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Susan J. de Jersey, Kimberley Mallan, Ms Justine Forster, Lynne A. Daniels



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A prospective study of breastfeeding intentions of healthy weight and overweight women as predictors of breastfeeding outcomes

Dr Susan J. de Jersey^{a,b*1}, PhD, Dr Kimberley Mallan^{b,c}, PhD, Ms Justine Forster^d, Professor Lynne A. Daniels^e, PhD,

^aAdvanced Accredited Practicing Dietitian, Department of Nutrition and Dietetics, Royal Brisbane and Women's Hospital, Herston, QLD 4029, Australia.

^bVisting Research Fellow, School of Exercise and Nutrition Sciences, Institute of Health and Biomedical Innovation, Queensland University of Technology, Victoria Park Road, Kelvin Grove QLD 4059 Australia

^cLecturer, School of Psychology (Brisbane Campus), Australian Catholic University, 1100 Nudgee Road, Banyo, QLD, 4014 Australia.

^dPast Student, School of Exercise and Nutrition Sciences, Institute of Health and Biomedical Innovation, Queensland University of Technology, Victoria Park Road, Kelvin Grove QLD 4059 Australia.

^eProfessor and Accredited Practicing Dietitian, School of Exercise and Nutrition Sciences, Queensland University of Technology, Victoria Park Road, Kelvin Grove QLD 4059 Australia.

susie.dejersey@qut.edu.au
susan.dejersey@health.qld.gov.au
kimberley.mallan@acu.edu.au

justine.a.forster@gmail.com

l2.daniels@qut.edu.au

***Corresponding Author.** Dr Susan de Jersey, Department of Nutrition and Dietetics,

Level 2 James Mayne Building, Royal Brisbane and Women's Hospital, Butterfield

Street, Herston QLD 4029, Phone: 07 3646 8628, Fax: 07 3646 1874

¹ Phone +617 3646 8628

Abstract**Objective**

Women with a higher BMI are at increased risk of breastfeeding for a shorter duration, however it is unclear if weight status itself or other factors such as feeding intentions are responsible for early breastfeeding cessation. The aim of this study was to determine the influence of maternal pre-pregnancy weight status on infant feeding intentions during pregnancy using a validated scale and assess whether high intentions to exclusively breastfeed measured during pregnancy predicted feeding mode at discharge and at 4 months postpartum in both healthy weight (Hwt) ($\text{BMI} < 25\text{kg/m}^2$) and overweight (Owt) ($\text{BMI} > 25\text{kg/m}^2$) women.

Design

This prospective, observational study commenced when participants were <20 weeks gestation, continuing until four months post partum. Self-administered questionnaires assessed pre-pregnancy weight, infant feeding intentions at 36 weeks gestation, and breastfeeding practices at hospital discharge and 4 months postpartum. Hospital records provided details of delivery mode, gestation and breastfeeding during hospital stay. Binary logistic regression analyses were used to compare weight groups on the breastfeeding beliefs and practices adjusting for selected covariates.

Participants and setting

A consecutive sample of pregnant women ($n=715$) were recruited from an Australian metropolitan hospital between August 2010 and January 2011. All women <20 weeks gestation were eligible unless they had pre-existing Type 1 or 2 diabetes or insufficient English language skills to complete questionnaires.

Measurements and findings

Of 715 women recruited, 402 had complete data at 4 months post-partum. There were no differences in high breastfeeding intentions (66% vs 53%, $p=0.10$) or initiation (96% vs. 98%, $p=0.33$) between Hwt and Owt women. Owt women were less likely to be exclusively breastfeeding at hospital discharge AOR [95%CI] 0.57 [0.33,0.98] and 4 months post-partum 0.62 [0.40,0.97]. High intention to breastfeed was positively associated with exclusively/fully breastfeeding at hospital discharge in Hwt 3.24 [1.52,6.89] but not Owt women 1.73 [0.75,4.00] and 4 months post partum in both weight groups (Hwt 4.1 [2.4-7.2], Owt 6.5 [2.9-14.3]).

Key conclusions

Healthy and overweight women appear to have similar antenatal intentions for infant feeding but overweight mothers are less likely to be exclusive breastfeeding at hospital discharge. High antenatal intentions for breastfeeding are related to exclusively/fully breastfeeding at 4 months post partum in both healthy and overweight women.

Implications for practice

Investigation of early hospital practices that support and hinder the establishment of successful breastfeeding in overweight mothers may help to identify effective strategies to protect breastfeeding relationships between mother-infant dyads, particularly those who have experienced a caesarean delivery.

