, $p = <.001$). Pooled estimates for the effect of interventions were not calculated at five months postpartum because only one study reported on the outcome (9).

Given the evidence for the impact of publication bias on main outcome effect estimates for exclusive breastfeeding, sensitivity analyses using the FAT-PET-PEESE approach (Hedges & Vevea, 1996; Stanley & Doucouliagos, 2012; Vevea & Hedges, 1996) were performed to assess the impact of publication bias on pooled effect estimates at each timepoint included in sub-analyses. PET-PEESE estimates accounting for overestimation of small-sample effects revealed that social-psychological interventions do not significantly

improve the likelihood of women exclusively breastfeeding at any timepoint across the postpartum period. Adjusted effect estimates were notably reduced and non-significant at one ($OR = 1.46$, 95% CI [0.60, 3.55], $p = .350$), two ($OR = .69$, 95% CI [0.44, 1.09], $p = .100$), three ($OR = .52$, 95% CI [0.13, 1.29], $p = .106$), four ($OR = .71$, 95% CI [0.40, 1.27], $p = .178$) and six months ($OR = 1.01$, 95% CI [0.59, 3.79], $p = .985$) postpartum (see online Supplement 2).

For three armed interventions (i.e. Fu et al., 2014 [4]), pooled effect estimates across the two intervention arms indicated interventions significantly increased the likelihood of exclusive breastfeeding at 1 month postpartum ($OR = 1.64$, 95% CI [1.11, 2.43], $p = .013$). However, when analysed separately, only the telephone-based arm of the intervention (which followed women throughout the postnatal period) significantly increased the likelihood of exclusive breastfeeding ($OR = 1.94$, 95% CI [1.14, 3.31], $p = .014$). Differences in effect estimates across other timepoints were negligible between the intervention arms (Fu et al., 2014 [4]) and none indicated a significant improvement in rates of exclusive breastfeeding at any other timepoint (see online Appendix F).

Breastfeeding Support

Abbass-Dick et al. (2015) (1) was the only study to measure perceived or actual breastfeeding support as an outcome using quantitative measures. At six weeks postpartum, there were no significant differences ($p = .120$) in the perceived support women received from partners between the intervention ($\bar{x} = 88.0$, $SD = 10.9$) and control groups ($\bar{x} = 85.6$, $SD = 10.5$). However, significantly more women in the intervention group reported actually receiving help and support from their partners (71% versus control group [52%], $p = .02$), and were satisfied with their partners' involvement (intervention 89% satisfied versus control 78.1% satisfied, $p = .040$). At 12 weeks postpartum, there were no significant differences in

perceived support received between women in the intervention ($\bar{x} = 86.6$, $SD = 11.7$) and control group ($\bar{x} = 83.6$, $SD = 14.4$, $p = .21$).

Su and Ouyang (2016) (14) qualitatively assessed maternal perceived support. Women in the intervention group reported their partners (fathers of their infants) had a better awareness of how to support them because of attending the antenatal intervention sessions. This included helping to take care of the infant and assisting with housework, and being supportive in advice to persevere with breastfeeding when they faced challenges. In comparison, women in the control group reported their partners wanted to help, but were unaware of what support would be helpful or how to provide it.

Quality Assessment

According to quality assessment carried out using GRADE (GRADE Working Group, 2004), the evidence included in this review and meta-analysis was of low quality with a high risk of bias. A summary of the risk of bias assessment is displayed in Figure 8 and online Appendix G, and quality of evidence ratings with justifications are provided in online Appendix H.

Quality of evidence was rated as low for all outcomes of interest. Despite the majority of included studies being controlled clinical trials, quality was downgraded one level on every outcome for *limitations in study design* due to risk of bias. Risk of bias was consistently rated as high across three domains (performance bias, detection bias and other bias). This was predominantly due to the inherent nature of social-psychological interventions and the methodological approaches used throughout infant feeding research as the majority of interventions were unable to blind participants to treatment allocation, did not blind outcome assessors, self-reported breastfeeding behaviour, and other biases (including sampling women with high breastfeeding motivation only; bias in definition of infant feeding categories; generalisability of results, and/or inadequate or insufficient intervention detail).

Inter-rater reliability for risk of bias assessment varied from high ($\kappa = 1.0$; $\alpha = 1.0$) on performance bias, to slight or no agreement ($\kappa = .032$; $\alpha = -.111$) on other bias. Notably, on the domain of detection bias, inter-rater reliability was very low ($\kappa = -.127$; $\alpha = -.181$) on the category of ‘flaws in measurement of outcome’ due to discrepancies in rater definition. A consensus on criteria for rating was agreed through discussion such that studies using self-report of breastfeeding behaviour according to WHO 24-hour recall method (WHO, 2003) were rated as unclear bias, while studies using self-report measurement of breastfeeding not using this method were rated as high risk of bias. Consistent discrepancies were also observed on the domain of other bias (reflected in α assuming a negative value) where raters focused on various aspects of additional bias introduced in study methodologies. Consensus ratings for other bias were reached by reviewing reasons for ratings and referring to guidelines available (GRADE Working Group, 2004; Higgins & Green, 2011). Full summary of risk of bias assessment and corresponding κ and α values are available in online Appendix G.

Quality of evidence for breastfeeding initiation was further downgraded to ‘low’ for *inconsistency of evidence* because the confidence interval of each individual effect estimate intercepted 1, meaning the likelihood of no significant effect could not be ruled out. FAT-PET-PEESE assessment of publication bias for breastfeeding initiation indicated no significant bias in funnel plot symmetry (*Egger’s test* [FAT], $p = .586$), and adjusted estimates indicated that small sample effects were unlikely to have biased the estimated effect size (see online Appendix H). Evidence was downgraded to ‘low’ for overall duration of any breastfeeding for *imprecision of evidence* because, as per criteria, findings failed to exclude important benefit or harm from intervention. No evidence of publication bias was detected in FAT-PET-PEESE analyses (see online Appendix H). However, evidence for duration of exclusive breastfeeding was downgraded to ‘low’ because publication bias was detected.

Asymmetry in the pattern of effect sizes distributed across the funnel plot suggested studies expected to appear in the bottom quadrant were not included in the analysis (see online Appendix H). FAT-PET-PEESE analyses (Hedges & Vevea, 1996; McShane, Bockenholt & Hansen, 2016; Stanley & Doucouliagos, 2012; Vevea & Hedges, 1996) were performed and revealed significant bias in funnel plot symmetry ($p = .021$). PET-PEESE estimates indicated that after accounting for small-sample effects, the impact of social-psychological interventions on rates of exclusive breastfeeding was non-significant (PET adjusted $OR = 0.85$, 95% CI [0.53, 1.36], $p = .469$; see online Appendix H).

Sub-Group Analyses: Intervention Characteristics

Timing of intervention delivery.

Initiation. Overall, interventions delivered in the postnatal period alone were found to significantly increase the likelihood of women initiating breastfeeding ($k = 3$, $OR = 2.48$, 95% CI [1.16, 5.31], $p = .019$; $I^2 = 0\%$, $p = .754$). Interventions delivered antenatally and postnatally did not significantly improve breastfeeding initiation ($k = 5$, $OR = 1.85$, 95% CI [0.78, 4.41], $p = .163$; $I^2 = 0\%$, $p = .922$). One intervention (Su & Ouyang, 2014 [17]) was delivered antenatally only and was not included in this comparative analysis. Full sub-group analysis for intervention timing are listed in online Appendix J.

Any Breastfeeding Overall. As reflected in the observed main effects analysis, social-psychological interventions did not significantly affect the likelihood of women performing any breastfeeding over the postpartum period regardless of whether the interventions were delivered across the antenatal and postnatal period ($k = 7$, $OR = 1.44$, 95% CI [0.84, 1.30], $p = .700$; $I^2 = 7.2\%$, $p = .373$) or postnatally only ($k = 8$, $OR = 0.81$, 95% CI [0.58, 1.14], $p = .231$; $I^2 = 64.8\%$, $p = .006$; see online Appendix J for full details). Su & Ouyang (2014) (17) were excluded from this sub-analysis because their study delivered an antenatal intervention only.

