

RESEARCH MANUSCRIPT

The Road To Maternal Responsiveness Is Paved With Good Intentions:

An Investigation into the Relative Effects of Breastfeeding Intention and Practice on
Observed Maternal Responsiveness after Birth.

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Abstract

OBJECTIVE The aim of this study was to investigate the differential effects of breastfeeding practice and having an intention to breastfeed (during pregnancy) on a mother's maternal responsiveness to her infant after birth.

METHODS Using longitudinal data from a subsample of 962 mother-infant dyads from a UK cohort study (Avon Longitudinal Study of Parents and Children), we investigated the influence of intention to breastfeed at 3 months pregnancy and breastfeeding practice and on mother-infant interactions at 12 months after birth. Breastfeeding intent and practice were assessed by questionnaires administered to the mothers. Intention to breastfeed in the first 3 months postpartum was measured at 32 weeks into the pregnancy, while breastfeeding practice (over first 12 months postpartum) was measured retrospectively at 15 months postpartum.

RESULTS Using logistic regression analyses, we found that intending to breastfeed at 32 weeks gestation significantly predicted maternal responsiveness, namely that an intention to breastfeed increased the odds of positive maternal responsiveness, independently of breastfeeding practice. However, we found the practice of breastfeeding was not an independent predictor of positive maternal responsiveness once intention to breastfeed was accounted for. Using a life course epidemiology approach we further demonstrated that maternal responsiveness is most positive when both the intention to breastfeed and breastfeeding practice are present.

CONCLUSIONS To our knowledge this is the first study to report that having the intention to breastfeed an infant is more strongly associated with positive maternal responsiveness than the act of breastfeeding itself. This may suggest that more responsive mothers choose to

breastfeed rather than breastfeeding practice directly *causing* enhanced responsiveness.

Further research will be needed to understand the nature of this intention and its relationships with maternal responsiveness. However, the results may also highlight the potential importance of parenting intentions/ preparations during pregnancy for a mothers developing abilities to be responsive to her infant after birth.

Background

Sensitivity is one of the key constructs of attachment theory ¹. Ainsworth and colleagues (1978) defined maternal sensitivity as a mother's ability to perceive and interpret accurately her infant's signals and communications and then respond appropriately. Subsequent research on maternal sensitivity has led to reworking of the definition to include: dynamic processes involving maternal abilities, reciprocal give and take with the infant, contingency on the infant's behaviour and quality of maternal behaviours ². Empirical research has identified sensitivity as an important but not exclusive predictor of secure attachment ^{3,4}. Related to the aforementioned finding, the causal role of maternal response on infant brain development has been directly demonstrated in non-human animal research ⁵. Determining the factors which influence maternal sensitivity is therefore an important scientific endeavour and will also be advantageous from a clinical perspective in assisting health professionals when offering advice to parents on how to optimise sensitive care giving.

Observations of mothers showing positive behavioural responses towards their infants (maternal responsiveness) provide a core index of maternal sensitivity. There is evidence that this component of maternal sensitivity is associated with the later emotional, cognitive and physical development of the infant ^{3,6}. Further understanding of the factors associated with maternal responsiveness could, therefore, inform programmes aimed at promoting healthy child development with breastfeeding as a potentially important consideration. The widespread physiological benefits of breastfeeding for the child continue to be well documented ^{7,8}. In light of the evidence The World Health Organization (WHO) recommends six months of exclusive breastfeeding for the infant to benefit from the positive effects of breastfeeding on child physical health. Whether breastfeeding is related to more positive maternal responses remains undetermined. Much of the research into the influence of breastfeeding on the

mother-infant relationship to date has focussed on infant development or infant attachment (rather than maternal sensitivity or responsiveness)^{9, 10} and although a positive relationship between breastfeeding and maternal sensitivity is often advocated, this claim is often not supported by empirical evidence¹¹. Theoretically, breastfeeding may enhance human maternal sensitivity via a number of different mechanisms. Suckling stimulates the endocrine system to release oxytocin and prolactin and animal research suggests these hormones play an essential role in promoting indices of maternal sensitivity in animals such as licking and grooming^{12, 13}. Alongside the noted biological effects of breastfeeding that may promote maternal care-giving, behavioural aspects of breastfeeding may encourage secure infant attachment for example, increased sensory interactions through touch¹⁴. In addition breastfeeding has been shown to positively affect maternal emotion which may in turn promote maternal sensitivity¹⁵. Another explanation for the association between breastfeeding and maternal sensitivity might be that mothers who choose to breastfeed are by their nature more maternally sensitive. Few studies have investigated the characteristics of women who choose to breastfeed in this context.

