



## Review Article

# Workplace programmes for supporting breast-feeding: a systematic review and meta-analysis

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### Abstract

**Objective:** To critically review the literature regarding workplace breast-feeding interventions and to assess their impact on breast-feeding indicators.

**Design:** A systematic review and meta-analysis was conducted. Electronic searches for workplace intervention studies to support breast-feeding, without restriction on language or study design, were performed in PubMed, CENTRAL, CINAHL, Embase, Web of Science, Business Source Complete, ProQuest-Sociology and ProQuest-Social Science to 13 April 2020. A meta-analysis of the pooled effect of the programmes on breast-feeding indicators was conducted.

**Results:** The search identified 10 215 articles; fourteen studies across eighteen publications met eligibility criteria. Programmes were delivered in the USA ( $n$  10), Turkey ( $n$  2), Thailand ( $n$  1) or Taiwan ( $n$  1). There were no randomised controlled trials. The pooled OR for exclusive breast-feeding at 3 or 6 months for participants *v.* non-participants of three non-randomised controlled studies was 3.21 (95% CI 1.70, 6.06,  $I_2 = 22\%$ ). Despite high heterogeneity, other pooled outcomes were consistently in a positive direction with acceptable CI. Pooled mean duration of breast-feeding for five single-arm studies was 9.16 months (95% CI 8.25, 10.07). Pooled proportion of breast-feeding at 6 months for six single-arm studies was 0.76 (95% CI 0.66, 0.84) and breast-feeding at 12 months for three single-arm studies was 0.41 (95% CI 0.22, 0.62). Most programmes were targeted at mothers; two were targeted at expectant fathers.

**Conclusions:** Workplace programmes may be effective in promoting breast-feeding among employed mothers and partners of employed fathers. However, no randomised controlled trials were identified, and better-quality research on workplace interventions to improve breast-feeding is needed.

**Keywords**  
Breast-feeding  
Workplace  
Intervention  
Return to work  
Systematic review

There is wide consensus about the benefits of breast-feeding for both mothers and infants. Breast-feeding supports optimal growth for infants, while also decreasing the risk of being underweight and obese among different populations<sup>(1–3)</sup>. Other short-term and long-term health benefits for infants include a reduced risk of infection and mortality in early life<sup>(4–7)</sup>, reduced risk of developing diabetes in later life<sup>(8,9)</sup> and moderate improvement in intelligence performance<sup>(10,11)</sup>. For maternal health, breast-feeding is known to decrease the risk of breast and ovarian cancers<sup>(12,13)</sup> and CVD<sup>(14,15)</sup>. Despite the WHO recommendations<sup>(16)</sup>, the

global prevalence of exclusive breast-feeding at 6 months is estimated at around 37% in low- and middle-income countries, with lower rates in high-income countries<sup>(17)</sup>.

A growing trend of working mothers is evident worldwide, with employment rates of mothers with children under 18 years old reported as increasing in Australia<sup>(18)</sup>, the USA<sup>(19)</sup> and the United Kingdom<sup>(20)</sup>. Maternal employment is a known barrier for exclusive breast-feeding practice<sup>(21,22)</sup> and has been shown to contribute to early discontinuation of breast-feeding<sup>(23,24)</sup>. Given the number of women participating in the workforce, it is worth

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investigating how to better support working mothers to breast-feed. In addition, there is evidence that support for breast-feeding by fathers has a strong influence on the duration of breast-feeding<sup>(25–28)</sup>. Workplace programmes for male employees as expectant fathers are potential strategies to balance the work–family conflict and to increase the involvement of fathers<sup>(29)</sup>.

Although a number of interventions have focused on the promotion of breast-feeding in the hospital and community setting<sup>(30)</sup>, there is limited research on the effectiveness of interventions to support breast-feeding in the workplace. A recent systematic review restricted to randomised controlled trials found no studies reporting workplace interventions<sup>(31)</sup>. Another descriptive review found that the provision of a lactation space was the most common support offered in the workplace, with many employers also offering breast-feeding breaks and lactation support programmes; however, the effectiveness of these interventions was not evaluated<sup>(32)</sup>. Given the increasing number of women participating in the workforce, how to better support working mothers to breast-feed needs further investigation. The current study aimed to critically review the literature regarding workplace interventions for supporting breast-feeding among employed parents and to assess their effectiveness for supporting breast-feeding.

## Method

A systematic review of the literature was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines<sup>(33)</sup> and was registered with the International Prospective Register of Systematic Reviews (CRD42018103009).

Inclusion criteria were studies: (1) that described workplace intervention studies which support breast-feeding; (2) that measured at least one outcome of interest, including primary outcomes (any breast-feeding indicators) or secondary outcomes (mother-related, infant-related and employment-related benefits); (3) of any study design except case studies; and (4) of any date of publication or language. Exclusion criteria were (1) non-intervention studies; (2) interventions not specifically focused on breast-feeding; (3) interventions delivered off-site and not specifically supported by the employer; (4) studies only reporting intention, attitude and knowledge outcomes; and (5) case study design.

Eight electronic databases were searched, including PubMed, Embase, CINAHL, CENTRAL, Web of Science, Business Source Complete, ProQuest-Sociology and ProQuest-Social Science for relevant articles up to and including 16 June 2018, and further updated on 13 April 2020. The search strategy in PubMed was (Breastfeeding OR 'breast milk' OR 'human milk' OR breastfe\* OR breast fe\* OR lactati\* OR 'Breast Feeding'(Mesh) OR 'Milk,

Human'(Mesh)) AND (Workplace OR work OR employ\* OR organisation\* OR organization\* OR occupation OR 'Return to Work'(Mesh) OR 'Employment'(Mesh)) AND (Intervention OR support OR program OR counselling OR peer OR education OR 'family practice') and was adapted to suit each of the different databases (see online supplementary material, search strategy). References of relevant reviews retrieved in the search were also checked to find additional studies.