Exclusive Breastfeeding Overall. Overall, only standalone postnatal interventions significantly increased the likelihood of women exclusively breastfeeding across the postpartum period ($k = 8$, unadjusted OR (uOR) = 2.14, 95% CI [1.41, 3.26], $p < .001$; $I^2 = 71.4\%$, $p = .001$). Women receiving postnatal intervention were over twice as likely to exclusively breastfeed over the postnatal period. In contrast, combined antenatal and postnatal interventions did not significantly increase the likelihood of exclusive breastfeeding across the postnatal period ($k = 7$, $uOR = 1.43$, 95% CI [0.96, 2.14], $p = .077$; $I^2 = 61.8\%$, $p = .015$). The standalone antenatal intervention (17) was not included in this comparative analysis.

Maternal parity.

Initiation. Interventions were effective at promoting breastfeeding initiation among first-time mothers (primiparous women) only ($k = 5$, $OR = 2.48$, 95% CI [1.33, 4.64], $p = .004$; $I^2 = 0\%$, $p = .890$). First-time mothers receiving social-psychological interventions were almost two and a half times more likely to initiate breastfeeding than women in control groups. Interventions targeting both primiparous and multiparous women were not found to be effective at promoting breastfeeding initiation ($k = 4$, $OR = 1.82$, 95% CI [0.56, 5.96], $p = .324$; $I^2 = 0\%$, $p = .786$). Full sub-analysis details for effectiveness of interventions by maternal parity are provided in online Appendix K.

Any Breastfeeding Overall. The overall effect of social-psychological interventions on any breastfeeding was not significant (see Figure 4) and there were no discernible differences in observed effects for any breastfeeding between interventions targeting primiparous women alone ($k = 10$, $OR = 0.87$, 95% CI [0.67, 1.12], $p = .282$; $I^2 = 45.4\%$, $p = .058$) or multiparous and primiparous women combined ($k = 5$, $OR = 0.79$, 95% CI [0.48, 1.29], $p = .346$; $I^2 = 56.5\%$, $p = .056$).

Exclusive Breastfeeding Overall. Random effects meta-analysis of fifteen studies

reporting on exclusive breastfeeding and maternal parity identified only interventions targeting first-time mothers were effective at increasing the likelihood of exclusive breastfeeding across the postpartum period ($k = 10$, $uOR = 1.92$, 95% CI [1.39, 2.65], $p < .001$; $I^2 = 59.7\%$, $p = .008$). Interventions targeting all women (primiparous and multiparous) were not effective at increasing the likelihood of exclusive breastfeeding across the postpartum period ($k = 5$, $uOR = 1.94$, 95% CI [0.83, 4.55], $p = .127$; $I^2 = 79.1\%$, $p = .001$).

Use of behaviour change techniques.

Interventions were grouped according to whether they employed five or fewer, or six or more behaviour change techniques to assess whether the effectiveness of interventions changed depending on the increased use of techniques. Interventions were grouped according to the median split (median = 5, range = 1-11) of behaviour change techniques used (see Figure 2). Full sub-group analyses for use of behaviour change techniques are outlined in online Appendix L.

Initiation. Effect estimates were larger among interventions that used five or fewer behaviour change techniques ($k = 4$, $OR = 2.52$, 95% CI [0.89, 7.12], $p = .081$; $I^2 = 0\%$, $p = .782$), however only interventions that used six or more techniques ($k = 5$, $OR = 2.24$, 95% CI [1.17, 4.32], $p = .015$; $I^2 = 0\%$, $p = .864$) significantly increased the likelihood of women initiating breastfeeding (see online Appendix L for full analysis).

Any Breastfeeding Overall. As reflected in main effects analyses, using six or more ($k = 8$, $OR = 0.78$, 95% CI [0.51, 1.17], $p = .222$; $I^2 = 66.8\%$, $p = .004$) or five or less ($k = 8$, $OR = 1.01$, 95% CI [.84, 1.21], $p = .954$; $I^2 = 0\%$, $p = .481$) behaviour change techniques had no significant impact on rates of any breastfeeding across the postnatal period.

Exclusive Breastfeeding Overall. Overall, social-psychological interventions significantly increased the likelihood of exclusive breastfeeding across the postpartum period

regardless of the number of behaviour change techniques used. However, the impact of interventions was notably larger among those employing six or more behaviour change techniques ($k = 8$, $uOR = 3.23$, 95% CI [1.79, 5.82], $p < .000$; $I^2 = 79.7\%$, $p < .001$) than interventions using five or fewer techniques ($k = 8$, $uOR = 1.28$, 95% CI [1.06, 1.54], $p = .010$; $I^2 = 0\%$, $p = .675$).

Discussion

Summary of Evidence

This review aimed to investigate the effectiveness of social-psychological interventions in promoting breastfeeding behaviours (initiation, duration and exclusivity) among women delivering healthy, term singleton infants. Twenty studies included in the review and meta-analyses employed a variety of behavioural interventions focused on education, support and self-efficacy using behaviour change techniques as defined by Abraham and Michie (2008) and individual study authors. Random-effects meta-analyses demonstrated such social-psychological interventions were effective at increasing the number of women who started breastfeeding (at all or exclusively) during the first week postpartum. However, interventions were not effective at improving rates of any (i.e. non-exclusive) breastfeeding throughout the postpartum period. Meta-analytic results initially suggested interventions were effective at supporting women to exclusively breastfeed up to six months postpartum, but after adjusting for publication bias, effect estimates were non-significant. There was limited evidence for the impact of interventions on the perceived or actual support women received. Evidence available through qualitative synthesis suggested social-psychological interventions aimed at women and their partners may increase the tangible help and support partners are able to offer women. Quality of the evidence reviewed for each outcome was low, and risk of bias was rated predominantly as unclear and high on all domains, particularly performance, detection and other bias. In analyses, moderate to high

statistical heterogeneity (Higgins & Green, 2011) was present throughout, most likely as a result of wide variability in the content, delivery and healthcare settings of the interventions and usual care delivered. Additionally, quality of reporting intervention methodology and outcome measurement was poor and unreliable for many studies included. Following the GRADE approach (GRADE Working Group, 2004), the true impact of social-psychological behaviour change interventions on breastfeeding behaviour may vary considerably to the effects observed here.

Discussion of findings

Interventions included in analyses show efforts to promote breastfeeding behaviour are being undertaken internationally using comparable content and implementation approaches. Included interventions used educational, support, and self-efficacy focused behaviour change techniques (Abraham & Michie, 2008) to promote breastfeeding behaviours via behaviour change interventions. Given the broad eligibility criteria for this review, it is of interest that no interventions used any formal psychological therapies such as cognitive-behavioural therapies or mindfulness. Emerging anecdotal evidence indicated that women's perceptions and understanding of milk supply (for example) contributes to early formula supplementation (Brown, 2016; McAndrew et al., 2012). Including active components of interventions that challenge unhelpful belief patterns, increase self-efficacy, and/or support women to self-identify problematic versus non-problematic feeding patterns (e.g. cluster feeding) could be effective (Chapman et al., 2013).

