



Scott, Sarah and Pritchard, Catherine and Szatkowski, Lisa (2016) The impact of breastfeeding peer support for mothers aged under 25: a time series analysis. *Maternal and Child Nutrition* . ISSN 1740-8709

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1 **The impact of breastfeeding peer support for mothers aged under 25: A time series**  
2 **analysis**

3

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12

13 **RUNNING TITLE:** Impact of breastfeeding peer support

14

15 **WORD COUNT:** 3,246

16 **NUMBER OF REFERENCES:** 33

17 **NUMBER OF TABLES:** 2

18 **NUMBER OF FIGURES:** 2

19

20

21 **ACKNOWLEDGEMENTS:** This study was performed with the support of Nottingham  
22 City Council and Nottingham CityCare Partnership. We thank Nottingham CityCare  
23 Partnership for providing the infant feeding data required for this study.

24

1 **FUNDING:** This study was undertaken as part of a Master of Public Health dissertation.  
2 Nottingham City Public Health (Nottingham City Primary Care Trust and Nottingham City  
3 Council) funded the lead author to complete this MPH programme. No further funding was  
4 secured for this study.

5

6 **CONFLICT OF INTEREST STATEMENT:** Sarah Scott, in her professional role with  
7 Nottingham City Council, is the commissioner of the breastfeeding peer support service  
8 evaluated in this study. Catherine Pritchard and Lisa Szatkowski have no conflicts of interest  
9 to disclose.

10

11 **CONTRIBUTORSHIP STATEMENT:** Sarah Scott conceptualised and helped design the  
12 study, carried out the data analysis, drafted the initial manuscript, contributed to subsequent  
13 versions and approved the final manuscript as submitted. Catherine Pritchard conceptualised  
14 and helped design the study, critically reviewed and revised the manuscript, and approved the  
15 final manuscript as submitted. Lisa Szatkowski helped design the study, supported the data  
16 analysis, critically reviewed the manuscript, and approved the final manuscript as submitted.

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1 **ABSTRACT**

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4 Breastfeeding is known to have positive health benefits for babies and mothers, yet the UK  
5 has one of the lowest breastfeeding initiation rates in Europe. Despite national guidance that  
6 recommends provision of breastfeeding peer support, there is conflicting evidence regarding  
7 its effectiveness, especially in high income countries, and a lack of evidence amongst young  
8 mothers. This study evaluates the effectiveness of a breastfeeding peer support service  
9 (BPSS) in one UK city in increasing breastfeeding initiation and duration in young mothers.  
10 Routinely-collected data were obtained on feeding method at birth, two and six weeks for all  
11 5,790 women aged <25 registered with a local general practitioner and who gave birth from  
12 April 2009 to September 2013. Segmented regression was used to quantify the impact of the  
13 introduction of the BPSS in September 2012 on the prevalence of breastfeeding at birth, two  
14 and six weeks, accounting for underlying trends. Results showed that breastfeeding  
15 prevalence at birth and two weeks began to increase month-on-month after the introduction  
16 of the BPSS, where previously figures had been static; prevalence at birth increased by 0.55  
17 percentage points per month (95%CI 0.10-1.00,  $p=0.018$ ) and at two weeks by 0.50  
18 percentage points (95%CI 0.15-0.86,  $p=0.007$ ). There was no change from an underlying  
19 marginally increasing trend in prevalence at six weeks. In conclusion, our findings suggest  
20 that a one-to-one breastfeeding peer support service provided by paid peer supporters and  
21 targeted at young mothers in the antenatal and postnatal periods **may be beneficial in**  
22 increasing breastfeeding initiation and prevalence at two weeks.

23

24 **KEY WORDS:** breastfeeding, peer support, health promotion, time series

1 **INTRODUCTION**

2

3 Breastfeeding promotes and protects the health of infants and mothers (Ip et al. 2007; Horta  
4 et al. 2007) and exclusive breastfeeding is recommended for the first six months of an  
5 infant’s life (World Health Organisation 2003). Studies have also shown an association  
6 between breastfeeding and improved cognitive development and academic attainment in later  
7 childhood (Horta et al. 2007; Victora et al. 2015). A recent review concluded that  
8 investments into evidence-based breastfeeding interventions could see a return on investment  
9 in as little as one year (Renfrew, Pokhrel, et al. 2012).