All search results were imported into EndNote X8 and de-duplicated prior to screening. Two reviewers (X.T. and P.P.) independently screened the title and abstract for articles, with disagreements resolved by consensus or a third reviewer (K.M.S.). The full text of all articles not excluded at title and abstract stage was further independently assessed by two authors (X.T. or P.P. and D.R., J.B. or L.v.H.) against the inclusion criteria. Quality assessment of included studies was undertaken independently by two reviewers (X.T. and K.M.S. or L.v.H.), with disagreements resolved by consensus or a third reviewer (D.R.) using the Mixed Method Assessment Tool (MMAT)<sup>(34)</sup>. For cross-sectional studies, the Quantitative Descriptive Domain (MMAT Domain 3.0) was used when all subjects received a programme and results only indicated the association between subject characteristics and outcomes, while the Quantitative Nonrandomised Domain (MMAT Domain 4.0) was used when the association between the programme exposure and outcomes was reported.

Data were extracted by one author (X.T.) and checked for accuracy by a second author and included source (review author, citation and contact details), study design, settings with context, participants, duration, follow-up time, programme details, delivery modes, method of data collection, measures, data analysis, results and conclusions. Mean, SD or 95 % CI for continuous outcomes and OR or 95 % CI for categorical outcomes were extracted for analysis. A meta-analysis was conducted where at least two similar quantitative studies with homogeneous outcome measures were reported. The package *meta* in R statistical software version 3.5.3 was used for meta-analysis<sup>(35)</sup>. Specifically, these functions were used: *metamean* for pooling the mean duration of breast-feeding in single-arm studies, *metabin* for binary outcome data comparing participants against non-participants in workplace programmes and *metaprop* for pooling proportions from single-arm studies. Pooling of the estimates for random effects models was carried out using the inverse variance method. Heterogeneity was assessed with the  $I_2$  statistic. If SD were not reported in studies included for meta-analysis, the SD from a similar quantitative study was applied, as suggested by the Cochrane Handbook for Systematic Reviews of Interventions<sup>(36)</sup>. A narrative review was used to synthesise qualitative studies and quantitative studies that were not included in a meta-analysis.

## Results

### Study selection

The original and updated search combined identified 16 014 articles from the eight databases (Fig. 1). After removing duplicates, 10 215 articles were screened based on title and abstract. Of these, 230 articles were subject to full-text review. The most common reason for exclusion was that the study was not an intervention study. A companion paper of one included study, which was

not identified in the search, was added as a result of handsearching. Fourteen studies were included and were reported across eighteen publications, of which nine out of fourteen studies were eligible to be included in the meta-analysis. Two studies<sup>(37,38)</sup> were ineligible for inclusion in the meta-analysis due to different study designs from other included studies, one study<sup>(39)</sup> was ineligible due to measuring breast-feeding rate in a different way from other included studies and two studies<sup>(40,41)</sup> were ineligible as they were qualitative studies.