Meta-analytic results found social-psychological interventions increased rates of initiation. The effect of interventions reviewed here appear comparable to peer-support programmes at increasing the number of women who initiate breastfeeding (Risk Ratio [RR] = 1.23, 95% CI [0.96, 1.58], RR = 4.02, 95% CI [2.63, 6.14]), but more effective than antenatal education interventions (Dyson et al., 2005; Fairbank et al., 2000). Systematic

review evidence indicated standalone antenatal education interventions are not effective (average $RR = 1.01$, 95% CI [0.94, 1.09]) at supporting breastfeeding uptake (Fairbank et al., 2000; Lumbiganon et al., 2016). However, antenatal education interventions providing repeated, proactive, culturally and individually tailored information (from healthcare professionals or peer-supporters) provided effective support for increasing initiation rates with effect estimates ranging from, $RR = 1.22$, 95% CI [1.06, 1.40], $p = .005$ (Balogun et al., 2016), to, $RR = 1.92$, 95% CI [1.44, 2.56] (Dyson et al., 2005; Fairbank et al., 2000). Social-psychological interventions reviewed each provided some form of tailored feedback, information (Ahmed et al., 2016; Fu et al., 2014; Hannula et al., 2014), and/or breastfeeding counselling (Kupratakul et al., 2010; Liu et al., 2017; Rosuzeita et al., 2018; Zhu et al., 2017), highlighting potential mechanisms of action in their effectiveness at supporting women breastfeed within the first week postpartum. Sub-analyses suggested standalone postnatal interventions delivered to first-time mothers were particularly effective at improving initiation rates which, although the evidence was weak, reflects current public health guidelines (NICE, 2015; WHO, 2013).

Although meta-analytic results indicated rates of breastfeeding initiation were improved with intervention, caution is needed when interpreting these findings for practice as true effects may be notably smaller than those observed here. For example, while effect estimates appeared large ($OR = 2.32$, 95% CI [1.33, 4.03]), the overall the number of women reported as initiating breastfeeding was already high: between 85 - 100% among control arms (Ahmed et al., 2016; Fu et al., 2014; Hannula et al., 2014; Rasmussen et al., 2011). In most cases only three or four more women started breastfeeding as a result of intervention (Liu et al., 2017; Rosuzeita et al., 2018; Su & Ouyang, 2016), which raises questions about the pragmatic efficacy of implementing such interventions as part of routine practice. In addition, breastfeeding initiation rates were likely confounded by poor measurement. For example,

Ahmed et al. (2016) claim all mothers initiated breastfeeding, yet over half of babies in the sample received formula milk as their first feed. Initiation is commonly defined as “putting baby to the breast in the first 48 hours after birth” (National Health Service [NHS] England, 2014), and studies frequently sum rates of partial and exclusive breastfeeding (Ahmed et al., 2016; Fu et al., 2014; Hannula et al., 2014; Kupratakul et al., 2010; Rasmussen et al., 2011; Rosuzeita et al., 2018; Su & Ouyang, 2016, Zhu et al., 2017). Together, these methods of measurement overinflate rates of successful initiation, especially when the physiological processes of lactation are considered. Overall, the proportion of women who intend to breastfeed (Lutsiv et al., 2013; McAndrew et al., 2012) and who attempt breastfeeding at least once are already high (McAndrew et al., 2012; Victora et al., 2016). However, the intention-behavioural gap widens dramatically throughout the first few weeks of the postnatal period where rates of any and exclusive breastfeeding drop exponentially across all settings (Victora et al., 2016).

Overall, social-psychological interventions did not increase rates of any breastfeeding across the postpartum period. In this context, *any breastfeeding* is a categorical measurement which refers to mix-feeding formula milk and breastmilk in unquantifiable amounts. As an outcome, women who predominantly formula-feed and women who predominantly breastfeed are assumed to perform the same behaviour. The category does not provide a meaningful way of interpreting the direction of effects observed in interventions and lacks sensitivity to detect meaningful changes in the behaviour gradient of infant feeding (Davie, Bick & Chilcot, 2018). Future investigations may consider using scales of proportionate infant feeding (including the proportion of infants’ diet that consists of breastmilk, frequency of feeds per day, and absolute duration of breastfeeding) to enable changes in feeding patterns over time and effectiveness of interventions to be observed more accurately. Including more nuanced outcomes of infant feeding practices (such as women’s experiences

and practices of expressing breastmilk alongside direct breastfeeds) may help identify effective interventions that promote best practice in infant feeding patterns. At present, *any breastfeeding* continues to be used as an outcome across infant feeding research, and reviews of support-focused interventions have identified significant improvements across the postnatal period (discussed in context below).

Meta-analyses for rates of exclusive breastfeeding across the postpartum period initially suggested social-psychological interventions were effective. Unadjusted effect estimates were comparatively smaller at one and four months postpartum i.e. timepoints where women are likely to offer supplemental formula feeds or begin to introduce complimentary family foods respectively (McAndrew et al., 2012; Victora et al., 2016). These timepoints may be useful as priority targets for future interventions to provide additional support or tailored intervention sessions to support the maintenance of exclusive breastfeeding through the postpartum period. Sub-analyses of unadjusted effect estimates suggested interventions were more effective if they included six or more behaviour change techniques. Whether these effects were significantly larger statistically using adjusted effect estimates is unknown as formal meta-regression was not possible. Should these effects be true, the resources and funding needed to implement efficient behaviour change interventions would be minimal relative to the benefits incurred by increased breastfeeding (Mallender et al., 2018; Stuebe et al., 2017).

After controlling for the impact of publication bias in analyses of exclusive breastfeeding, adjusted effect estimates were found to be non-significant; social-psychological interventions were not effective at improving any or exclusive breastfeeding at any timepoint up to six months postpartum. Unadjusted effect estimates for any or exclusive breastfeeding did not appear to trend linearly over time, or coincide with the duration of active intervention in the postnatal period; the majority of interventions (1, 2, 3, 4, 7, 11, 12,

13, 15, 16, 17, 19, 20) ceased at or before six weeks postpartum. Overall, evidence available suggested the content, format or delivery method of social-psychological interventions were either inadequate or inappropriate at supporting women to maintain breastfeeding across the postpartum period. Recent systematic review evidence indicated any form of additional breastfeeding support significantly reduces the likelihood of women stopping breastfeeding before the recommended six months, average $RR = 0.91$, 95% CI [.88, .95], $p < .001$ (Renfrew et al., 2012). Evidence available for the effectiveness of telephone-based support is encouraging, but lacks impact and consistency to suggest implementing such interventions as part of routine postnatal care (Lavender, Richens, Milan, Smyth & Dowswell, 2013). Effective support was characterised as predictable, individualised support delivered during the antenatal and postnatal periods with access to face-to-face contact in settings where uptake rates were already high (McFadden et al., 2017; Renfrew et al., 2012). High breastfeeding initiation rates observed in analyses may reflect pressure women feel to conform to breastfeeding behaviour, particularly in clinical settings where advice and support is available. However, as availability and consistency of appropriate support diminish across the postpartum period, breastfeeding success rates suffer. Future efforts to promote breastfeeding rates should consider early and prolonged postnatal support and intervention to ensure exclusive breastfeeding is well-established and, crucially, continued throughout the postnatal period.

Evidence for the effectiveness of interventions at improving support (as a process of an intervention or as an outcome) could not be synthesized due to insufficient data. Evidence available within the review suggested women in intervention groups reported receiving more tangible support from their partners (Abbass-Dick et al., 2015; Su & Ouyang, 2016) but it is unclear to what extent this translated into helping to improve or support breastfeeding uptake or continuation. The wider evidence-base indicates proactive postnatal support helps to

improve rates of exclusive breastfeeding across time (Renfrew et al., 2012). Peer-support interventions, for example, were more effective at supporting any breastfeeding when delivered with greater intensity across the postpartum period (Jolly et al., 2012). As with exclusive breastfeeding, the resources required to increase such support would be outweighed by the benefits, and would be significant in improving the wider, long-term health of women and their infants (Horta et al., 2007; Victora et al., 2016; WHO, 2003). However, whether women find the support offered helpful or satisfactory is not routinely measured. Studies of breastfeeding promotion could consider acceptability of support offered as quantified outcome measurements to inform best practice moving forward.