10

11 Many European countries including Sweden, Norway and Denmark have breastfeeding  
12 initiation rates between 90% and 100% (Organisation for Economic Co-Operation and  
13 Development 2009), compared to just 73.9% in England (Department of Health 2013). Just  
14 over a third of mothers in England are still breastfeeding at six months with the greatest drop  
15 in prevalence occurring during the first two weeks following birth (Health and Social Care  
16 Information Centre 2012a). Factors positively associated with breastfeeding prevalence at six  
17 weeks in the UK Infant Feeding Survey include being of non-White ethnicity, being aged 30  
18 or more and being a mother from a managerial or professional occupation (Health and Social  
19 Care Information Centre 2012b). Common reasons that mothers give for stopping  
20 breastfeeding during the first two weeks post-partum include the baby not sucking and  
21 painful nipples (Health and Social Care Information Centre 2012a); these issues are likely to  
22 be due to poor positioning and attachment to the breast. Amongst teenage mothers, negative  
23 moral norms about breastfeeding and embarrassment of breastfeeding in public are key  
24 barriers to breastfeeding (Dyson et al. 2010; Ingram et al. 2008).

25

1 Improving breastfeeding rates is a national priority in the UK (Department of Health 2012)  
2 and National Institute for Health and Care Excellence (NICE) guidance recommends  
3 breastfeeding peer support (BPS) as an effective intervention for achieving this(National  
4 Institute for Health and Care Excellence 2008). BPS is defined as support with breastfeeding  
5 that is provided by trained peers rather than a health professional. The peer supporter is  
6 usually from the same area and/or socioeconomic background as the new mother and has  
7 breastfed herself (Dyson et al. 2005). Despite this recommendation to provide BPS, there is  
8 conflicting evidence regarding the effectiveness of the intervention and a lack of evidence for  
9 those women least likely to breastfeed, including young mothers (Britton et al. 2007).

10

11 A Cochrane systematic review found that mothers who received BPS were significantly less  
12 likely to stop breastfeeding before six months than those who had not received this  
13 intervention (Renfrew, McCormick, et al. 2012); however, more than half of the studies  
14 included in this review were judged as having a high risk of bias due to inadequate or lack of  
15 blinding. A second systematic review and meta-analysis concluded that although BPS  
16 increased duration of breastfeeding in low or middle income countries, it had no significant  
17 impact in high income countries, including the UK (Jolly et al. 2012). However, the authors  
18 acknowledged that the effect of high intensity BPS (defined as five or more contacts) in the  
19 UK is unknown. The majority of published evaluations of BPS have been conducted in North  
20 America (Arlotti et al. 1998; Martens 2002; Kruske et al. 2007) so findings may not be  
21 transferable to the UK due to differences in what constitutes routine maternal care. An  
22 evaluation of BPS in Glasgow, Scotland, found that women who had received support were  
23 almost twice as likely to breastfeed than those who did not receive support (McInnes et al.  
24 2000). Other BPS evaluations undertaken within the UK generally conclude that BPS is

1 beneficial, although sample sizes are small (Ingram et al. 2005; Ingram 2013; Alexander et al.  
2 2003).

3

4 The Breastfeeding Peer Support Service (BPSS) evaluated here launched in September 2012.

5 The service serves an urban city which is the 20th most deprived authority in England

6 (Nottingham Insight 2014), where 68.9% of babies are breastfed at birth, lower than the

7 England average of 73.9% (Department of Health 2013). In 2012/13, the prevalence of

8 breastfeeding at six weeks amongst Nottingham mothers was 46.4% (Department of Health

9 2013). Similar to the pattern seen nationally, younger mothers resident in this city are less

10 likely to breastfeed than their older counterparts (Nottingham Insight 2012). The BPSS

11 therefore targets young mothers less than 25 years of age, which distinguishes it from other

12 interventions previously evaluated. The underlying philosophy of the service model is based

13 on the Social Cognitive Theory in that it aims to influence breastfeeding self-efficacy through

14 empowerment, role modelling and positive reinforcement (Bandura 2001). In order to be

15 influential role models, peer supporters are recruited from and reflect the diversity of the

16 community in which they work; they are women who have previously breastfed themselves.