As a result of a review of the literature four studies were identified that directly tested the relationship between breastfeeding and maternal sensitivity. Britton and colleagues (2006) investigated the relationship between breastfeeding intent (prenatally), breastfeeding practice (initiation and duration), maternal sensitivity and infant attachment. Maternal sensitivity was measured via observational ratings of the quality of the mother-infant from videotape footage at 3 and 6 months. Both breastfeeding intent and breastfeeding practice were found to positively correlate with maternal sensitivity; however the independence of these associations was not tested¹⁶. Another study demonstrated that breastfeeding is associated with enhanced sensitivity in mothers attention to infant distress compared to those

who bottle fed and this difference emerged only after birth once feeding had commenced¹⁷. Conversely, Drake and co-workers (2007) examined potential predictors of maternal sensitivity and found that breastfeeding did not significantly predict maternal sensitivity as rated by subjective reports but that self-esteem, satisfaction with life and number of children were significant factors¹⁸. In a recent neuroimaging study, Kim and colleagues (2011) demonstrated links between breastfeeding and mothers showing greater responses to infant cues in brain regions implicated in maternal-infant bonding and empathy during the early postpartum. The authors concluded that such brain activations may facilitate greater maternal sensitivity as infants enter their social world¹⁹.

A potentially confounding issue when studying the relationship between breastfeeding and maternal sensitivity concerns the factors which influence a mother's decision to breastfeed before the child is born. For example, Britton and colleagues (2006) found that intention to breastfeed prior to the child's birth predicted maternal sensitivity at 3 months postpartum. This raises an important question for future research, that is, whether breastfeeding per se enhances maternal sensitivity or if mothers who choose to breast feed have greater existing levels of maternal sensitivity compared to mothers who do not decide to breastfeed. Disentangling breastfeeding intention and breastfeeding practice requires large sample sizes as the two factors are likely to be highly correlated (i.e. those that intend to breastfeed usually do). Therefore, it is perhaps unsurprising that Britton et al., (2006) found both intention to breastfeed and breastfeeding practice predicted maternal sensitivity as measurements were obtained from the same women. To separate the effects of intention and practice, studies need to have sufficient numbers to include women in the rarer categories, that is those who had no intention to breastfeed but who went on to breastfeed,.

In the present study we aimed to investigate the differential effects of having the intention to breastfeed prenatally and breastfeeding practice on maternal responsiveness (measured postnatally). To overcome the limitations of previous studies, we used data from the Avon Longitudinal Study of Parents and Children (ALSPAC) (<http://www.bristol.ac.uk/alspac>). This longitudinal study collected data prospectively starting in pregnancy, including breastfeeding intention and a range of relevant confounding variables. It is sufficiently large to allow investigation of subgroups of women according to their breastfeeding attitudes and behaviour overtime thus allowing a life-course model-building approach to be used²⁴. This approach permitted us to test the effects of four groups of women which included those who had the intention to breastfeed (at 32 weeks gestation) and went on to practice breastfeeding, those who intended to breastfeed and did not go on to practice breastfeeding, those who did not intend to breastfeed and did go on to practice breastfeeding and those who did not intend to breastfeed and did not go one to practice breastfeeding. We hypothesised those women who intended to breastfeed and then went on to practice breastfeeding would show a greater proportion of positive maternal responses when compared to the other 3 groups. We also hypothesised that breastfeeding practice would be the critical factor in predicting higher levels of positive responses, i.e. those women who did not intend to breastfeed but went on to breastfeed would display more positive responsiveness than women who intended to breastfeed but did not go on to breastfeed (there are a number of reasons why a mother may be unable to breastfeed e.g. physical difficulties).

Method

Sample

The sample consisted of participants from the Avon Longitudinal Study of Parents and Children (ALSPAC). ALSPAC is an ongoing population based study investigating a wide range of environmental and other influences on the health and development of children. The core sample comprises 14 541 pregnant women who had been expected to deliver their infants between April 1, 1991, and December 31, 1992, from the former Avon region in the United Kingdom. Of this “core” cohort, 13,988 singletons/twins were alive at 12 months of age, 13,617 of these were singletons. The representative nature of the original ALSPAC sample has been explored by comparison with the 1991 National census data of mothers with infants under 1 year of age who were residents in the county of Avon. Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and the University of Exeter Ethics committee. For more detailed information on the ALSPAC study please refer to the website: <http://www.alspac.bris.ac.uk>

The current study involves a 10% subsample of the ALSPAC cohort children referred to as “Children in Focus”. This sample was selected from the final 6 months of ALSPAC births, occurring from 6th June-11th December 1992. The aim of these clinics was to examine the children in ways that cannot be done using questionnaires. Infants were brought to the clinic and participated in physical examinations, cognitive assessments and observations of behaviour. The representativeness of this sample compared with the sample who did not attend the clinics is presented in Table 1 (sample demographics table). At the 12-month Children in Focus clinic, 1,213 parent-infant pairs attended and 1,144 completed an observed

and videotaped mother-infant interaction from which a measure of maternal responsiveness was derived.