As highlighted in UK NICE (2015) guidelines, women should be supported to breastfeed by services (and interventions) that are evidence-based. The majority of interventions included in this review did not theorise or explicitly outline how the interventions were intended to work. Only three studies (Liu et al., 2017; Wu et al., 2014; Zhu et al., 2017) referred to theory to inform the active components of intervention, and relied on self-efficacy theory (Bandura, 1977; Dennis, 2002) and the theory of planned behaviour (Ajzen, 1991). Despite proposing conceptual frameworks for social-psychological mechanisms of action, limitations in methodology, design and reporting prevent the identification of any underlying causal mechanisms of effective intervention, and inhibit formal process evaluation (Craig et al., 2008). Guidance from the Medical Research Council UK (Craig et al., 2013) highlighted that understanding active ingredients of interventions is crucial to establishing an evidence-based that can be implemented successfully in practice (Moore et al., 2015). Mechanisms of action among successful breastfeeding interventions remain unknown, and education and low-impact support interventions alone are insufficient in promoting long term breastfeeding (any or exclusively) behaviour (Fairbank et al., 2000; Haroon et al., 2013; Lumbiganon et al., 2016; Renfrew et al., 2012). Principles of process

evaluation for complex interventions should be considered and implemented in future behaviour change intervention aiming to promote breastfeeding behaviour if there is to be any real improvement to public health.

Limitations

Results of this meta-analysis and interpretations of findings were limited by the quality of evidence included in analyses. The risk of bias both within and across all studies was consistently high and unclear across most domains (151 / 200). This was predominately because the interventions investigated here were social-psychological in nature, and because there are notable weaknesses in the methodological approaches used throughout infant feeding research (i.e. self-report outcomes and measurement error). This was reflected in the moderate and high statistical heterogeneity observed throughout. Sub-analyses for the impact of risk of bias were limited further, as the threshold for lower risk of bias still represented a high risk of bias overall. The outcome of the impact of risk of bias on overall effects for any breastfeeding duration and exclusive breastfeeding duration was therefore as would be expected. There was also evidence of publication bias when observing the outcome of exclusive breastfeeding, although this was accounted for in adjusted analyses and interpretations.

Meta-analytic results for the impact of interventions on breastfeeding initiation rates were limited by the data reviewed. The number of studies included and the sample sizes within were small which, when pooled for an overall effect estimate, increased the likelihood of a type I error when using traditional DerSimonian and Laird (1986) random-effects meta-analysis (Guolo & Varin, 2017). Effect estimates calculated using meta-regression analyses to explore the impact of study quality rating and study type are limited in power and precision due to the small number of studies included, the high heterogeneity and high risk of bias ratings across studies, and low quality of evidence ratings across all main outcomes.

Despite employing broad eligibility criteria to include interventions, the review identified a limited variation of interventions currently employed to promote breastfeeding behaviour, and analyses were therefore restricted to the behaviour change techniques explored. Two studies (Agrasada, Gustafsson, Kylberg & Ewald, 2005; Chapman, Damio, Young & Pérez-Escamilla, 2004) comparable in content and delivery to the interventions reviewed here were excluded from the review during full-text screening. International guidelines for infant feeding care and support were updated in the WHO (2003) publication and introduced into practice and local policies thereafter. Excluding women recruited prior to 2004 aimed to reduce the contextual variation in feeding policies, care practices and healthcare recommendations available at the time interventions were delivered. Considering findings of eligible intervention studies published prior to 2004 may contribute knowledge about the effectiveness of social-psychological interventions for breastfeeding and complement conclusions available here, but need to be considered in the context of infant feeding guidelines available to date.

Evidence for biological and physiological barriers to breastfeeding have not been considered. Women who are obese, and/or diagnosed with diabetes or hypertension, or who experience intrapartum intervention (e.g. caesarean section) are less likely to establish and maintain breastfeeding (Finkelstein et al., 2013; Leeners, Rath, Kuse & Neumaier-Wagner, 2005; Poston et al., 2016) with evidence for causal physiological pathways available e.g. delayed onset lactogenesis (De Bortoli & Amir, 2016; Nommsen-Rivers, Chantry, Pearson, Cohen & Dewey, 2010). The extent to which reduced uptake and duration of breastfeeding among women with such conditions and experiences are due to physiological mechanisms rather than inappropriate postnatal care and support remains unknown. Attention to maternal morbidities with potential to impact breastfeeding success should therefore be considered when developing interventions and assessing acceptability, feasibility and effectiveness, to

identify successful tailored support practices.

Furthermore, studies included often did not report interventions with adequate or sufficient detail, and did not consider aspects of design or analyses that would identify causal pathways of effective intervention. Analyses of absolute breastfeeding duration (exclusive or non-exclusive) could not be performed due to insufficient data in the literature reviewed. Evidence for the effectiveness of interventions at improving the absolute duration of breastfeeding (e.g. days or weeks) would contribute meaningfully to the current evidence base, and efforts to record and report this should be considered in future investigations.

Conclusions

Interventions targeting social-psychological constructs improved rates of breastfeeding initiation but were not effective at supporting maintenance of any or exclusive breastfeeding. Initiation rates in many settings were noted to be high already, so efforts should focus on early, consistent, and prolonged support across the postpartum period to ensure breastfeeding is well-established and sustained. Future interventions need to be theory and evidence-based and informed by wider behaviour change research. Modifications to the method of measurement in infant feeding should be considered, particularly to observe meaningful improvements in breastfeeding across the infant feeding spectrum.

Women who receive prolonged and more intense postnatal support and guidance from family, friends and/or healthcare professionals (including peer supporters) are more likely to continue to exclusively breastfeed (Brown, 2017; Cochrane Collaboration, 2017; Grant et al., 2017; Renfrew et al., 2012; Sinha et al., 2015), but formal process evaluation for best-practice support is yet to be carried out. Interventions aiming to promote and support breastfeeding should assimilate behaviour change research and process evaluation guidelines for public health research, to enable key mechanisms of action responsible for inducing change to be identified and form a high-quality evidence-base to be implemented in practice.

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Table 1
Eligibility PICOS Criteria for Inclusion and Exclusion of Data

	Inclusion Criteria	Exclusion Criteria
Population	Women age 18 years or older; delivering single baby at $\geq 37^{+0}$ weeks gestation; recruited \geq January 2004; interventions aimed at women and/or their significant others.	Sample with women < 18 years old; infants born before 37^{+0} weeks gestation and/or require admission to a Neonatal Unit.
Intervention	Social-psychological interventions aimed at improving breastfeeding outcomes (initiation; duration; exclusivity): cognitive behavioural therapies, action and commitment therapy, psychoanalytic, psychodynamic, systemic, mindfulness and/or art therapies; use of behaviour change techniques* ; start during antenatal period or postnatal period up to 6 months post-delivery.	Pharmacological or medical-based interventions; public health and/or policy-based interventions (e.g. baby friendly initiative); targeting maternal lactation factors; intrapartum interventions.
Control/Comparator	Control groups receiving no intervention treatment, care-as-usual as defined by study authors, or an alternative social-psychological, medical or pharmacological intervention	Comparators receiving intrapartum interventions; comparisons to previous infant feeding behaviours (e.g. previous parity).
Outcome(s)	Breastfeeding initiation (rate or %); Duration (N or % of women performing any or exclusive breastfeeding over time and/or absolute duration (days/weeks); Exclusivity (N or % of women feeding exclusively over time); Self-report perceived or actual support among women and/or significant others	Maternal lactation factors (e.g. timing of lactogenesis onset, assessment of milk quality or quantity)
Study Design	Randomised or non-randomised controlled trial; quasi-experimental studies; any country of origin; total $N \geq 20$	Meta-analysis; systematic review; narrative review; case study; qualitative study; grey literature; policy documents or guidelines; non-peer reviewed publications; opinion pieces; commentaries; editorials; conference/poster abstracts; theses.