17 The supporters receive externally accredited breastfeeding peer support training prior to

18 supporting women. Paid peer supporters offer intensive one-to-one support from 30-34 weeks

19 gestation until six weeks post-partum, with the highest intensity of support provided during

20 the two weeks following birth (Figure 1). Other characteristics of the Nottingham BPSS

21 include: proactively contacting all eligible women; offering a home visit to new mothers

22 within 24-48 hours of their transfer home; offering ongoing, responsive support (face to face

23 or telephone) according to women's individual needs; peer supporters having regular

24 supervision and access to a health professional for consultation; integration with midwifery,

25 health visiting and children's centres.

1 The purpose of this study was to evaluate the effectiveness of the Nottingham BPSS in  
2 increasing breastfeeding initiation and duration in mothers under 25 years of age.

3

4

5 [INSERT FIGURE 1 HERE]

6

7

## 8 **METHODS**

9

### 10 **Data sources**

11

12 Data from the Nottingham Child Health Information System (CHIS) (routine data collected  
13 by the service provider) were obtained. This dataset comprised information for all women  
14 aged <25 years at the date of delivery registered with a Nottingham general practitioner (GP)  
15 who gave birth to a live baby from 1<sup>st</sup> April 2009 until 30<sup>th</sup> September 2013, with recorded  
16 data on feeding method at birth, two weeks and six weeks. Health visitors collected data on  
17 infant feeding at birth by asking mothers retrospectively during a post-natal home visit at two  
18 weeks post-partum. Infant feeding data at two and six weeks were gathered from health  
19 visitor observation at the routine two and six week home visits.

20

21 Since 2008, all Primary Care Trusts (PCTs) in England and now CHIS providers have been  
22 required to submit quarterly data on breastfeeding prevalence at six weeks to the Department  
23 of Health as part of the Vital Sign Monitoring Return (Department of Health 2013). These  
24 data have to meet quality assurance criteria and validation checks are conducted. Nottingham  
25 data have consistently met these standards.



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The primary outcome measures were breastfeeding prevalence at birth, two and six weeks post-partum. As the aim of the BPSS is to increase *any* breastfeeding, outcome measures focus on this rather than on exclusive breastfeeding. A small amount of feeding data at birth, two weeks and six weeks were missing (3.9%, 3.7% and 0.1% respectively). Some of these missing values were imputed when there was high confidence in what those data were. For example, if a mother was breastfeeding at birth and six weeks but data were missing for two weeks, then it was assumed that she was breastfeeding at two weeks. Prior to September 2010, if an infant was fed any breast milk, then data were recorded as ‘Breast/Breast and Bottle’. This changed in September 2010, so that three feeding options were recorded (‘Breast’, ‘Bottle’ or ‘Mixed’). Thus, data that were recorded as either ‘Breast/Breast and Bottle’ or ‘mixed’ were replaced with ‘Breast’, as these infants were receiving some breast milk. This was deemed appropriate given the focus on *any* breastfeeding rather than *exclusive* breastfeeding. This variable was then converted to a binary variable in which ‘Breast’ was coded as ‘1’ and ‘Bottle’ as ‘0’. Breastfeeding prevalence was calculated for each feeding outcome at each month during the study period.

All data were anonymised by the service provider prior to transferring to the authors for analysis. The study was approved by the service provider’s Information Governance Department and the University of Nottingham’s Division of Epidemiology and Public Health Research Ethics Committee.