Measures

Outcome variable

Maternal responsiveness data were derived from the Thorpe Interaction Measure (TIM)²⁰, that was undertaken at the 12-month clinic. The TIM involved a mother and her child sharing a picture book. Mothers were asked to engage their child in this activity as they would at home and the duration of the interactions was approximately 5 minutes. During the interaction, the sensitivity of the mother's non-verbal behaviour towards her infant was rated. In the development of these measurements of behaviour, inter-rater reliability of at least kappa=0.6 across four raters was established for all categories of behaviour in the coding system described below. The ratings were provided by an independent trained researcher during the observation.

The focus of this study was on non-verbal rather than verbal maternal responses as these behaviours reflect the more instinctive and automatic responses that are most relevant to our hypotheses and that are less likely to be consciously controlled and susceptible to biases by the circumstance and social desirability. The behaviours coded in the non-verbal scale also compare to maternal responses used to code this core component of maternal sensitivity in other validated maternal sensitivity scales.

Table 1: Sample demographics

	Mothers who did not attend the clinics but who had a live singleton infant at 12 months (<i>n</i>=12,415)	Mothers who attended the clinic but had missing data (<i>n</i>=347)	Complete case sample (<i>n</i>=894)	<i>p</i>	Breastfeeding: intention YES Practice YES (<i>n</i>=441)	Breastfeeding: intention NO Practice YES (<i>n</i>=76)	Breastfeeding: intention YES Practice NO (<i>n</i>=182)	Breastfeeding: intention NO Practice NO (<i>n</i>=263)	<i>p</i>
Maternal age at delivery	28 (5)	28 (5)	29 (4)	<0.001	30 (5)	29 (5)	28 (4)	27 (4)	<0.001
Primiparous	44%	46%	47%	<0.001	43%	53%	62%	37%	<0.001
Education									
% with degree	14%	13%	16%	<0.001	24%	16%	9%	3%	<0.001
% with O-level/A-level	61%	64%	65%	<0.001	63%	63%	65%	61%	<0.001
% no or CSE only	16%	12%	8%	<0.001	13%	21%	24%	36%	<0.001
Pregnancy intended YES	69%	67%	77%	<0.001	74%	70%	72%	68%	<0.001

In addition there was little variance in verbal responses with 80% of mothers showing positive verbal responses. In previous studies verbal maternal responses have been considered as separate from the responses used to categorise maternal sensitivity²¹. From the data in ALSPAC, we have demonstrated the inter-rater reliability and predictive validity of the measure of non-verbal maternal responsiveness on later infant development. For example, positive maternal responses were independently associated with a 0.3 standard deviation increase in experimenter assessed infant development assessment scores at 18 months even after controlling for mother and preceding infant developmental variables²².

Mother's non-verbal behaviour towards the infant was categorised as positive, neutral or negative. Examples of positive non-verbal responses included observations of stroking, kissing, making eye contact with the infant or smiling at the infant. Behaviour was categorised as neutral if no observations of positive or negative behaviour was seen and the mother was non-responsive. Negative non-verbal responses included avoidance of the infant's eye gaze, poking or pushing the infant. Negative behaviours were rare and we would argue that combining negative and neutral behaviours was inappropriate because these responses may be qualitatively different. For example, neutral responses are defined by non-responsive behaviour whereas negative responses involve an active response. Therefore, we did not include negative responses in analyses. For analyses scores were coded as positive = 1 and neutral = 0

Exposure Variables: breastfeeding practice and breastfeeding intention.

Information on how the mother intended to feed her baby in the first 3 months postpartum was obtained through questionnaire completed at 32 weeks gestation. Response categories were breast, bottle, breast & bottle or uncertain. For the initial main effects analysis, we created three breastfeeding intention groups, Yes/Maybe/No. The "yes" group corresponded

to the breast category, the “no” group corresponded to the bottle category and the “maybe” group was created by collapsing across the breast & bottle and uncertain categories.