Note. *As defined by Abraham & Michie (2008) taxonomy of behaviour change techniques, as well as additional techniques not included in the taxonomy but explicitly described by study authors. Therefore, eligible behaviour change techniques include (but are not limited to): providing general information about health behaviour; providing information on benefits/consequences of behaviour; provide information about others' approval; prompt intention formation; prompt barrier identification (e.g. problem solving), provide general encouragement; set graded tasks; provide instruction; model/demonstrate behaviour; prompt specific goal setting; prompt review of behaviour goals; prompt self-monitoring of behaviour; provide feedback on performance; provide contingent rewards; teach to use prompts/cues; agree a behavioural contract; prompt practice/guided practice; use follow up prompts; provide opportunities for social comparison; plan/prompt social support/change; prompt identification

as role model; prompt self-talk; relapse prevention; stress management; motivational interviewing and/or time management.

Table 2
Study Characteristics Table

#	Study Details		Population		Maternal Age (yrs) (\bar{x} (SD))	Sample Size ^a N (I:C)	Comparison Control characteristics (As defined and described by authors)	Results							
	Author (Year)	Country	Design	Demographic				Initiation % (n)	Duration (Any) % (n) ^{months}		Duration (Exclusive) % (n) ^{months}				
							(I)	(C)	(I)	(C)	(I)	(C)			
1	Abbass-Dick, Nelson, Watson and Dennis (2015).	Toronto, Canada	RCT	PP & their male partners	(I) 30.4 (3.7) (C) 30.7 (3.8)	214 (107:107)	"Usual Care"; Standard in-hospital breastfeeding support and assistance as needed. Community breastfeeding support available.	NR	NR	26.0 (27) ^{6wks} 28.9 (30) ³	31.4 (32) ^{6wks} 27.6 (29) ³	72.1 (75) ^{6wks} 67.3 (70) ³	60.8 (62) ^{6wks} 60.0 (63) ³		
2	Ahmed, Szucs, Zhang and King (2016).	Midwestern U.S.A	RCT	PP & MP	(I) 29.9 (6.5) (C) 29.2 (6.3)	106 (49:57)	"Usual Care"; Standard in-hospital breastfeeding support and education; 1 phone call follow-up at 1-week PN; Community breastfeeding support available; Contact with LC available and encouraged if needed	100 (49)	100 (57)	30.6 (15) ¹ 24.5 (12) ² 24.5 (12) ³	54.4 (31) ¹ 59.6 (34) ² 47.4 (27) ³	63.3 (31) ¹ 63.3 (31) ² 55.1 (27) ³	40.4 (23) ¹ 19.3 (11) ² 19.3 (11) ³		
3	Bunik et al. (2010)	Colorado, U.S.A	RCT	PP	(I): 21.9 (med) (C): 22 (med)	335 (155:180)	"Usual Care" - Standard in-hospital care; Formula provided in discharge bags; PN HV at 3-5 days and 2weeks at home.	NR	NR	74 (88) ¹ 49 (58) ³ 28 (33) ⁶	74 (96) ¹ 54 (70) ³ 37 (48) ⁶	N/A No women exclusively women			
4	Fu et al. (2014)*	Hong Kong (S.A.R)	C-RCT	PP	I ^H 31.0 (4.6) I ^T 30.3 (4.3) (C) 30.2 (4.5)	724 (191 ^H :269 ^T :264)	"Usual Postpartum Care" - PN breastfeeding education from MW or LC; 1-2-1 support session available if needed; 1 x PN follow-up appointment at clinic; PSG information provided.	H ¹⁰⁰ (190) T ^{92.2} (259)	98.5 (256)	H ⁵⁰ (95) ¹ H ^{35.8} (68) ² H ^{25.3} (48) ³	T ^{47.9} (125) T ^{37.2} (97) ² T ^{29.9} (78) ³	50.4 (131) ¹ 33.5 (87) ² 25 (65) ³	H ^{21.6} (41) ¹ H ^{17.4} (33) ² H ^{17.9} (34) ³	T ^{28.4} (74) T ^{21.5} (56) ² T ^{17.6} (46) ³	16.9 (44) ¹ 15.4 (40) ² 14.2 (37) ³
5	Hannula, Kaunonen and Puukka (2014)	Helsinki, Finland	QE	PP & MP	(I) 30.7 (4.1) (C) 30.9 (4.6)	705 (431:274)	"Usual Care" - 1-2-1 information from MV/N; Breastfeeding education video available; Public childbirth and parenting education group available.	99.5 (423)	99.3 (271)	NR		NR			
6	Jiang et al. (2014)	Shanghai, China	QE	PP	NR	582 (281:301)	"Usual Care" - Routine perinatal care and PN check-ups in first year	NR	NR	20.2 (52) ¹²	19.2 (50) ¹²	46.4 (123) ⁴ 15.1 (40) ⁶	39.9 (114) ⁴ 6.3 (18) ⁶		
7	Kang, Choi and Ryu (2008).	Chungju, Republic of Korea	QE	PP & MP	NR	60 (30:30)	"Usual Care" - Routine PN breastfeeding information.	NR	NR	NR	NR	76.6 (23) ¹ 66.7 (20) ² 60 (18) ³	46.7 (14) ¹ 26.7 (8) ² 20 (6) ³		
8	Khresheh, Jalamdeh and Barclay (2011)	Karak, Jordan	RCT	PP	NR	140 (72:68)	"Usual Care" - Routine PN care	NR	NR	NR	NR	39 (17) ⁶	27 (12) ⁶		
9	Kupratakul, Taneepanichskul, Voramongkol & Phupong (2010)	Bangkok, Thailand	RCT	PP & MP	(I) 27.8 (6.5) (C) 28.8 (6.3)	80 (40:40)	"Usual Care" - Standard breastfeeding education x2(minimum) at routine AN appointments: breast and nipple check, advice on benefits of breastfeeding, importance of exclusive breastfeeding, information on latching and positioning, early initiation, disadvantages of formula feeding, and breastfeeding and return to work; Breastfeeding information leaflet provided.	100 (40)	89.5 (34)	22.5 (15) ¹ 37.5 (15) ² 50 (20) ³ 52.5 (21) ⁴ 55 (22) ⁵ 55 (22) ⁶	36.8 (14) ¹ 26.3 (10) ² 31.6 (12) ³ 39.5 (15) ⁴ 31.6 (12) ⁵ 21.1 (8) ⁶	77.5 (31) ¹ 62.5 (25) ² 50 (2) ³ 35 (14) ⁴ 25 (10) ⁵ 20 (8) ⁶	52.6 (20) ¹ 36.8 (14) ² 34.2 (13) ³ 7.9 (3) ⁴ 2.6 (1) ⁵ 0 (0) ⁶		
10	Labarère et al. (2011)	France	QE	PP & MP	(I) 30 (med) (27-33) (C) 30 (med) (27-33)	549 (272:277)	"Usual Care" - 1hour routine AN education and childbirth classes; Telephone support number provided.	NR	NR	87.9 (211) ¹	88.6 (209) ¹	NR	NR		