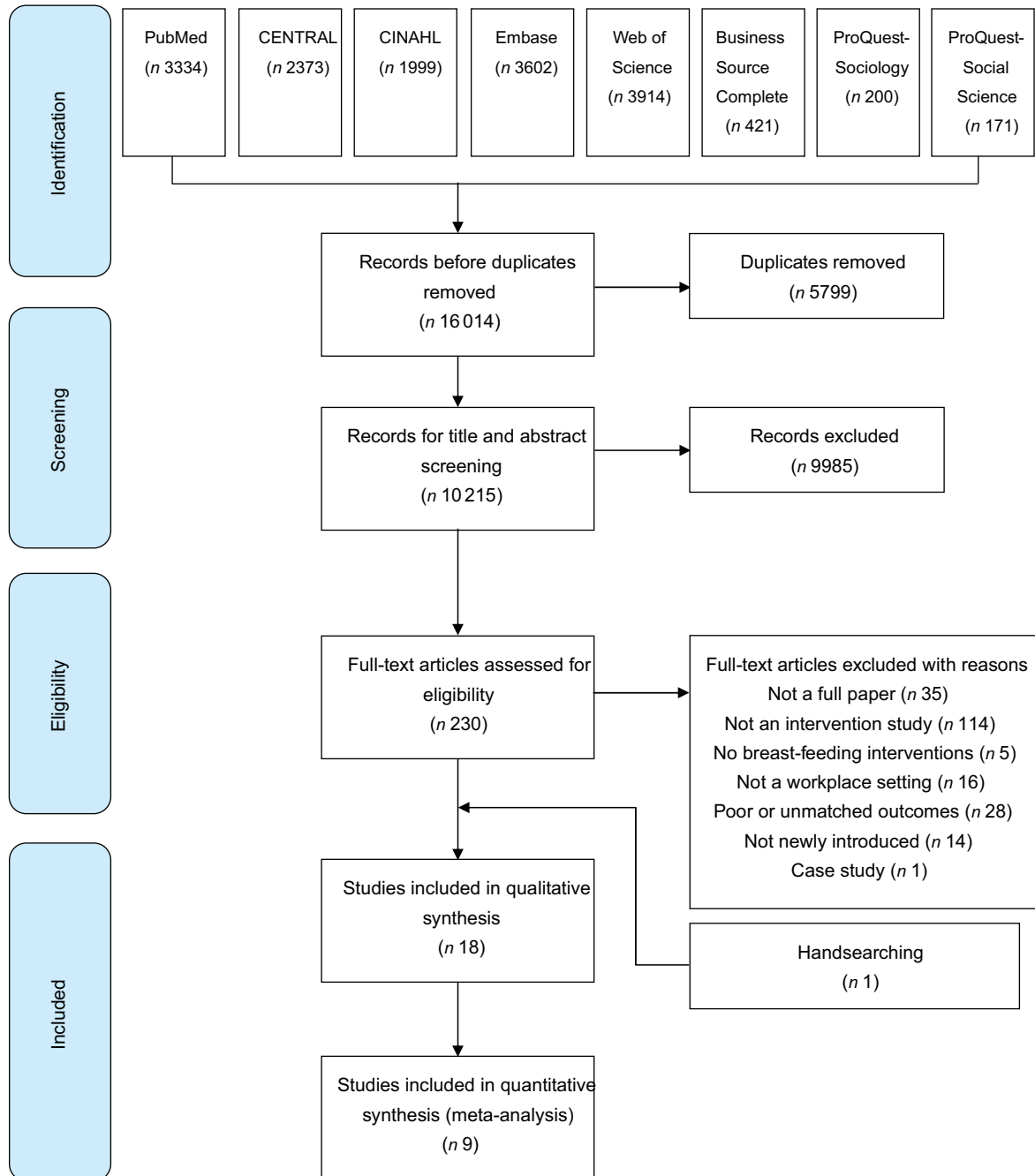


Fig. 1 (colour online) Flow chart of study selection

### Study characteristics

Table 1 shows an overview of the characteristics of the included studies. The majority of studies ( $n = 10$ ) were programmes delivered in the USA, with remaining studies reporting on programmes delivered in Turkey ( $n = 2$ ), Thailand ( $n = 1$ ) or Taiwan ( $n = 1$ ). Four publications were non-randomised controlled studies<sup>(38,42–44)</sup>, and two of these four also included qualitative results from focus groups<sup>(43,44)</sup>. Nine publications<sup>(37,39,45–51)</sup> reporting eight breast-feeding support programmes were cross-sectional studies, most of which participants had received an intervention. Three publications across two studies reported only qualitative results on women's breast-feeding experiences<sup>(40,41,52)</sup>.

There were eight publications that represented multiple reports of four studies (Table 2). There were two reports of one intervention composed of a breast pump room and lactation consultant<sup>(48,53)</sup>. One of these reports presented cross-sectional results of infant feeding choice (formula or breast) for all participants in the programme<sup>(48)</sup> and the other presented a comparison of maternal absenteeism and infant illness between formula-fed and breast-fed babies of mothers participating in the programme in a retrospective cohort study<sup>(53)</sup>. There were two reports of a comprehensive hospital employee lactation programme encompassing multiple intervention components<sup>(50,54)</sup>. One publication presented cross-sectional breast-feeding outcome<sup>(50)</sup>, and the other publication presented qualitative data from a survey of participants<sup>(54)</sup>. There were two reports of an intervention consisting of lactation consultants for employee support and access to a lactation room<sup>(45,46)</sup>. Both reports presented cross-sectional data on duration of breast-feeding; however, one was focused on breast-feeding duration for all participants<sup>(46)</sup> while the other described breast-feeding problems of participants and compared breast-feeding duration of employees with lactation problems against those experiencing no problems<sup>(45)</sup>. Finally, there were two reports of a qualitative study investigating women's experiences of breast-feeding-friendly workplaces<sup>(40,52)</sup>. The current study reported on women's experiences of returning to work with the findings separated into two papers, one focused on the translation of policy into practice<sup>(40)</sup> and the other focused on the findings related to physical environment<sup>(52)</sup>.

### Quality assessment

The quality of included studies was found to be variable based on the MMAT<sup>(34)</sup> (Fig. 2). Among eighteen articles assessed with the MMAT, four qualitative publications<sup>(40,41,52,54)</sup> were assessed with only the 'Qualitative Domain' (MMAT Domain 2.0); two mixed methods studies<sup>(43,44)</sup> were assessed with MMAT Domains 2.0, 3.0 and 5.0; two quantitative non-randomised controlled trials<sup>(38,42)</sup>, one cross-sectional study<sup>(37)</sup> and one retrospective cohort study<sup>(53)</sup> were assessed with MMAT

Domain 3.0; and the remaining eight quantitative articles<sup>(39,45–51)</sup> were assessed with MMAT Domain 4.0. Overall, the majority of studies were low-to-moderate quality, although the proportion of articles assessed within the 'qualitative domain' that met the methodological criteria was comparatively higher than the proportion of articles assessed within the 'quantitative domain' (i.e., the green bar represented in Fig. 2). The main criteria with a higher proportion of articles assessed as 'Can't tell' or 'No' included questions related to selection bias of sample or how representative the sample was, triangulation of qualitative and quantitative results for mixed methods studies (MMAT Domain 5.0) and the validity of measurement tools used.

### Programme summary

Most of the included studies described a comprehensive breast-feeding support programme, consisting of several components. Table 2 summarises all the components of eligible workplace programmes, incorporating one or more of the following strategies: group education, individual consultation/s, telephone support, breast-feeding space on site, provision of expression equipment, breast-feeding break/s within working day, supportive policies or supported interactions with health professionals. The most common component included was the provision of breast milk expression equipment for free or with a discount, with the equipment often provided along with the breast-feeding room. The intervention in two studies<sup>(37,40,52)</sup> was certifying worksites as 'infant or breast-feeding friendly' by developing criteria for modifying worksites. The measures were similar to those listed above, such as supportive policies and lactation room. One study<sup>(42)</sup> investigated the effectiveness of the improvement of the law regulating maternity leave, including extending paid and unpaid maternity leave and less working hours after returning to work.

Two of the programmes<sup>(43,47)</sup> were designed for male employees as expectant fathers. The programme<sup>(51)</sup> in the USA provided group education, individual consultation and pump rental to the partners of the employees, whereas a programme<sup>(43)</sup> in Turkey focused on training worksite physicians and delivering six group education sessions covering a variety of topics.

### Breast-feeding duration

Seven studies across eight publications<sup>(37,38,45–47,49,51,53)</sup> reported the duration of breast-feeding and all studies reported a positive impact on breast-feeding duration. Five single-arm studies were able to be included in a meta-analysis, reporting mean duration of breast-feeding of participants ranging from 8 months to 10 months. From a sample of 896 subjects participating in a workplace breast-feeding promotion programme, the pooled mean duration of breast-feeding for five single-arm studies<sup>(46–49,51)</sup> was