Information on breastfeeding practice was acquired through the mothers’ completion of questionnaires on their feeding methods at 15 months post partum. When asked about duration of breastfeeding, possible responses were never, less than 3 months, 3-5 months or 6 months plus. These groups were used in the logistic regression analysis.

Confounding Variables.

Variables that have been previously show to be associated with breastfeeding and maternal responsiveness were derived from questionnaires completed by mothers during the prenatal period and the first year postpartum. These included maternal age (in years), highest maternal education (Lowest level of education or none, High School Level education [O-level or A-level] or University Level education), parity (0=primiparous, 1=multiparous), depression and whether the pregnancy had been intended (YES, NO). Symptoms of depression were measured continuously using the Edinburgh Postnatal depression Scale (EPDS) ²³ at 18 weeks gestation. The EPDS is a 10 item self report questionnaire specifically designed to screen for perinatal depression by avoiding using physical symptoms which may lead to measurement error in pregnancy.

Missing Data.

The data set contained missing data which varied across variables. Therefore, each analysis was first performed with all available data for the exposure and outcome variables (referred to as all data) and then limited to data that was complete for all exposure, outcome and confounding variables (referred to as complete case).

Analysis

All statistical analyses were performed using Stata version 9. To start, an analysis to investigate the main effects and interactions of breastfeeding intention and breastfeeding practice on maternal responsiveness was performed on the complete case sample (n=894). A nested models analysis was then performed where we compared a fully saturated regression model with three nested models (full details of analysis are provided below). For the purposes of increased power, confounds were not included in the nested models analysis which meant all women who had data on breastfeeding intention, breastfeeding practice and non-verbal responses were included (n=962).

Main Effects

The outcome measure for all analyses was non-verbal maternal responses (0=neutral, 1=positive) and the exposure variables were breastfeeding intention and breastfeeding practice. In the main effects analysis, breastfeeding intention was comprised of 3 levels: No, Maybe or Yes and breastfeeding practice measure in duration was comprised of 4 levels: Never, less than 3 months, 3-5 months or 6 months plus. Logistic regression was used to investigate the presence of main effects and/or an interaction of breastfeeding practice and breastfeeding intention on maternal responsiveness.

Investigation of the relative effects of breastfeeding practice and breastfeeding intention on maternal responsiveness (nested models)

We further explored the relative effects of breastfeeding practice and breastfeeding intention on the outcome using a life course epidemiology approach²⁴. We compared a fully saturated regression model which explores the effect of all possible patterns of breastfeeding practice and intention, with three nested models. The three models are described below and

illustrated in Fig 1&2. Each of these models was compared to the fully saturated model using likelihood ratio tests. Higher p values and relatively lower Bayesian Information Criterion (BIC) values suggest the relative goodness of fit of the nested model and thus whether the hypotheses indicated by the constraints (as defined below) is supported.

Saturated Model

We investigated the impact of all potential patterns of breastfeeding intention (BI) and breastfeeding practice (BP) on maternal sensitivity by creating a four level categorical group variable. The 4 levels were: Breastfeeding intention YES and breastfeeding practice YES (BI:YES/BP:YES), breastfeeding intention YES and breastfeeding practice NO (BI:YES/BP:NO), Breastfeeding intention NO and breastfeeding practice YES (BI:NO/BP:YES) and Breastfeeding intention NO and breastfeeding practice NO (BI:NO/BP:NO) (see figure 2). The group designated as the reference category was (BI:NO/BP:NO).