**Statistical analyses**

1 Following recognised procedures (Wagner et al. 2002; Cochrane Effective Practice and  
2 Organisation of Care Group 2013), interrupted time series models using segmented  
3 regression were built for each of the three primary outcomes to quantify any immediate  
4 increase or decrease, or change in trend, in breastfeeding prevalence at the point the BPSS  
5 was introduced relative to beforehand, whilst controlling for the pre-intervention trend and  
6 any underlying seasonal pattern. As the BPSS launched in September 2012, the start of  
7 October 2012 was considered to be the appropriate change point in the time series. This  
8 allowed one month for the service to start becoming embedded before we expected to see any  
9 changes in infant feeding outcomes.

10 A backwards regression procedure using the Likelihood Ratio Test was used to build a  
11 parsimonious model containing only parameters with statistically significant  $p$  values ( $<0.05$ )  
12 to ensure non-significant variables were not impacting on the magnitude and significance of  
13 other variables in the model. Examination of the autocorrelation function of model residuals  
14 showed that autocorrelation had been adequately modelled in the data.

#### 15 *Sensitivity analysis*

16 Sensitivity analyses were conducted to verify that the imputation of some outcome data, as  
17 described earlier, had not altered the findings. Segmented regression analysis was conducted  
18 for each outcome using the original data prior to imputation. The results using the non-  
19 imputed data were compared to the results when imputed data were used. The sensitivity  
20 analyses showed no difference in findings and so, for conciseness, these results have not been  
21 presented.

22 All analyses were completed using STATA version 12.0 (STATA Corp, College Station, TX,  
23 USA).

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## RESULTS

345 women accessed the BPSS between October 2012 and September 2013, 29% of the eligible population. Access steadily increased throughout the study period from 4% of the eligible population in October 2012 to 61% by September 2013. The median number of contacts per client was 6 (IQR 3-9). Table 1 details the characteristics of all women in the target age group during the study period (October 2009 to September 2013) and also those who accessed the BPSS after its introduction in October 2012.

[INSERT TABLE 1 HERE]

Table 2 shows the final, parsimonious, segmented regression models fitted to identify whether the introduction of the Nottingham BPSS had either an immediate or longer term impact on breastfeeding prevalence at birth, two and six weeks.

[INSERT TABLE 2 HERE]

Prior to the introduction of the BPSS, the proportion of mothers giving birth each month who breastfed at birth and were feeding at two weeks showed no month-on-month change; the baseline trend for breastfeeding at six weeks was increasing by 0.09% (95% CI 0.02-0.17) per month prior to the introduction of the BPSS. There was no immediate change in the proportion of women who breastfed at birth, two weeks or six weeks following the

1 introduction of the BPSS. However, the breastfeeding prevalence at birth and at two weeks  
2 begun to increase by 0.55% (95% CI 0.10-1.00) and 0.50% (95% CI 0.15-0.86) per month  
3 respectively. **By the end of the study period this translated to an additional 6.6 women per**  
4 **100 giving birth per month who initiated breastfeeding and an additional 6 per 100 who were**  
5 **breastfeeding at two weeks compared to the pre-intervention period.** There was no significant  
6 change in the pre-intervention trend for breastfeeding at six weeks after the introduction of  
7 the BPSS. The original time series graphs which include the fitted models for each outcome  
8 are illustrated in Figure 2.

9  
10

11 [INSERT FIGURE 2 HERE]

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## 14 **DISCUSSION**

15  
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17 This study is, to the best of our knowledge, the first quantitative evaluation using time series  
18 analysis of a BPSS targeted at younger women in the UK. Our results show that breastfeeding  
19 prevalence at birth and two weeks among mothers aged under 25 began to increase month-  
20 on-month after the introduction of the BPSS, where previously the prevalence had been static  
21 over time. However, there was no change from an underlying marginally increasing trend in  
22 breastfeeding prevalence at six weeks.