11	Li, Cong, Li & Li (2018)	Yantai, China	QE	PP	(I) 28.0 (3.7) (C) 27.3 (3.8)	100 (50:50)	"Usual Care" - Routine obstetric care	NR	NR	34 (17) ^{6wks}	58 (29) ^{6wks}	62 (31) ^{6wks}	38 (19) ^{6wks}
12	Liu, Zhu, Yang, Wu & Ye (2017)	Xiamen, China	QE	PP	(I) 67.7% 25-30yrs (C) 75.4% 25-30yrs	146 (71:75)	"Usual Care" - Choice of physician, antenatal visits and antenatal classes.	4.6 (3) ^{EBF}	2.3 (2) ^{EBF}	NR	NR	27.7 (18) ¹ 24.6 (16) ²	3.1 (2) ¹ 1.5 (1) ²
13	Maycock et al. (2013)	Perth, Australia	RCT	Mother Father couples	(I) 27 (med) (18-44) (C): 27 (med) (18-42)	699 couples M: 656 (358: 298) F: 667 (365: 302)	"Usual Care" - Weekly AN classes; Routine in-hospital and PN care	NR	NR	35.1 (124) ^{6wks}	30.5 (91) ^{6wks}	46.5 (164) ^{6wks}	44.6 (133) ^{6wks}
14	Meedya, Fahy, Yoxall & Parratt. (2014)	Sydney, Australia	QE	PP	26.6 (2.9) ^{Total}	366 (172:194)	"Usual Care"- AN breastfeeding education including importance of early skin-to-skin and early initiation; PN referral to MW/LC for any breastfeeding problems; PN breastfeeding education by MW/LC.	NR	NR	36.1 (52) ¹ 49.6 (55) ⁴ 80.9 (76) ⁶	50.4 (60) ¹ 55.6 (40) ⁴ 93.4 (57) ⁶	63.9 (92) ¹ 50.5 (56) ⁴ 19.1 (18) ⁶	49.6 (59) ¹ 44.4 (32) ⁴ 6.6 (4) ⁶
15	Rasmussen, Zelek, Altabet and Kjolhede (2011)	New York, U.S.A	RCT	PP & MP, obese women	(I) 27.3 (8.6) (C) 26.6 (9.1)	40 (20:20)	"Usual Care" - Standard AN (phone call from LC) and PN (room-in with infant) care.	100 (19)	100 (20)	68 (13) ¹ 32 (6) ³	90 (18) ¹ 60 (12) ³	42 (8) ¹	67 (12) ¹
16	Rosuzeita, Rabiah, Rohani, & Shukri (2018)	Kelantan, Malaysia	QE	PP	(I) 26.7 (3.8) (C) 24.6 (4.10)	96 (48:48)	"Usual Care" - discuss breastfeeding at immunisation checks, communication with LC, leaflets given during AN/PN follow-up, breastfeeding advice at any time from any health care workers, the media, peer counsellors, family or friends".	93.8 (45)	89.1 (41)	NR	NR	53.2 (25) ^{6wks} 54.3 (25) ⁴ 27.3 (12) ⁶	42.2 (19) ^{6wks} 2.5 (13) ⁴ 16.7 (7) ⁶
17	Su & Ouyang (2016)	Wu Han, China	QE	PP & their male partner s	(I) 28 (4.22) (C) 29 (2.88)	72 couples (36:36)	Only mothers to attend AN education sessions (i.e. without partner) which included benefits of breastfeeding, risk of formula feeding/ incorrect feeding, stomach capacity of babies, initiating breastfeeding, latching and positioning, common breastfeeding problems.	97.2 (35)	86.1 (31)	33.3 (12) ¹ 34.3 (12) ⁴ 40 (14) ⁶	14.7 (5) ¹ 44.1 (15) ⁴ 38.2 (13) ⁶	61.1 (22) ¹ 51.4 (18) ⁴ 40 (14) ⁶	61.8 (21) ¹ 26.4 (9) ⁴ 17.6 (6) ⁶
18	Tahir & Al-Sadat (2013)	Kuala Lumpur, Malaysia	RCT	PP& MP	(I) 28.5 (4.29) (C) 23.7 (4.43)	357 (179:178)	"Usual Care"- AN and PN breastfeeding education leaflet; PN discussion breastfeeding at vaccination appointment; opportunity to discuss with LC or HCP at routine HV.	NR	NR	11.5 (19) ¹ 48.1 (78) ⁴ 78.2 (125) ⁶	17.9 (29) ¹ 48.4 (77) ⁴ 74.1 (117) ⁶	84.3 (140) ¹ 42 (68) ⁴ 12.5 (20) ⁶	74.7 (121) ¹ 39 (62) ⁴ 12 (19) ⁶
19	Wu et al. (2014)	Wu Han, China	QE	PP	(I) 28.4 (2.76) (C) 27.8 (2.98)	74 (37:37)	"Usual Care"- Standard in-hospital care; PN follow-up by N	NR	NR	90.9 (30) ¹ 87.9 (NR) ²	76.5 (26) ¹ 67.6 (NR) ²	NR	NR
20	Zhu, Zhang, Ling & Wan (2017)	Shanghai, CHINA	QE	PP & SO	(I) 29.6 (3.39) (C)29.02 (3.76)	285 (157:128)	"Usual Care" -1 antenatal breastfeeding class, rooming-in, breastfeeding initiation encouraged within 30mins of delivery, lactation consultant support, and information leaflet on breastfeeding presented in the ward during their stay.	94.9 (149)	88.3 (113)	35.0 (55) ^{6wks}	49.2 (63) ^{6wks}	57.3 (90) ^{6wks}	28.1 (36) ^{6wks}

Note. ^aSample size was n recruited and received intervention; RCT = Randomised Controlled Trial; C-RCT = Cluster Randomised Controlled Trial; QE = Quasi-Experimental Controlled Trial; PP = Primiparous women; MP = Multiparous women; SO = Significant Other; AN = Antenatal; PN = Postnatal; LC = Lactation Consultant; HV = Health Visits; MW = Midwife; N = Nurse; HCP = Health Care Practitioner/Provider; PSG = Peer Support Group; (I) = Intervention Group; (C) = Control Group; Med = Median; M = males; F = females; *For Fu et al. I^H = Intervention Arm 1 (In-Hospital Support arm) and I^T = Intervention Arm 2 (Telephone Support arm); NR = Not Reported; ^{EBF} = Data only available for Exclusive breastfeeding, not exclusive and any breastfeeding as in all other data for initiation.

Table 3

Study Intervention Characteristics Table

	Structure and Timing of Intervention Delivery	Content	Mode of Delivery
Abb ass- Dic k et al. (201 5).	PN 15 minute face-to-face (1-2-1) discussion with LC in-hospital (within 48 hours PN)	How breastfeeding works; how fathers can help mothers who are breastfeeding; how and where to access breastfeeding support in the community	F2F (1-2-1); Video; Website; Booklet
	11 minute educational video	Information on co-parenting; breastfeeding; demonstrate couples working together towards breastfeeding goals	
	Co-parenting activity booklet	Information, skills and elements of co-parenting	
	Breastfeeding booklet	Educational information on breastfeeding to take home	
	Access to website with informational resources	Information on breastfeeding; co-parenting and 'additional helpful information' resources	
	Email (1 week & 3 weeks PN)	Assistance and reminder to work through co-parenting activity booklet and information resources	
	Telephone call (2 weeks PN)	Follow-up for questions and concerns about materials provided.	
Ah med et al. (201 6).	PN Interactive Web Based Breastfeeding monitoring system (30 days use) LC or RA introduced women to application prior to hospital discharge.	Mothers entered information on breastfeeding routine, wet and dirty nappies and any breastfeeding problems into interactive system monitored by LC or RA. Application provides tailored feedback messages on breastfeeding behaviour based on information entered; sends positive messages to mothers reporting optimal breastfeeding behaviours. Information available on system at all times: Feeding cues; milk supply; jaundice; latching; pumping; return to work/school.	Website

Bunik et al. (2010)	PN	Telephone Calls from Nurse every day from day of discharge to 2 weeks PN	Importance of colostrum and good latch; engorgement; assessing milk supply with baby 'output'; nipple pain; thrush; duration of breastfeeding; crying; modesty while breastfeeding; family support; ' <i>La cuarentena</i> '; support groups; maternal illness and breastfeeding; post-partum depression and baby blues; medications; diet; pumping; return to work; time away from baby; growth spurts and cluster feeding.	TP (1-2-1)
Fu et al. (2014) [#]	PN	(H) 1-2-1, face-to-face sessions with MW/LC: x 2 within 24 hrs of delivery; x 1 within 24 hours before discharge. Each session 30 - 45 minutes	Discussed and demonstrate benefits of exclusive breastfeeding; lactation process; breastfeeding problems; guidance and instructions for latching and positioning; feeding cues; pumping and hand expressing. MW/ LC observed and guided a feed each session.	F2F (1-2-1)
		(T) One telephone call within 72 hours discharge from MW / LC.	Information and discussion on breastfeeding general knowledge; infant feeding cues and feeding patterns; mother and infant health; latching and positioning; milk supply; infant weight gain; breastfeeding problems.	TP (1-2-1)
		Weekly telephone call up to 4 weeks PN or until breastfeeding cessation. Delivered by MW / LC. Each session 20 – 30 minutes.	Feeding in public; return to work; pumping and expressing; where to seek further professional support and medical consultation; verbal encouragement of exclusive breastfeeding at each session.	