**Table 1** Characteristics of included studies

First author, year	Study design	Programme	Location	Industry (number of organisations/sites)	Participants, <i>n</i>	Outcome measurement, (covariates included in analysis)
Katcher 1985 <sup>(38)</sup>	Non-RCT	Lactation consultation service	USA	A non-profit voluntary community hospital ( <i>n</i> 1)	I = 27 C = 21	Duration of BF; duration of EBF (covariates not considered)
Sahip 2007 <sup>(43)</sup>	Non-RCT, focus group	Education for expectant fathers	Turkey	Banks ( <i>n</i> 3), an electronics factory ( <i>n</i> 1), a plastics factory ( <i>n</i> 1), a telecommunications company ( <i>n</i> 1) and a washing machine manufacturing company ( <i>n</i> 1)	I = 80 C = 80 Working fathers	Rate of EBF at 3 months; rate of EBF at 6 months Rate of BF at 9 months; qualitative results (Controlled for wife's participation in antenatal education)
Yimyam 2014 <sup>(44)</sup>	Non-RCT, focus group	Workplace BF support model	Thailand	An electronic industrial company ( <i>n</i> 1)	I = 33 C = 24	Rate of EBF at 6 months; rate of BF at 6 months. Qualitative results (covariates not considered)
Eren 2018 <sup>(42)</sup>	Non-RCT	Law regulating maternity leave	Turkey	Three major hospitals in Istanbul ( <i>n</i> 3)	I = 28 C = 81	Rate of EBF > 4 months and at 6 months; rate of BF > 12 months (covariates not considered).
Cohen 1994 <sup>(48)</sup>	Cross-sectional	Lactation programme	USA	A utilities company ( <i>n</i> 1) and a space corporation ( <i>n</i> 1)	187	Duration of BF; duration of maternity leave; rate of BF at 6 months
Cohen 1995 <sup>(53)</sup>	Retrospective cohort		USA	A utilities company ( <i>n</i> 1) and a space corporation ( <i>n</i> 1)	BF = 59 Formula = 42	Duration of receiving no more than two bottles of formula; rate of infant illness; rate of maternal absenteeism
Cohen 2002 <sup>(47)</sup>	Cross-sectional	Fathering programme	USA	Department of water and power, public utility company ( <i>n</i> 1)	128 working fathers	Duration of BF; rate of BF at 6 months
Ortiz 2004 <sup>(49)</sup>	Cross-sectional	Corporate lactation programme	USA	Accounting firms ( <i>n</i> 2), entertainment industry company ( <i>n</i> 1), incorporated city government ( <i>n</i> 1), service corporation ( <i>n</i> 1)	462	Duration of postnatal leave; rate of BF at 6 months; rate of BF at 12 months
Balkam 2011 <sup>(46)</sup>	Cross-sectional	Workplace lactation programme	USA	A large public-sector employer ( <i>n</i> 1)	128	Duration of BF; rate of EBF at 6 months Rate of BF at 6 months
Balkam 2016 <sup>(45)</sup>	Cross-sectional		USA	A large public-sector employer ( <i>n</i> 1)	128	Duration of BF
Tsai 2013 <sup>(39)</sup>	Cross-sectional	BF-friendly workplace	Taiwan	A large electronics manufacturer with ten plants ( <i>n</i> 1)	715	Rate of BF for 1–6 months; rate of BF for >6 months
Spatz 2014 <sup>(50)</sup>	Cross-sectional	Employee lactation programme	USA	A hospital ( <i>n</i> 1)	545	Rate of EBF (1–6 months) Rate of BF at 6 months Rate of BF at 12 months
Froh 2016 <sup>(54)</sup>	Qualitative*		USA	A hospital ( <i>n</i> 1)	545	Qualitative results
Whaley 2002 <sup>(51)</sup>	Cross-sectional	BF support within WIC programme	USA	Local agencies that provide WIC services ( <i>n</i> 6)	121	Rate of BF at 6 months Rate of BF at 12 months
Hilliard 2018 <sup>(37)</sup>	Cross-sectional	Infant friendly business designation	USA	A variety of businesses in North Dakota ( <i>n</i> > 10)	392	Duration of BF Duration of BF
Johnson 2017 <sup>(41)</sup>	Qualitative	BF support initiative	USA	A private university ( <i>n</i> 1)	22	Qualitative results
Cheyney 2019a <sup>(40)</sup>	Qualitative	Worksite Health ScoreCard	USA	'Breastfeeding-friendly' worksites in a rural New England town ( <i>n</i> 15)	21	Qualitative results
Cheyney 2019b <sup>(52)</sup>	Qualitative		USA	'Breastfeeding-friendly' worksites in a rural New England town ( <i>n</i> 15)	21	Qualitative results

Non-RCT, non-randomised controlled trial; BF, breast-feeding; EBF, exclusive breast-feeding; I, intervention; C, comparison; WIC, women, infants and children programme.

\*Secondary data analysis from a survey reported in Spatz 2014<sup>(50)</sup>.

**Table 2** Summary of workplace breast-feeding interventions reported in included studies

First author, year	Programme components							Health professional support	
	Group education	Individual consultation	Telephone support	Breast-feeding room	Expression facility	Breast-feeding break	Workplace policy		
Katcher 1985 <sup>(38)</sup>		✓		✓	✓	✓	✓ <sup>§</sup>	Workplace visit before returning to work	Nurse
Sahip 2007 <sup>(43)</sup>	✓							Training physicians	Physician
Yimyam 2014 <sup>(44)</sup>	✓	✓			✓	✓		Developed a workplace breast-feeding support model	Nurse, midwife, Lactation consultant
Cohen 1994 & 1995 <sup>(48,53)</sup>	✓ <sup>¶</sup>	✓		✓	✓				Lactation professional
Cohen 2002 <sup>(47)</sup>	✓	✓			✓				Nurse, nutritionist
Ortiz 2004 <sup>(49)</sup>	✓	✓	✓	✓	✓				Lactation consultant
Balkam 2011 & 2016 <sup>(45,46)</sup>	✓	✓	✓	✓	✓				Lactation consultant (nurse)
Tsai 2013 <sup>(39)</sup>				✓		✓			Not involved
Spatz 2014 & Froh 2016 <sup>(50,54)</sup>	✓			✓	✓ <sup>†</sup>	✓	✓ <sup>  </sup>		Nurse
Whaley 2002 <sup>(51)</sup>					✓			Breast-feeding support group	
Johnson 2017 <sup>*(41)</sup>				✓	✓				Not involved
Cheyney 2019a & 2019b <sup>(40,52)</sup>							✓	Lactation-specific items added in Worksite Health Scorecard	Expert panel
Eren 2018 <sup>(42)</sup>							✓ <sup>¶</sup>	Improvement of the law regulating maternity leave	
Hilliard 2018 <sup>(37)</sup>				✓	✓ <sup>‡</sup>	✓	✓		

\*Time for breast-feeding breaks was part of the second stage for the programme, but most interviewees were still in stage one.