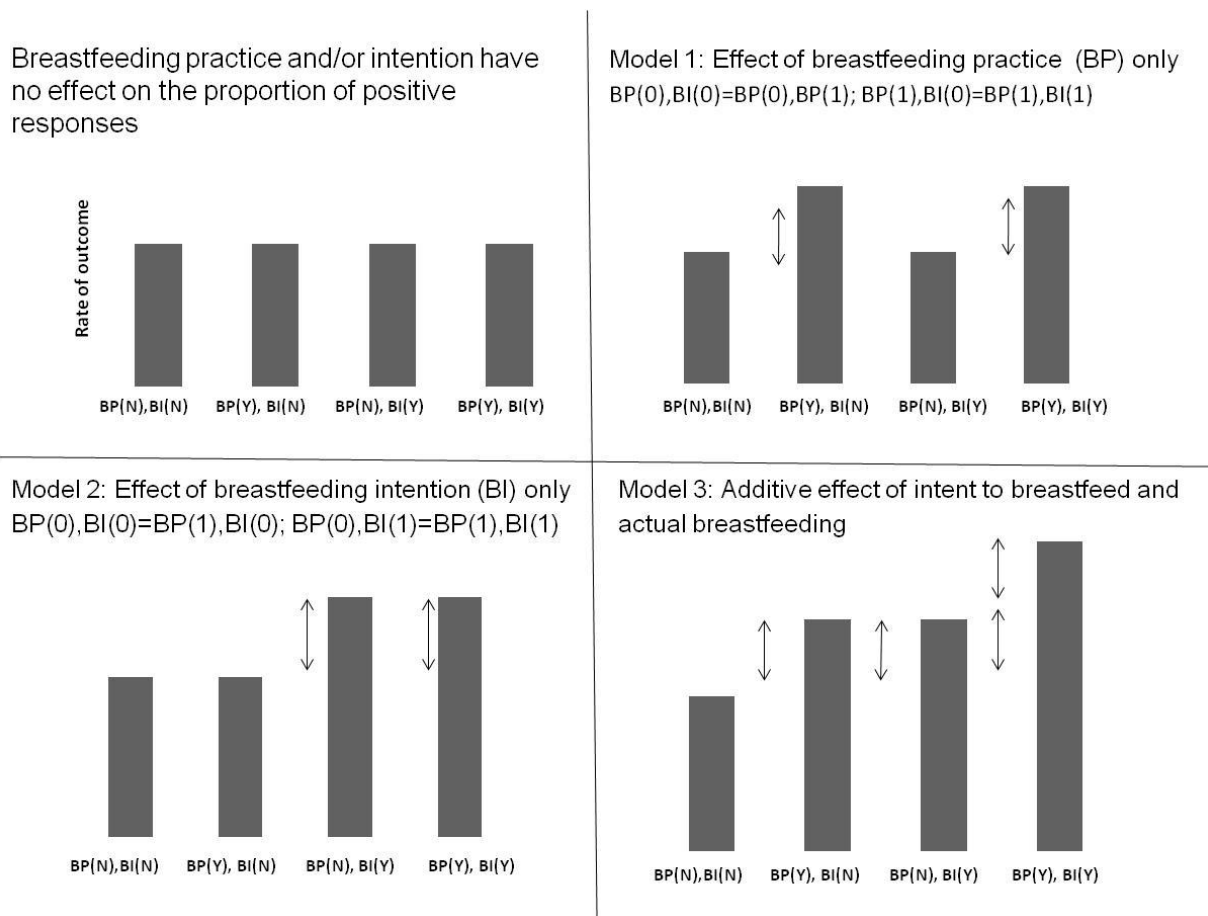


Figure 2: Representation of the four models for comparison using the nested models approach

²⁴. A full description of each model is presented below. (BI = breastfeeding intention, BP=Breastfeeding practice, N=No, Y=Yes).

Nested Models

Model 1 – Critical effect of breastfeeding practice. This model tests the hypothesis that only breastfeeding practice will influence maternal responsiveness. This model tests this hypothesis by restricting the nested model with the following constraints 1) There is no effect of breastfeeding intention without practice, i.e, this group do not differ from the reference category who did not intend to and did not breastfeed: $BI:Y/BI:N = (BI:N/BI:Y)$. 2) The effect of practicing breastfeeding with and without intention will be equal $(BI:N/BI:Y) = (BI:Y/BI:N)$,

Model 2 – Critical effect of intention to breastfeed Only an intention to breastfeed will influence the outcome. This model tests this hypothesis with the following constraints which are the reverse of the model above: there is no effect of breastfeeding practice without intention: $BI:NO/BP:YES = (BI:NO/BP:NO)$ and $(BI:NO/BP:YES) = (BI:YES/BP:YES)$,

Model 3 – Additive effect of both breastfeeding practice and breastfeeding intention This model tests the hypothesis that both breastfeeding intention and practice contribute to maternal responsiveness. This is tested by the constraint that the sum of the effects of only intending to breastfeed and only practicing breastfeeding equal the effects of intending to and actually breastfeeding $(BI:NO/BP:YES) + (BI:YES/BP:NO) = (BI:YES/BP:YES)$,

Results

Sample demographics

In total, 962 women completed the mother-infant interaction at 12 months, the questionnaire on breastfeeding intention at 32 weeks gestation and the questionnaire on feeding methods (breastfeeding practice) at 18 months postpartum. However, only 894 of these mother-infant pairs also had complete case data for confounding variables. Sample characteristics are provided in table 1.

The association of breastfeeding intention and breastfeeding practice with maternal responsiveness (main effects)

As shown in table 2, we found that mothers who had the intention to breastfeed during pregnancy have higher odds ratio of showing positive maternal responses compared to those who did not intend to breastfeed. A separate logistic regression was performed for the

Table 2: Logistic regressions to investigate the main effects of breastfeeding intention and breastfeeding practice on the odds of mothers displaying positive responsiveness.