23 It is generally accepted that randomised controlled trials (RCTs) are the gold standard of  
24 experimental designs. However, this study was a post-hoc evaluation of the implementation  
25 of a new service where a RCT was not planned or conducted as part of the initial  
26 implementation. Segmented regression analyses of a time series is the strongest quasi-  
27 experimental design for evaluating the impact of interventions and is ideal for evaluating

1 non-randomised community interventions (Wagner et al. 2002). The method is powerful as it  
2 accounts for the pre-intervention magnitude and trend in the data (Cochrane Effective  
3 Practice and Organisation of Care Group 2013) This study therefore provides stronger  
4 evidence on the effect of BPS on infant feeding outcomes than those previous studies which  
5 have compared breastfeeding prevalence before and after the intervention without  
6 considering secular trends. However, we acknowledge that there are some limitations with  
7 our data and analysis.

8 Feeding outcomes at birth were self-reported and thus there was potential reporting bias in  
9 the data analysed; mothers who accessed the service may have been more likely to give  
10 socially-desirable responses than women who had not accessed the service, resulting in an  
11 overestimation of the intervention effect at birth. However, as the BPSS only contacted  
12 mothers post-natally who were reported by a midwife as having initiated breastfeeding, the  
13 risk of bias is considered to be minimal. The risk of bias in the recording of feeding outcomes  
14 at two and six weeks is lower as these are based on observation of feeding behaviour.

15 There is a risk of confounding in a time series analysis if other factors related to the outcome  
16 change at the time of the intervention. The UNICEF Baby Friendly Initiative (UNICEF UK  
17 2015) and Family Nurse Partnership (National Health Service 2015) commenced in the study  
18 area several years prior to the introduction of the BPSS and, therefore, the effects of these  
19 would likely have been accounted for in the baseline trend. The 'Be A Star' (Be A Star 2015)  
20 social marketing campaign, which aims to shift community norms around breastfeeding, was,  
21 however, launched in Nottingham in October 2012. It is possible that this intervention  
22 contributed to the effects found in this study. However, we believe this contribution is likely  
23 to be minimal as community cultural norms are unlikely to have changed quickly. Evidence  
24 suggests that there are complex, multifactorial influences on a mother's decision and ability  
25 to breastfeed (Dyson et al. 2005). The study design did not allow for the exploration of

1 cultural influences and attitudes to breastfeeding and the impact these had on the outcomes of  
2 the intervention.

3 Intervention effects may have been underestimated as women who gave birth during the first  
4 six to ten weeks of the study period would not have benefited from the full service offer as  
5 they would have already passed the gestation for an antenatal contact. Also, only 29% of the  
6 eligible population accessed the service during the study period which may have limited the  
7 intervention effect. The gradual increase in reach over time was as expected as the service  
8 became embedded in the community and newly recruited and trained peer supporters  
9 developed in skills and experience. Towards the end of the study period, reach became  
10 similar to that of the Bristol BPSS (47%), where peer supporters also directly contacted all  
11 pregnant women in the target group (Ingram 2013). Further analysis using time series  
12 analysis would be useful to identify the longer term impact once the service was fully  
13 embedded.

14 The statistically significant increase in breastfeeding prevalence at two weeks post-partum  
15 demonstrates the success of the BPSS in supporting mothers during these most challenging  
16 two weeks. The UK Infant Feeding Survey found that when women experienced  
17 breastfeeding problems, those who did not receive help were more likely to have stopped  
18 breastfeeding within the first two weeks than those who received support (27% compared  
19 with 15%) (Health and Social Care Information Centre 2012a). This BPSS demonstrates this  
20 in practice, strengthening the evidence of effectiveness of BPS during the first two weeks  
21 post-partum.

22 Given the month-on-month increase in breastfeeding prevalence at birth and two weeks  
23 following the introduction of the BPSS, one might expect there to also be some increase in  
24 the trend at six weeks, given that the greatest drop off occurs during the first two weeks post-

1 partum. One potential explanation for not finding this is that, as breastfeeding prevalence  
2 gradually reduces from the time of birth, any impact on breastfeeding at six weeks might be  
3 smaller than that at two weeks. It is, therefore, possible that the study was not sufficiently  
4 powered to detect changes at six weeks. Secondly, as the service aims to provide the most  
5 intense support during the two weeks after birth, it is plausible that the intervention was not  
6 of sufficient intensity to impact breastfeeding prevalence following this time point. This  
7 positive effect on breastfeeding outcomes at birth and two weeks, yet lack of effect at six  
8 weeks is similar to that found by other studies (McInnes et al. 2000; Agboado et al. 2010).  
9 The programmes in these studies also included antenatal and postnatal support and were of  
10 higher intensity during the first two weeks post-partum.