Keywords: Breastfeeding intentions, pregnancy, Infant Feeding Intentions Scale, exclusive breastfeeding, healthy weight, overweight, obese, initiation.

Introduction

Despite international recommendations for exclusive breastfeeding until 6 months of age (World Health Organization., 2003), very few women achieve this recommendation. In Australia 96% of mothers initiate breastfeeding, however at 3 months only 39% of infants are exclusively breastfed with this rate declining to 15% at 5 months of age (Australian Institute of Health and Welfare, 2011).

Breastfeeding confers a range of health benefits (Rollins et al., 2016), is associated with reduced risk of future overweight in children (Yan et al., 2014) and accelerated weight loss and return to pre-pregnancy weight for mothers (López-Olmedo et al., 2015). Supporting mothers to successfully initiate, establish and continue breastfeeding is a public health imperative (Rollins et al., 2016).

Having a higher body mass index (BMI) is associated with delay in establishing lactation post-delivery and an increased risk of early breastfeeding cessation (Hilson et al., 2004, Rasmussen and Kjolhede, 2004, Amir and Donath, 2007, Turcksin et al., 2012). Failure to establish breastfeeding increases the risk of formula feeding, which independently increases the risk of childhood obesity (Owen et al., 2005) and hence further enhances the risk conferred by maternal obesity (Hediger et al., 2001).

Reasons for poorer breastfeeding outcomes in women with a higher BMI are multifactorial with possible influences including anatomical and physiological issues, medical conditions, and sociocultural and psychological factors (Amir and Donath, 2007). Health behaviour theories provides a framework to examine the psychosocial influences on behaviour (Armitage and Conner, 2000). Motivational health behaviour theories often assess intention with the view that having motivation to perform a

certain behaviour is sufficient to achieve the desired health outcome (Armitage and Conner, 2000). Breastfeeding intentions prior to and during pregnancy are strong predictors of breastfeeding initiation and duration when BMI is not considered (Donath and Amir, 2003, Forster et al., 2006). Whether lower breastfeeding intentions among women with a higher BMI in part account for lower rates of breastfeeding in obese women is not frequently studied. Indeed, it is still unclear if intentions to breastfeed are significantly lower among women with a higher BMI compared to women with a healthy BMI. A systematic review (Turcksin et al., 2012) identified two papers (Hilson et al., 2004, Guelinckx et al., 2012) suggesting that obese women may be less likely to intend to breastfeed and intend to do so for a shorter duration than women in other weight status categories (Turcksin et al., 2012). However, a more recent study of 2824 US women did not find a difference between intended method of infant feeding or intended duration of breastfeeding according to maternal BMI category of obese, pre-obese or healthy/underweight (Hauff et al., 2014). Methods of assessing infant feeding intentions in these papers were variable and none appear to have used a validated measure (Hauff et al., 2014, Guelinckx et al., 2012, Hilson et al., 2004).

There have been four published interventions designed to support overweight and obese women establish and continue breastfeeding and they have shown mixed results (Rasmussen et al., 2011, Carlsen et al., 2013, Chapman et al., 2013) with only one demonstrating a positive outcome on feeding outcomes (Carlsen et al., 2013). With around a third to half of women in Australia entering pregnancy pre-obese (BMI 25-29.9kg/m²) or obese (BMI >30.0kg/m²) (McIntyre et al., 2012), identifying factors impacting on breastfeeding outcomes in these women at high risk of lactation failure is integral to developing appropriate support strategies for them to establish and

continue a successful breastfeeding relationship with their baby. Establishing whether intentions to breastfeed are lower among Australian women who enter pregnancy above a healthy weight, and how intentions translate into achieving breastfeeding recommendations have important clinical implications. While it is clear that women with an increased BMI are less likely to continue breastfeeding even if initiated, it is unclear whether poorer breastfeeding outcomes are related to higher weight status itself (Amir and Donath, 2007) or other factors such as lower socioeconomic status/education, caesarean delivery and separation of mother and infant after birth (Jevitt et al., 2007).

The aim of this study was to determine the influence of maternal pre-pregnancy weight status (healthy weight BMI $<25\text{kg/m}^2$ vs. overweight BMI $>25\text{kg/m}^2$) on infant feeding intentions using a validated measure, and to assess whether intentions to breastfeed predicted exclusive breastfeeding at discharge and at 4 months postpartum in both healthy weight and overweight women.