Odds of showing positive responses (0=neutral, 1=positive)	Unadjusted n=894			Adjusted (combined) n=894			Adjusted (for all confounds) n=894		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
<i>Breastfeeding intention</i>									
Reference – no (n=169)									
Maybe (n=294)	1.74	1.19 – 2.55	0.004	1.86	1.15 – 3.00	0.01	1.80	1.09- 2.92	0.02
Yes (n=431)	2.38	1.66 – 3.43	<.001	2.36	1.44 – 3.86	0.001	2.34	1.42- 3.86	0.001
<i>Breastfeeding practice</i>									
Reference – no (n=183)									
-3 months (n=229)	1.12	0.76- 1.66	0.56	0.75	0.47- 1.21	0.24	0.73	0.45- 1.19	0.21
3-5 months (n=170)	1.62	1.06- 2.48	0.02	0.99	0.59- 1.67	0.98	0.94	0.55- 1.60	0.83
6+ months (n=312)	1.83	1.27- 2.66	0.001	1.03	0.63- 1.70	0.90	0.93	0.55- 1.57	0.78

Note: Unadjusted displays independent effects of breastfeeding intention and breastfeeding practice.

Adjusted (combined) represents both exposure variables entered into the regression model. Adjusted

(for all confounds) is adjusted for maternal age, parity, maternal education, maternal depression and

whether the pregnancy was wanted or not.

exposure variable breastfeeding practice and we found that there was a main effect of the duration of breastfeeding on maternal responsiveness. As shown in table 2, a dose-response effect was observed with the odds of positive maternal responses increasing as the duration of breastfeeding practice increased.

Independent effects

We then performed a logistic regression entering both exposure variables (breastfeeding intention and breastfeeding practice) into the same model. There was evidence that the effect of breastfeeding intention on maternal responsiveness remained, however, the effect of breastfeeding practice on maternal responsiveness disappeared, and suggesting breastfeeding intention explained a larger proportion of the variance in maternal responsiveness. A logistic regression entering the two exposure variables into the model and fully adjusting for all confounding variables was then performed. The results indicated that the main effect of breastfeeding intention on the outcome survived and was not fully explained by maternal age, maternal level of education, social status, depression scores or parity. No interactions of breastfeeding intention and breastfeeding practice on maternal responsiveness were observed (Likelihood Ratio $\chi^2(6)=8.95$, $p=0.18$).

Comparison of hypotheses

As illustrated in figure 2, the highest levels of maternal responsiveness were found in those who intended to breastfeed and went on to breastfeed (accumulation effect). The comparisons of the saturated and nested models as illustrated in table 3 test whether differences exist between the two models. Low *p values* indicate a difference between the models, suggesting the nested model fits the data less well than the saturated model. This was the case for model

1, where a critical effect of breastfeeding practice on maternal responsiveness was significantly less good at predicting the data than the saturated model.