†Personal-use breast pump purchase programme at cost for employees.

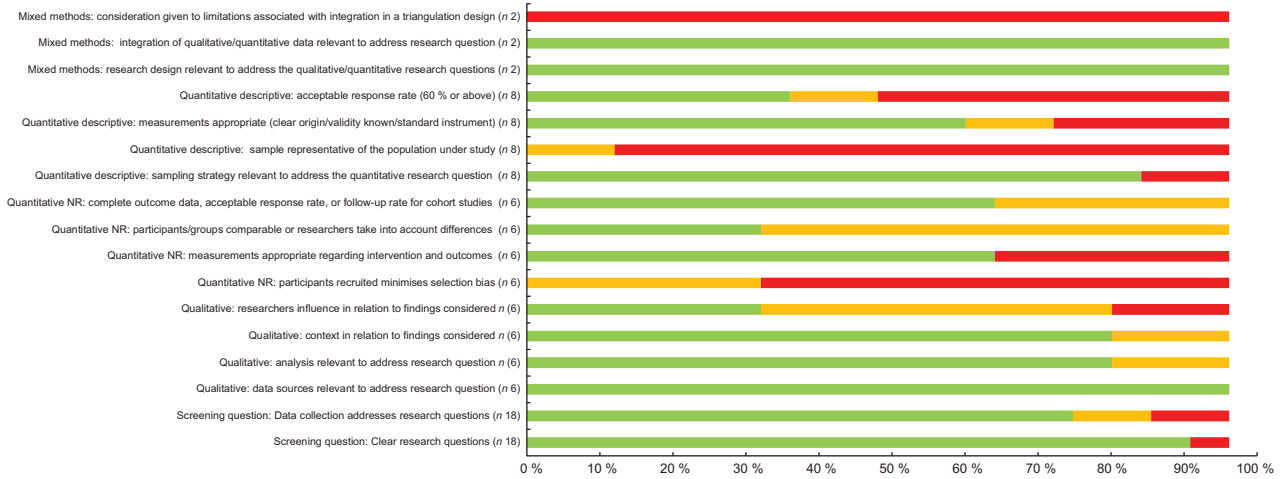
‡Source of clean water and refrigerator.

§Hospital personnel policy extended for the whole programme.

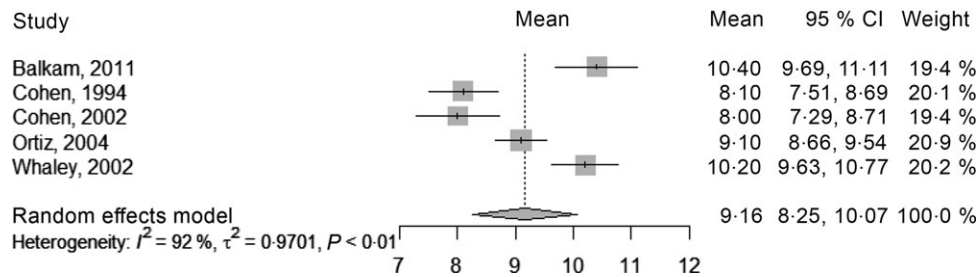
¶Policy to guarantee specific break times for expressing milk.

||Including paid and unpaid maternity leave, and shorter working duration.





**Fig. 2** (colour online) Proportion of studies meeting quality assessment criteria for each of the MMAT questions. ■, yes; ■, cannot tell; ■, no



**Fig. 3** Forest plot showing the pooled mean duration (months) of breast-feeding for five single-arm studies (896 subjects)

9.16 months (95 % CI 8.25, 10.07,  $I_2 = 92\%$ , Fig. 3). The  $I_2$  of 92% indicated high heterogeneity among these observational studies, and the potential sources of heterogeneity included the study design, the sample, the programme components and the method of data collection. The two other studies reporting duration of breast-feeding were a non-randomised controlled study<sup>(38)</sup> and a cross-sectional study with comparison of employee breast-feeding among organisations who were currently, previously or never participating in a workplace programme that included lactation support<sup>(37)</sup>. The results from these two studies were not pooled due to insufficient trials to perform a meta-analysis. These results are reported narratively.

The non-randomised study<sup>(38)</sup> ( $n = 48$ , participant = 27, comparison = 21) implemented a programme that included the provision of a pump, professional advice and time during the work day for expression of breast milk and reported an average of 11.7 months of breast-feeding duration among participating employees. This was significantly higher than a mean of 6.0 months among employees on maternity leave before the implementation of the programme ( $P < 0.003$ ). It reported a mean of 12.1 weeks of exclusive breast-feeding duration among participants

compared with 10.6 weeks of exclusive breast-feeding duration among non-participants, without indicating whether the difference was significant.

The cross-sectional study<sup>(37)</sup> divided participants into four groups, based on their employment at worksites designated in 2011 or 2012 and recently recertified as ‘infant friendly business’ ( $n = 42$ ), worksites designated later than 2012 ( $n = 14$ ), worksites designated in 2011 or 2012 but not recertified ( $n = 7$ ) and worksites not currently designated ( $n = 147$ ). The durations of total breast-feeding among the four groups were not significantly different ( $P = 0.30$ ). The potential reason for the lack of effect was that whether a worksite was designated did not necessarily indicate the actual support in the worksite and non-designated worksites may have still offered employees breast-feeding support.

The study by Balkam *et al.*<sup>(46)</sup> was reported across two publications: the first of which was included in the meta-analysis and the second report of the current study<sup>(45)</sup> was not included in the meta-analysis and had a different focus. It explored the problems experienced by women breast-feeding and participating in a workplace programme and how the problems affected their duration of breast-feeding.