Han nula et al. (2014)	AN & PN	Web-page access (AN) N and MW staff training via lectures and workshops to support women to breastfeed Access to an outpatient breastfeeding support clinic if needed.	Information, pictures, videos and educational games under six themes: Mum; Dad; Baby; Life as a family; What to do when you need help; Support. Empowering parents; importance of partners' presence and role; importance of first breastfeed and skin-to-skin; how to assess breastfeeding and identify need for tailored support using the LATCH ¹ ;	Website; F2F (1-2-1)
Jiang et al. (2014)	AN & PN	Weekly SMS Text messages (180-210 characters long). Each 2 month period has a 'theme' of time appropriate information: Third trimester, 0-2 months, 2-4 months, 4-6 months, >6 months.	Third trimester: preparing for breastfeeding; breastfeeding instructions for vaginal or caesarean delivery; how to avoid infant reflux 0-2 months PN: Problems with initiating breastfeeding and how to respond; breastfeeding after caesarean delivery. 2-4 months PN: Encouraging exclusive breastfeeding; advice against complimentary feeding; return to work and breastfeeding 4-6 months PN: How to return to work and breastfeed; support for continuing EBF to 6 months; infant weaning at 6 months ≥6 months: Encourage continued breastfeeding; how to introduce family foods	SMS

Kan g, et al. (200 8).	PN	<p>Four 60 minute workshop-style sessions. Face-to-face, groups (up to 10 women in each); delivered by RA (also LC).</p> <p>Session 1: 3 days after entering PN care; Session 2, 3 & 4 over subsequent 5 days.</p> <p>Empowerment programme 4 x 60 minute workshop style sessions over 5 days in groups of up to 10 women.</p>	<p>Content based on conceptual framework of Freire (1983)² empowerment education model.</p> <p>Session 1: Personal Empowerment; Reasons for choosing breastfeeding; information on breastmilk; confirming choice to breastfeed; affirming choice with “shouting out loud the breastfeeding self-efficacy improvement slogan”</p> <p>Session 2: Personal Empowerment; “shouting out loud the breastfeeding self-efficacy improvement slogan”; advantages of breastfeeding; problems encountered with breastfeeding; breastmilk knowledge sharing; confirm 10 steps to successful breastfeeding; correct breastfeeding method; introduce breastfeeding diary; breastfeeding problem solving; breast care.</p> <p>Session 3: Group Empowerment; Family and friend support; information on successful breastfeeding; discuss breastfeeding difficulties; share breastfeeding experiences; provide breastfeeding diary; discuss breastfeeding problem solving.</p> <p>Session 4: Social Policy Empowerment; Discuss breastfeeding policy; watch breastfeeding video; discuss emotions during breastfeeding; present breastfeeding diary; summary of workshops.</p>	F2F (group); Booklet; Journal; Videos
Khr eshe h et al. (201 1)	PN	<p>One 1 hour breastfeeding education session within 2 hours PN (face-to-face (1-2-1)); provide breastfeeding information leaflet.</p> <p>Telephone call (2 months PN)</p> <p>Telephone call (4 months PN)</p>	<p>Benefits of breastfeeding; importance of exclusive breastfeeding; information on latching and positioning; overview of breastfeeding problems; information on infant growth and development.</p> <p>Provide breastfeeding information and support; monitor breastfeeding progress and identify problems.</p>	F2F (1- 2-1); TP (1-2-1)

Kup rata & kul et al. (201 0)	AN & PN	One 3 hour face-to-face (group) <i>Knowledge Sharing Practices with Empowerment Strategies (KSPEs)</i> session delivered by researcher (AN) One-to-one individual postnatal support (home visits) available for women who had problems with exclusive breastfeeding.	Knowledge Sharing Practice (KSP) and applying them with empowerment based on Gibson's theory which consists of 4 steps: discovering reality, critical reflection, taking charge, and holding on. Discuss breastfeeding knowledge and techniques using storytelling, experiencing by best practices, demonstrating and displaying thoughts of pregnant women.	F2F (group); F2F (1- 2-1) (if necessar y)
Lab arèr & e et al. (201 1)	AN & PN	CD-ROM introduced and provided during antenatal childbirth classes (AN) During PN stay in hospital access to computer with CD-ROM provided; copy of CD-ROM provided at discharge to take home and use. Animations and videos on CD-ROM used to demonstrate breastfeeding positioning and latching techniques. Telephone number of PSG provided	Content based on self-efficacy theory with 4 main themes: health benefits of prolonged breastfeeding duration; realistic breastfeeding duration goals; cognitive and behaviour skills to address breastfeeding problems; self-monitoring of breastfeeding behaviour. CD-ROM included 12 modules to complete in any order; Benefits of prolonged breastfeeding; the process of lactation; practical tips for breastfeeding; breastfeeding initiation in hospital; common breastfeeding problems; managing common breastfeeding problems; breastfeeding in special conditions; breastfeeding and going to work; breastfeeding accessories and supplies; frequently asked questions; breastfeeding resources and initiatives.	CD- ROM; Booklet

Li et al. (2018)	PN	Throughout their stay in hospital women received an education and behaviour intervention.	Benefits of breastfeeding (through booklet, online platform, class and one-to-one advice)	F2F (1-2-1), website, booklet.
		Information on breastfeeding provided on admission.	Guidance on latch, positioning and posture	
		Within 30 minutes of delivery, nurse consultation	Demonstrate correct latch, positioning and posture.	
		Nurse guided activity	Mothers guided by nurses to be active and get out of bed to do 'moderate activity' postpartum ; Nutritional, sleep and rest recommendations	
		Instructions for breast care and massage	Guided breast care and breast massage; hot compress for 10mins and massage for 20mins; Provide solutions and guidance for lactation issues (engorgement, mastitis, nipple pain etc.).	
		Access to online platform for help and advice		
		Breastfeeding class (<i>no details</i>)	Guided to participate in newborn care	

Liu et al. (2017)	AN & PN	One 1 hour antenatal breastfeeding workshop One 1 hour postnatal one-to-one breastfeeding counselling session (researcher provided): Husbands/significant others invited to workshop.	<p>Based on self-efficacy theory: Explore feelings and thoughts related to previous accomplishments and prompted think about incorporating skills into performance of future breastfeeding (<i>i.e. future performance accomplishments</i>).</p> <p>Video demonstration of skills and perseverance needed with breastfeeding and common problems that occur when breastfeeding (<i>enhance vicarious experience</i>)</p> <p>Highlight importance of support and encouragement needed from others (<i>verbal persuasion aimed at husbands</i>)</p> <p>Visual and written examples of how negative physiological responses can affect mothers, and guidance/ discussion on how to change perceptions and gain control. (<i>Self-talking/ problem solving/ physiological responses</i>).</p>	F2F (group) (AN); F2F 1-2-1 (PN); written material
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May coc k et al. (201 3)	AN & PN	One 2 hour, face-to-face (group) education session (AN) by male facilitator PN social support packages delivered to fathers (parents) at home, weekly up to 6 weeks PN; leaflets; materials to facilitate behaviour; promotional and motivational materials.	Benefits of breastfeeding; difficulties with breastfeeding; how and what support to offer; infant development and postpartum depression; problem solving and methods for reducing father's anxiety; role of the father in supporting breastfeeding discussed. 1-week PN: Congratulations card; nipple cream; developmental milestones leaflet for fathers to track baby's growth and development. 2-weeks PN: good nutrition for breastfeeding; dietary guidelines. 3-weeks PN: 'how to relax' leaflet; herbal teas to reduce stress and fatigue. 4-weeks PN: Beer holder with study logo 5-weeks PN: postcard with signs and symptoms of postnatal depression; information booklet on postnatal depression; contact information for more support.	F2F (group); Booklets
Mee dya, et al. (201 4)	AN & PN	One face-to-face (group) education session (1.5 hours) in second trimester delivered by LC; 10 - 20 people per group; educational materials to take home. Two telephone calls with LC (10 days PN and 3 months PN)	Benefits of breastfeeding; importance of skin-to-skin; importance of early initiation; latching and positioning; demand feeding; rooming-in; feeding cues; satiety cues; effects of dummies and bottles before breastfeeding is established; normal changes to body; normal baby behaviour; infant growth and development up to 6 months. Learning materials provided (information leaflet, breastfeeding calendar, DVD and motivational postcards). Encouragement; positive reinforcement; discuss difficulties and concerns; baby's behaviour; sufficient milk supply.	F2F (group); TP (1-2- 1)