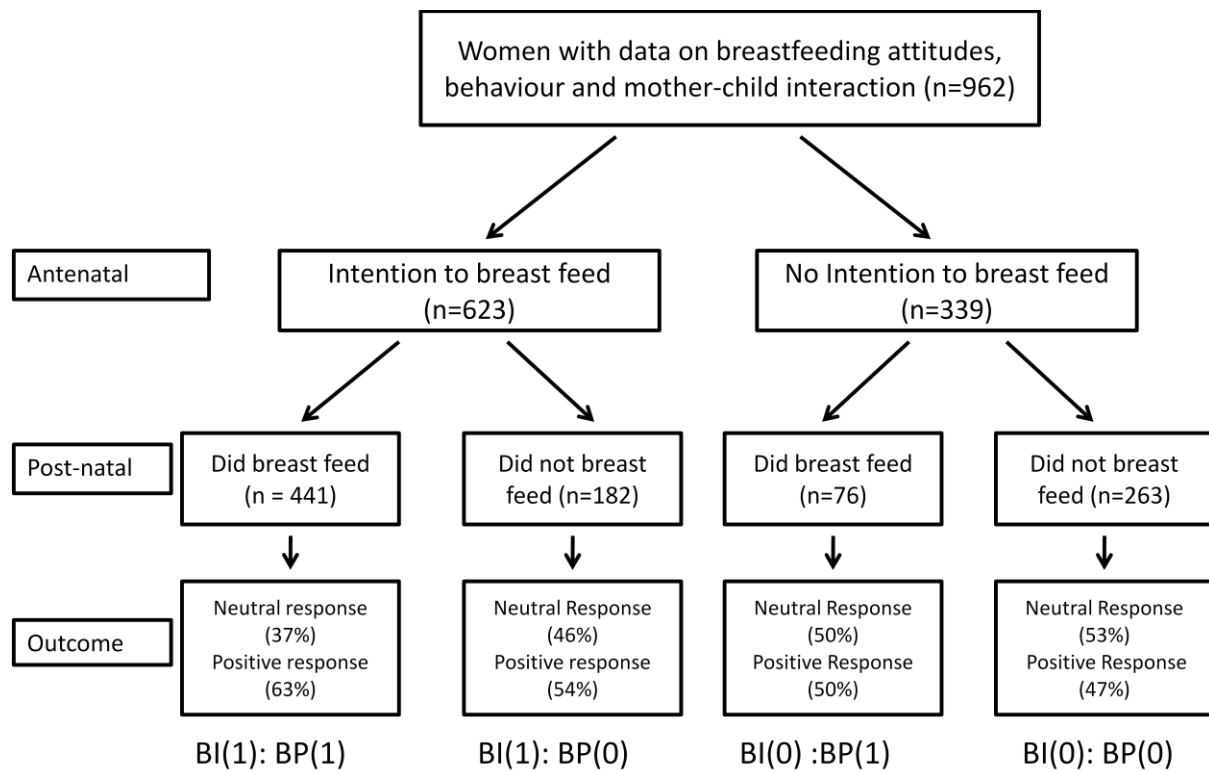


Figure 2: Shows the sample sizes of each of the 4 categories and also illustrates the respective effects of each group on the outcome (percent mothers demonstrating neutral versus positive responsiveness).

Table 3: Comparison of nested models representing specific effects of breastfeeding intention and practice with the fully saturated model.

Test Nested Model	Comparison	<i>df</i>	X^2	P	BIC
Breastfeeding practice critical(1)	Saturated model	2	6.2	0.046	1,323
Intention to breastfeed critical(2)	Saturated model	2	4.1	0.118	1,321
Additive effect of both intention and breastfeeding practice(3)	Saturated model	2	0.7	0.704	1,317

We therefore found evidence that breastfeeding practice alone is not associated with positive maternal responsiveness rather. The other 3 models did not differ from the saturated model, suggesting that they fit the data as well and thus providing support for the hypothesis that they represent, i.e., intention to breastfeed alone is associated with maternal responsiveness (model 2) and that both intention and practice contribute to maternal responsiveness. Comparison of BIC model fit indices suggested that positive maternal responsiveness was most likely however, when both an intention to breastfeed and

breastfeeding practice were present (i.e. accumulation model 3). This is further illustrated by the descriptive in figure 2.

Discussion

The purpose of this research was to test whether the act of breastfeeding enhances a mother's maternal responsiveness, or whether women who choose to breastfeed are in their nature more maternally responsive. We found that breastfeeding alone is not sufficient for maternal responsiveness but may only be beneficial for this when there is a prior intention to breastfeed. These findings suggest that women who are more maternally responsive choose to breastfeed, and provide evidence against the idea of a direct biologically mediated (i.e., oxytocin) causal pathway from actual breastfeeding to more sensitive maternal behaviour. This perhaps supports recent evidence against the notion that oxytocin mediates the relationship between breastfeeding and maternal sensitivity²⁵.

Although we initially observed an association between breastfeeding duration and maternal sensitivity, this effect did not survive when breastfeeding intention was entered into the model. The fact that there is little change in the effect of breastfeeding intention when accounting for maternal age, education, parity, depression and also whether the pregnancy was intended, suggests we may need to look to other maternal characteristics and experiences to elucidate the determinants of maternal sensitivity which may (along with associated social and cultural factors) influence women's choice to breastfeed. We may cautiously speculate that intention may reflect a form of maternal instinct or parenting preparations. According to The Theory of Planned Behaviour²⁶, behavioural beliefs (consequences of the behaviour) produce a favourable or unfavourable attitude toward the behaviour, normative beliefs (normative expectations of others) result in social pressure or subjective norm, and control

beliefs give rise to perceived behavioural control. The more favourable the attitude and subjective norm and the greater the perceived control the stronger the person's intention to perform the behaviour will be. There is growing evidence to suggest that perceptions early life experiences of caregiving influence the development of maternal responsiveness^{27,28} and the adult secure attachment style is associated with greater maternal sensitivity²⁹. This may suggest that some women exhibit characteristics that may predispose them to more positive maternal responsiveness and breastfeeding intention in pregnancy. In addition, the development of mother-foetus attachment during pregnancy has been shown to predict maternal sensitivity³⁰ and may explain why some mothers choose to breastfeed later in their pregnancy. Those who intended to breastfeed but couldn't, may be more likely to still engage in some of the behaviours (close contact and cuddling) associated with breastfeeding that may be important in explaining the association between breastfeeding and responsiveness. Thus, breastfeeding may still generally be associated with positive responsiveness but indirectly through behaviours that women who intended to breastfeeding still practice.