**Rate of exclusive breast-feeding**

Five studies<sup>(42-44,46,50)</sup> reported the rate of exclusive breast-feeding. Of these, three studies<sup>(42-44)</sup> were non-randomised controlled studies and two<sup>(46,50)</sup> were cross-sectional studies. Sahip *et al.*<sup>(43)</sup> reported exclusive breast-feeding at 3 months while the other four studies reported exclusive breast-feeding at 6 months. Three studies were included in a meta-analysis and reported the outcome at 3 months<sup>(43)</sup> or 6 months<sup>(42,44)</sup>. All three studies showed a positive effect of workplace programmes on exclusive breast-feeding, with CI suggesting significance of effect. The smaller study (*n* 57) included in the meta-analysis<sup>(44)</sup> reported an OR for exclusive breast-feeding of 13.14 for participants compared with non-participants; however, the current study had a wide CI (1.57, 109.94). The other two studies<sup>(42,43)</sup> included in the meta-analysis had smaller positive OR and narrower CI (Fig. 4). The pooled OR for participants *v.* non-participants of these three non-randomised controlled studies on exclusive breast-feeding at 3 or 6 months was 3.21 (95 % CI 1.70, 6.06,  $I_2 = 22\%$ , Fig. 4). In all studies, participants in workplace programmes (after improving the law regulating maternity leave in one study<sup>(42)</sup>) were more likely to practise exclusive breast-feeding.

Two cross-sectional studies measured exclusive breast-feeding but were not included in the meta-analysis, so are described narratively. The first study<sup>(46)</sup> (*n* 128) reported on the usage of individual components of a multi-component workplace lactation support programme, and showed 57 % of participants who used any of the components were able to maintain exclusive breast-feeding at 6 months. The second study reported on a similar programme with multiple components in a hospital workplace<sup>(50)</sup> (*n* 545) and indicated a lower rate of exclusive breast-feeding at 6 months, at 35 % of respondents. The rate of exclusive breast-feeding decreased from 69.7 % at 1 month to 35 % at 6 months, and a critical drop was observed at 4 months, which was 50.8 %<sup>(50)</sup>.

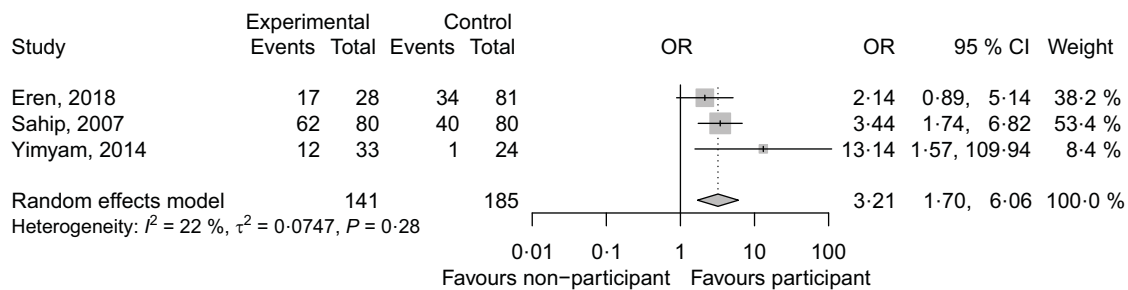
The study by Balkam *et al.*<sup>(46)</sup> assessed the intervention programme as well as the effectiveness of individual components in the programme. The results indicated the effectiveness of telephone support and return to work consultations for supporting exclusive breast-feeding, but not

prenatal education or the availability of a lactation room. Additionally, with each increase in the number of components received, the rate of exclusive breast-feeding at 6 months was significantly higher ( $P < 0.05$ ).

**Rate of any breast-feeding**

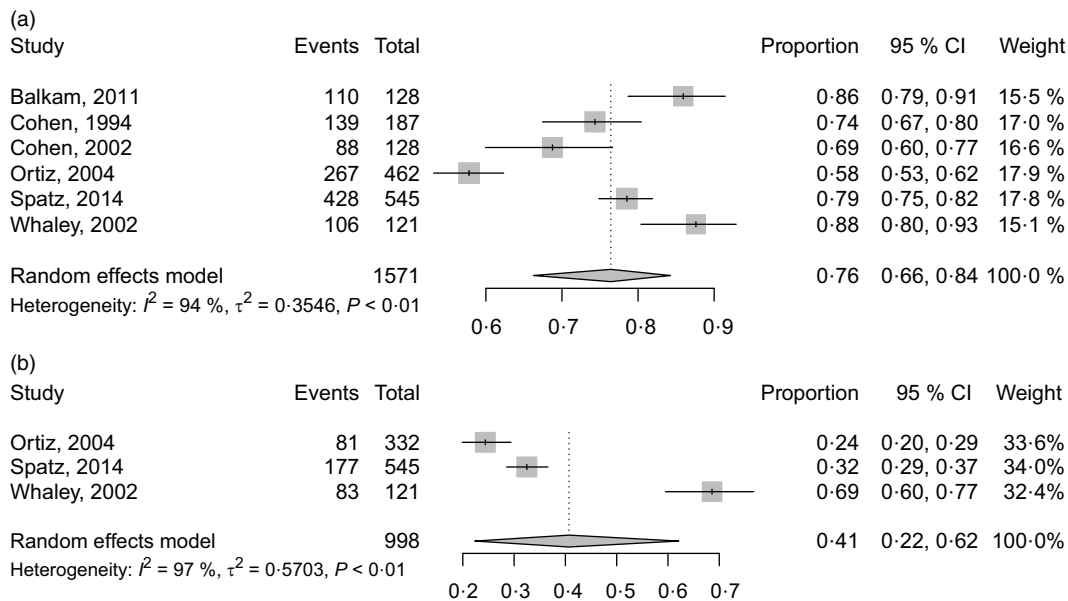
Nine studies<sup>(39,43,44,46-51)</sup> reported the rate of any breast-feeding. Six of these studies<sup>(46-51)</sup> were included in a meta-analysis of proportion of participants with any breast-feeding at 6 months (Fig. 5a) and three studies<sup>(49-51)</sup> were pooled for proportion of participants with any breast-feeding at 12 months (Fig. 5b). The proportion of participants' breast-feeding at 6 months ranged from 58 to 90 % in the six included studies. The pooled proportion for breast-feeding at 6 months from the meta-analysis of six single-arm studies<sup>(46-51)</sup> was 0.76 (95 % CI 0.66, 0.84,  $I_2 = 94\%$ , Fig. 5a), indicating that 76 % of participants in a workplace programme maintained any breast-feeding at 6 months. Across the three studies<sup>(49-51)</sup> reporting any breast-feeding at 12 months, the proportion was more variable ranging from 24 to 69 % of participants. The pooled proportion for breast-feeding at 12 months from the meta-analysis for three single-arm<sup>(49-51)</sup> studies was 0.41 (95 % CI 0.22, 0.62,  $I_2 = 97\%$ , Fig. 5b), indicating that 41 % of participants in a workplace programme maintained any breast-feeding at 12 months. The high heterogeneity in studies reporting the 6-month outcome ( $I_2 = 94\%$ ) and studies reporting the 12-month outcome ( $I_2 = 97\%$ ) potentially resulted from the observational study designs, diversity in the samples (which were all American women but from different states and backgrounds), the diversity of programme components and different ways of measuring the outcomes.