Rasmusen et al. (2011)	AN & PN	<p>One telephone call (AN) from LC</p> <p>PN targeted care</p> <p>Two telephone calls: 24 hours and 72 hours after discharge from LC; visit from LC ordered if necessary.</p>	<p>Asked about women's knowledge, expectations and perceptions; review practical points on breastfeeding; answer any questions.</p> <p>Room-in with infant following delivery; observed breastfeeding using MBA³ tool once during each 8-hour shift; encourage women to get up and move; ask visitors to leave if they had been there more than 2-hours or if there were too many visitors.</p> <p>Content unknown.</p>	F2F (1-2-1); TP (1-2-1)
Rosuzei et al. (2018)	AN & PN	<p>Antenatal breastfeeding education module at 28+ weeks on breastfeeding (slide presentation given as visual notes) and information booklets given out. Video and practical demonstrations.</p> <p>Within one week PN, one face-to-face support session from researcher</p>	<p>Breast anatomy, lactation, advantages of breastfeeding, latching and positioning, indicators of milk supply, feeding cues, common breastfeeding problems and solutions, formula cost, manual breastmilk expression, pumping/expressing, storage of breastmilk and diet. Video entitled "Nature's Way: Video Guide to Breastfeeding" was shown. Practice breastfeeding positioning using mannequins.</p> <p>Information on breastfeeding, encouragement on exclusive breastfeeding to 6 months, answer questions, discuss any doubts or anxieties, assist with establishing breastfeeding (video shown again), manual expression, management of nipple damage, discuss any problems with breastfeeding.</p>	F2F 1-2-1 (PN); written material; video

Su & Ouyang (2016)	AN	<p>One face-to-face (group) education session (1 - 1.5 hours) for mothers and fathers; 4 - 8 people in each group</p> <p>Lecture</p> <p>Skills training</p> <p>Discussion</p>	<p>Information booklet provided</p> <p>Benefits of breastfeeding; risks of formula feeding or incorrect feeding; stomach capacity of babies; breastfeeding initiation; latching and positioning; common problems with breastfeeding and solutions to these; decision making in breastfeeding; validate mothers feeding decisions and discuss how fathers can be involved in decision making going forward; how fathers can provide emotional support for breastfeeding; how to implement being supportive for mothers; meeting the needs of the mother (breast models and newborn dolls used as props and demonstration tools throughout).</p> <p>Demonstrate the correct breastfeeding positions; practice the behaviour; Fathers demonstrate how they can help mothers with positioning and practice.</p> <p>Do you have any misconceptions about breastfeeding; What do you know now you didn't know before; any questions or concerns?</p>	F2F (group)
Tahir & Al-Sadat (2013)	PN	<p>Telephone sessions twice per-month from LC to provide lactation counselling; from 0 to 6 months PN; Average duration of phone call 58.4 minutes (<i>SD</i> = 38.5) (range 0-210 minutes). On average 4.33 calls per participant (<i>SD</i> = 3.14) (range 0-12 calls).</p>	<p>“Lactation Counselling” - Content unknown.</p>	TP (1-2-1)

Wu et al. (2014)	PN	Two face-to-face (1-2-1) sessions: 24 hours and 48 hours PN. One telephone session one week after hospital discharge.	<p>Individualised intervention for each mother based on Bandura Self-Efficacy Theory⁴ performance accomplishment, vicarious experience, verbal persuasion, physiological and emotional states.</p> <p>Six topical modules tailored to include: Why breastfeeding is important; Helping the mother with early breastfeeding; Positioning a baby at the breast; Expressing breast milk; Concerns about not enough milk; Breast conditions.</p> <p>Verbal persuasion: Provide positive feedback whenever appropriate, highlighting personal capabilities; Create optimistic beliefs (i.e. you have what it takes to succeed.); Correct any inaccurate and low perceptions of performance capability; Provide accurate information to increase sense of ability; Provide support when handling pressure and failure; Encourage mother to envision successful performances and manage self-defeating thoughts on how she might persevere through any breastfeeding difficulties that are apparent to the mother.</p> <p>Performance accomplishment: Provide positive reinforcement and suggestions about how to improve future breastfeeding and expressing performance; Give attention to successful or improved aspects of breastfeeding performance; Set short-term goals that the mother will be able to achieve; Identify and reinforce past and present successes or accomplishments; Provide anticipatory guidance that difficulties may be encountered, especially in the early period; Success usually requires tenacious effort and it is how the difficulties are handled that will determine future success.</p>	F2F (1-2-1); TP (1-2-1)
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Vicarious experience: Use visual aids to make unobservable breastfeeding skills apparent to mother; demonstrate positioning or proper latch; Provide written materials to supplement learning.

Physiological and emotional states: Correct any misinterpretations of body states; Provide anticipatory guidance that the tendency to experience anxiety, pain, and fatigue should be explicitly acknowledged and normalized.

<p>Zhu et al. (2017)</p>	<p>PN</p>	<p>Information session at 1 day postpartum; 30 – 60 minutes with mother and significant other.</p> <p>Group education in obstetric unit (1 hour) at 2 days postpartum; 30 minute lecture, 15 minutes practice, 15 minutes discussion.</p> <p>Group activity at 6 week check-up appointment</p> <p>Telephone counselling (within 3 days after discharge) weekly to 6 weeks postpartum. Phone calls for 20 – 30 minutes.</p>	<p>Benefits of breastfeeding, breastfeeding techniques, coping strategies for breastfeeding problems (e.g. breast pain, engorgement etc.), milk intake and supply, nutritional value of breastmilk.</p> <p>Lecture on breastfeeding, video on benefits and importance of breastfeeding, practice of correct breastfeeding position and latching, discussion on the plan for breastfeeding going forward and sharing experiences with others about successful initiation.</p> <p>Group discussion; benefits of breastfeeding, importance of exclusive breastfeeding, discuss beliefs about breastfeeding and correct wrong beliefs, encourage maintenance of exclusive breastfeeding, discuss problem solving for breastfeeding issues.</p> <p>Emphasize importance of exclusive breastfeeding, provide emotional support, reinforce coping strategies, dealing with problems with breastfeeding.</p>	<p>F2F (1-2-1 and group); video; TP (1-2-1).</p> <p>Intervention delivered by trained Obstetric nurse.</p>
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AN = Antenatal; PN = Postnatal; LC = Lactation Consultant; MW = Midwife; N = Nurse; PSG = Peer Support Group; RA = Research Assistant;
#For Fu et al. (H) = Intervention Arm 1 (In-Hospital Support arm) and (T) = Intervention Arm 2 (Telephone Support arm); F2F = Face-to-face delivery; TP = Telephone; 1-2-1 = one-to-one delivery.