Furthermore, mothers deciding to bottle-feed do so most often because of mother-centred reasons, whereas breastfeeding mothers do so for infant-centered reasons³¹, again suggesting pre-feeding differences in maternal motivation. Society's perception of breastfeeding could also moderate the link between breastfeeding and maternal sensitivity. In contrast with non-western societies, in western society the decision to breastfeed has become a political issue that is affected by cultural perceptions and conflict between being a mother and pursuing a career³² and thus decisions on infant feeding are likely to differ between across social groups and cultures. In some societies, breastfeeding is the norm of infant feeding practice and breastfeeding may not necessarily predict the quality of maternal care, whereas in other societies breastfeeding may not be strongly encouraged. Mothers who

initiate breastfeeding differ from bottle-feeding mothers in age, socio-economic status, ethnicity, smoking status, maternal employment and attitudinal and intrapersonal characteristics³³. Thus, future studies are needed to assess whether these confounding maternal and environmental/ contextual factors may have affected the choice of feeding styles and contribute to long-term differences in maternal sensitive responsiveness between breastfeeding and bottle-feeding mothers.

The strengths of the study include the large total sample size, the observed measurement of maternal responses and the availability of potentially confounding variables including early infant characteristics. However, some limitations should also be noted. The rarer group (no intention to breastfeed but then went on to breastfeed) had a relatively small sample size and limited power to detect differences. Women in the complete case sample varied from the rest of the ALSPAC sample (see table 1) and included women of higher education, who were more likely to have breastfed their infant and were less likely to have been depressed during pregnancy and after birth. The measure of maternal responsiveness is also somewhat crude, focussing on one dimension of maternal sensitivity. A further limitation is that we were unable to provide information on why women who intended to breastfeeding then went on to bottle feed. There may be a number of reasons for example, physical difficulties, social pressures etc. Such information would be useful in furthering our understanding of the origins of differences between the groups studied here. The dataset was cleaned of missing data that varied across variables. It should also be noted that any bias introduced in this data as a result is likely to mean fewer women with depression retained (we know non responders are likely to have higher depression scores as well as a range of disadvantage) and so less power - it is possible, but very unlikely, that there is a differential loss of data according to the relationship between intention to breast feeding and maternal

sensitivity which produces a spurious association. Imputation is a method that can be used to account for bias however more often than not it produces very similar results with narrower confidence interval.

The results of this study have implications for health policy and health interventions. Considering that beneficial effects of breastfeeding for the infant-mother relationship are often assumed and advocated, despite limited empirical evidence, it may be reassuring to mothers that they can still be sensitive to baby despite not being able to breastfeed. As breastfeeding is crucial for healthy infant development, determining the characteristics of women who do not intend to breastfeed will be an important avenue for developing ways of working prenatally to improve maternal sensitivity.

In summary, to our knowledge this is the first study to show that breastfeeding intention during pregnancy is a more important predictor of maternal responsiveness than the act of breastfeeding itself, and that enhancing effects of breastfeeding are dependent on the presence of an intention to breast feed in pregnancy.

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APPENDIX A: ETHICAL APPROVAL

Psychology Research Ethics
Committee

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To: Catherine Jones
From: Cris Burgess
CC: Rebecca Pearson
Re: Application 2012/ 538 Ethics Committee
Date: April 2013

The School of Psychology Ethics Committee has now discussed your application, **2012/538 – An investigation into the relative effects of breastfeeding intention and practice on maternal responsiveness (ALSPAC: Bristol)**. The project has been approved in principle for the duration of your study.

The agreement of the Committee is subject to your compliance with the British Psychological Society Code of Conduct and the University of Exeter procedures for data protection (<http://www.ex.ac.uk/admin/academic/datapro/>). In any correspondence with the Ethics Committee about this application, please quote the reference number above.

I wish you every success with your research.

A handwritten signature in black ink, appearing to read 'Cris Burgess', with a horizontal line underneath.

Cris Burgess

Chair of Psychology Research Ethics Committee