Three studies<sup>(39,43,44)</sup> reporting any breast-feeding outcome were not able to be included in the meta-analysis, and these are reported narratively. The first of these studies was a cross-sectional study by Tsai<sup>(39)</sup> and participants were categorised by the rate of breast-feeding: no more than 1 month, 1-6 months and more than 6 months, which made the outcomes unsuitable to pool with other studies. For all employees included in the current study, using breast milk expressing breaks significantly increased both proportions of mothers who maintained breast-feeding for



**Fig. 4** Forest plot of OR for exclusive breast-feeding at 3 (Sahip, 2007) or 6 months (Eren, 2018 & Yimyam, 2014) for participants *v.* non-participants of workplace programmes for three non-randomised controlled studies





**Fig. 5** (a) Forest plot of breast-feeding proportion of participants in a workplace programme: any breast-feeding at 6 months for six studies (1571 subjects). (b) Forest plot of breast-feeding proportion of participants in a workplace programme: any breast-feeding at 12 months for three studies (998 subjects)

1–6 months (44.0 %) and for more than 6 months (49.4 %) ( $P < 0.0001$ )<sup>(39)</sup>.

The remaining two studies<sup>(43,44)</sup> that were excluded from meta-analysis were non-randomised controlled studies. Yimyam *et al.*<sup>(44)</sup> reported the rate of breast-feeding at 6 months in a Thai workplace was significantly higher among mothers participating in a programme (containing education and support by health professionals, breast-feeding support campaign and a designated breast-feeding corner in the workplace) compared with non-participants ( $\chi^2 = 4.52$ ,  $P = 0.033$ ). Similarly, Sahip<sup>(43)</sup> reported the rate of breast-feeding at 9 months in a Turkish workplace six-session breast-feeding education programme targeted at expectant fathers was significantly higher among partners of employees participating in the programme compared with those of non-participants (OR = 2.64, 95 % CI 1.36, 5.09,  $P < 0.01$ ).

### Secondary outcomes

Three studies<sup>(48,49,53)</sup> reported secondary outcomes including postnatal leave, infant illness and infant-related maternal absenteeism. The length of postnatal leave, as a secondary outcome, was extracted to assess how well a workplace programme supported employees to deal with work–family conflicts and whether employers also benefited from such programmes in case mothers returned to work earlier. These are summarised narratively. Cohen *et al.*<sup>(48)</sup> reported on a three-phase lactation programme (prenatal, perinatal and return to work) which showed a longer maternity leave period of 3.4 months among participants compared with 2.3 months among non-participants. Ortiz *et al.*<sup>(49)</sup> reported mean postnatal leave of 2.8 months

(SD = 1.4) for 336 mothers who successfully expressed milk at work (with no comparator group).

A retrospective cohort study by Cohen *et al.* investigated how a workplace breast-feeding support programme improved breast-feeding practice<sup>(48)</sup>, and then how it further benefited employers in terms of infant illness incidents and infant-related maternal absenteeism<sup>(53)</sup>. A sample of breast-fed babies ( $n = 59$ ), whose mothers were participants of a workplace programme, was compared with a sample of formula-fed babies ( $n = 42$ ). The results showed that babies in the breast-fed group had lower incidence and severity of infant illness, and less maternal absenteeism directly related to infant illness<sup>(53)</sup>. To be specific, among twenty-eight babies who were not experiencing any illness during the study period, the proportion of breast-fed babies was 86 %, which was significantly higher ( $P < 0.005$ ) than that of formula-fed babies (14 %). Another example was infant illness episodes causing one-day-absence. Among forty infant illness episodes causing one-day-absence, the proportion of breast-feeding mothers was 25 %, which was significantly lower ( $P < 0.05$ ) than that of mothers using formula (75 %). Overall, these results suggested that employers also benefited from offering a workplace breast-feeding support programme to employees.

### Qualitative results

Two mixed methods studies<sup>(43,44)</sup> and three qualitative studies<sup>(40,41,54)</sup> reported qualitative findings on workplace breast-feeding programmes. Sahip *et al.* reported that the programme (educating expectant fathers) enhanced the confidence of new parents to feed babies in a way they thought was right; however, some mothers reported they

were stressed by their husbands' suggestions<sup>(43)</sup>. Yimyan *et al.*<sup>(44)</sup> reported positive comments from breast-feeding mothers who reported feeling supported, reduced family costs and healthier infants as well as comments from management who reported feeling positive about being able to support breast-feeding employees<sup>(44)</sup>. The results of the two qualitative studies indicated that mothers have varied experiences in combining breast-feeding and employment, and many barriers still needed to be addressed even after implementing a workplace programme, including time, space and understanding from colleagues and supervisors<sup>(41,54)</sup>. One study<sup>(40,52)</sup> highlighted that although employers had put effort in supporting breast-feeding, many barriers still existed for working mothers to feel comfortable to practise breast-feeding.