11 The findings from this study are interesting given the consistent negative findings of UK-  
12 based RCTs of the effectiveness of BPS (Jolly et al. 2012). This may be because of the  
13 heterogeneous nature of BPS interventions. A systematic review and meta-analysis of the  
14 effect of setting (low, middle or high income country), intensity and timing of BPS found that  
15 low intensity BPS (defined as less than five contacts) was found to have little effect. Three of  
16 the four UK trials in this review were interventions of low intensity. However, the  
17 Nottingham BPSS was of higher intensity which might explain the tentatively positive  
18 findings. The Nottingham BPSS is contracted to deliver a service based on best practice  
19 guidance and alignment with BFI standards (National Institute for Health and Care  
20 Excellence 2008). The proactive approach, the provision of a face to face contact within 48  
21 hours of the birth, ongoing needs-led support and successful integrated working with  
22 midwifery and health visiting are all important best practice features of the intervention,  
23 which might help explain its apparent positive impact.

24 It is possible that the personal attributes of the peer supporters, including the fact that they  
25 were local women of similar socioeconomic backgrounds to those they were supporting,

1 contributed to the impact of the intervention. It would be useful to explore this further  
2 through qualitative research to understand the specific elements of the intervention that  
3 contributed to its effectiveness.

#### 4 **CONCLUSION**

5  
6 This study makes an important contribution to the evidence base on the effectiveness of  
7 breastfeeding peer support, using a novel methodology. Findings have shown that an  
8 intensive one-to-one BPSS provided by paid peer supporters in both the antenatal and  
9 postnatal periods may be beneficial in increasing breastfeeding initiation and duration until  
10 two weeks amongst younger mothers. The lack of impact on breastfeeding prevalence at six  
11 weeks suggests that intensive BPS may need to continue beyond two weeks in order to see  
12 longer term effects on breastfeeding prevalence, although this requires further exploration.  
13 Further analysis using time series methods would be useful to identify the longer term impact  
14 once the service is fully embedded, and a process evaluation would help to determine the  
15 mechanism of action of the intervention and to identify any implementation issues. An RCT  
16 might be considered in the longer term to formally evaluate the effectiveness and cost-  
17 effectiveness of the BPSS.

18

#### 19 **KEY MESSAGES**

20 Increasing maternal age is positively associated with breastfeeding in the UK. Breastfeeding  
21 peer support is recommended in national guidance. However, there is conflicting evidence on  
22 its effectiveness, particularly in high income countries, and a lack of evidence among mothers  
23 aged <25. Our time series analysis of routinely-collected service monitoring data suggests  
24 that one-to-one breastfeeding peer support provided by paid peer supporters to mothers aged  
25 <25 may be beneficial in increasing breastfeeding initiation and breastfeeding at two weeks.



1 Further analysis, potentially including a randomised-controlled trial of the intervention, is  
2 now recommended.

3

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1 **FIGURE AND TABLE LEGENDS**

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3 **Figure 1:** An illustration of key contacts with pregnant and new mothers aged <25 provided  
4 by the BPSS

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6 **Table 1:** Characteristics of all mothers aged <25 who gave birth to a live infant, and those  
7 who accessed the BPSS

8

9 **Table 2:** Changes in the prevalence of breastfeeding pre- and post-introduction of the BPSS  
10 (parameters with 95% confidence intervals and p values)

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12 **Figure 2:** Percentage of mothers aged <25 who breastfed at birth, two and six weeks post-  
13 partum: original data (solid lines) and fitted model (dashed lines)

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