## Discussion

This review set out to critically analyse the literature on workplace interventions to support breast-feeding and to assess their effectiveness in improving breast-feeding outcomes. There were no randomised controlled trials and study designs were limited to non-randomised controlled trials, cross-sectional studies and a retrospective cohort study. The results from the set of meta-analyses suggest that workplace programmes are effective in supporting breast-feeding among employed mothers, and partners of employed fathers, in terms of breast-feeding duration, proportions of exclusive breast-feeding and any breast-feeding. These results build on previous reviews which concluded that the workplace is an important and potential place to situate supportive breast-feeding programmes to improve breast-feeding practice<sup>(32,55)</sup>. To the best of our knowledge, the present study represents the first time that meta-analysis has been used to investigate the effectiveness of workplace interventions for supporting breast-feeding. The positive results are encouraging, although cautiously so. High heterogeneity in the meta-analyses of single-arm studies, the small number of studies included in the meta-analyses and overall low-quality design of the included studies means that the results identify promising interventions but definitive recommendations for workplace programmes cannot be made.

The meta-analysis results, across a range of measures, highlight the potential for improving breast-feeding outcomes for employees. In terms of the rate of any breast-feeding for the single-arm studies included in the meta-analysis, all delivered in the USA, the pooled effect size suggests 76% of participants in workplace programmes ( $n$  6 studies) were breast-feeding at 6 months. The individual studies reported proportions ranging from 58 to 88%, with five of the studies indicating higher proportions (between 69 and 88% of mothers) that are of public health significance when compared with the general prevalence (55%) in that country. These comprehensive

programmes<sup>(46–51)</sup> shared common programme components, in that they all included the provision of breast milk expression facilities and incorporated a group component, in the form of either group education or support group. Four of these six studies<sup>(46,48–50)</sup> also provided employees with a dedicated breast-feeding room.

Furthermore, while the three non-randomised controlled studies suggested that those participating in workplace programmes were more likely to exclusively breast-feed, the pooled result should be interpreted with caution given each of the programme components and contexts was quite different despite low statistical heterogeneity. The programme delivered in Turkey was a comprehensive education programme for expectant fathers, in which there were six sessions, lasting 3–4 h per session<sup>(43)</sup>. The programme delivered in Thailand was a multi-component breast-feeding support programme offering working mothers group education, individual consultations, breast milk expression facilities and breast-feeding breaks<sup>(44)</sup>. Another study in Turkey investigated the improvement of laws regulating maternity law, including leaving work 3 h earlier in the first 6 months after delivery and 1 1/2 h earlier in the following 3 months, withdrawing night shifts from the time of the pregnancy to 24 months after delivery, and provision of 16 weeks of paid leave and optional unpaid leave of 24 months<sup>(42)</sup>.

In addition to those programmes reported in the included studies for this review, there were also several innovative programmes that were retrieved in the search but were excluded for not reporting outcomes of interest. These may be useful for employers looking for innovative ideas for workplace breast-feeding programmes, which could be tested in future research. One study<sup>(56)</sup> reported on the development of a comprehensive information kit to combine breast-feeding and paid employment which was distributed across Australia. A set of distribution strategies were implemented with the use of current employer networks including targeting industries with the highest proportion of females in their workforce; targeting human resource managers, Chief Executive Officers, union representatives; media promotion of the project; internet searching for target employers; newsletters/journals of some industry organisations; and curating project materials on the Australian National Breastfeeding Strategy website. Another study<sup>(57)</sup> made use of existing employee benefit systems, in which employees accumulated points for conducting healthy behaviours, which were then exchanged for benefits, such as paid leave. In this way, healthy behaviours were encouraged. As an extension, the study reported adding breast-feeding as a new option which led to 152 employees logging breast-feeding activities, with an average duration of 12 weeks per employee. A further, recently described large-scale programme<sup>(58)</sup> was implemented across different companies with a focus on industries with a larger proportion of women in the workforce. Companies with an existing lactation programme were identified as



mentor businesses and assigned to those without a lactation programme (mentee businesses)<sup>(58)</sup>. Mentor businesses helped mentee businesses to establish new policies or interventions for supporting employee breast-feeding. One further excluded study reported that the Nevada Health Division implemented a policy enabling employees to bring new babies to work, which was simple and low cost to employers<sup>(59)</sup> and while this report did not meet the inclusion criteria for the review (as it was a single case study), it highlights outcomes which may be important to employers.

It is of value to establish evidence that employers can benefit from supporting breast-feeding among employees and to further set policies and laws in place. Only one included study reported on infant outcomes and concluded lower child-related maternal absenteeism with a workplace breast-feeding programme. This is important as employers often make decisions on workplace policies or interventions based on cost and this finding highlights another advantage of a workplace programme to support breast-feeding<sup>(60)</sup>. Including more of these employer-centred outcomes, such as infant health, maternal health and child-related parental leave, would be of interest in future research.

The strengths of this review are the comprehensive search strategy across both health and business databases, the inclusion of all intervention study designs, with no restriction on language or date. Independent researcher screening, data extraction and appraisal of studies provide confidence in the robustness of the methods. However, a few limitations should be noted, most significant being that eligible studies were generally low to moderate in quality, and many of the studies in the meta-analyses were single-arm studies with no comparison. In addition, the number of studies able to be included in the meta-analyses was limited. All included studies reported at least one positive outcome, raising the potential for publication bias as workplace programmes with negative effects were not identified as eligible for inclusion. Therefore, the results could potentially overestimate effectiveness. An assessment of publication bias was not possible due to varied outcomes from included studies. Finally, not all studies in the meta-analysis measured the outcomes in the same way but were treated as if they were. Measuring outcomes in different ways also resulted in the exclusion of some studies in the meta-analysis. While a meta-analysis allowed the pooling of results where the same outcomes were reported, we acknowledge that the lack of robust study designs and variability across the pooled studies (reflected in the high heterogeneity) means that there is uncertainty in these results. However, these results are still of value in establishing guidance to those wishing to develop effective programmes to promote breast-feeding in the workplace setting, and those interested in developing robust study designs to provide more certainty about effectiveness. Until more rigorous studies are conducted to better

evaluate the effectiveness of these interventions, the results provide some useful evidence relating to the research question.

## Conclusion

Workplace programmes play an important role in promoting breast-feeding among employed mothers and partners of employed fathers. The meta-analysis demonstrates a non-causal association between group components, provision of breast-feeding facilities and space and improved breast-feeding outcomes. Further, high-quality research on the effectiveness of these workplace interventions to improve breast-feeding practice is essential to direct human resource and public health practitioners to implement programmes that meet the needs of mothers, infants and the employers.

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## Supplementary material

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