Methods

Study design

The New Beginnings Healthy Mothers and Babies study was a prospective cohort study examining the influence of pre-pregnancy weight status on lifestyle factors and psychosocial factors during the pregnancy and the postpartum period. Details of study recruitment have been reported elsewhere (de Jersey et al., 2012). Briefly, a consecutive sample of eligible women were recruited from a major metropolitan tertiary hospital in Australia between August 2010 and January 2011. Women were either recruited via study information being mailed out in hospital registration packs

prior to their first hospital visit or by research staff at the initial antenatal appointment (around 16 week's gestation). Women excluded from the study were those who had pre-existing type 1 or 2 diabetes and/or insufficient facility with English to complete the questionnaires. Women who delivered preterm (less than 32 weeks gestation) or experienced neonatal death were withdrawn from the study. Sample size was calculated based on primary study categorical variables, and has been described elsewhere (de Jersey et al., 2012). The recruiting hospital was in preparation for Baby Friendly Hospital Accreditation (Organization, 1998), but had not been assessed at the time this study was conducted.

Data were collected at four time points, 16 weeks and 36 weeks gestation, and 4 months postpartum using self-administered questionnaires and at hospital discharge using routine data sources. Participants were considered to remain in the study unless they actively withdrew or became ineligible through a miscarriage or early delivery (<32 weeks gestation), or did not have a 36 week appointment booked at the hospital. Therefore, non-response at baseline or 36 weeks did not preclude a participant being sent a post-partum questionnaire. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Human Research Ethics Committee for both the recruiting hospital<blinded> (HREC/10/QRBW/139) and collaborating university<blinded> (10000058). Written informed consent was obtained from all participants.

Measures

Participant characteristics

At baseline (16 weeks gestation) data on maternal age (years), education (university vs. no university), parity (nulliparous vs. multiparous), marital status (married/*de facto* vs. other), country of birth (Australia vs. other), and possession of a Health Care Card indicating low socioeconomic status (yes vs. no) were collected. Method of delivery (vaginal [including assisted] vs. caesarean section), infant gestational age, gender and birth weight were collected from hospital perinatal records. Information on postpartum depressive symptomatology (Edinburgh Postnatal Depression Scale (Cox et al., 1987)), and smoking status (smoker vs. non-smoker) were collected via self-report at 4 months postpartum.

Weight status

Self-reported pre-pregnancy weight and measured height were used to calculate pre-pregnancy BMI (kg/m^2). The World Health Organization's classification of BMI was used to group pre-pregnancy BMI into underweight ($<18.5\text{kg/m}^2$), healthy weight ($18.5\text{--}24.9\text{kg/m}^2$), pre-obese ($25\text{--}29.9\text{kg/m}^2$) and obese ($>30\text{kg/m}^2$) (World Health Organisation, 2000). Only a small percentage of women in the current sample were categorized as underweight (5%) and obese (10%) prior to pregnancy. Therefore the underweight and healthy weight categories were combined, as was the pre-obese and obese categories to create "healthy weight" ($M=21$, $SD=2\text{ kg/m}^2$) and "overweight" ($M=29$, $SD=5\text{ kg/m}^2$) pre-pregnancy weight status groups. Categorization of healthy weight and overweight groups is common in body weight literature (Campbell et al., 2006, Olson et al., 2009).

Breastfeeding intentions

Breastfeeding intention was measured using the validated 5-item Infant Feeding Intentions Scale (IFIS) (Nommsen-Rivers and Dewey, 2009). Response options and scoring is outlined in Table 1. The continuous variable (possible range of 0-16) was highly skewed, therefore breastfeeding intention scores were dichotomised based on a median split to low intention to exclusively breastfeed to 6 months (score < 15) and high intention to exclusively breastfeed to six months (score > 15)

Initiation

Breastfeeding initiation was assessed at 4 months postpartum using a single self-reported item “Did you ever breastfeed your baby either in hospital or after you went home?” with a yes or no response.

Feeding mode at discharge and 4 months postpartum

Feeding mode (exclusively breast feeding yes/no) at discharge was determined from hospital perinatal records that report all fluids during the hospital admission and in the 24 hours prior to discharge. At 4 months postpartum women were asked “How are you currently feeding your baby?” with 4 response categories breastfeeding exclusively (no other food or fluids); breastfeeding fully, with occasional water and juices; formula feeding only; combination (breast and formula feeding). These response categories were dichotomised into exclusively/fully breastfeeding vs combined breast- and formula feeding/formula feeding only for ease of interpretation and to classify those who were other exclusively breastfeeding but had introduced a small amount of solids (groups as fully breastfeeding).

Statistical analyses

Only participants with complete data on variables in the regression analyses were included in the final sample and as such no data were imputed. Comparisons between participants included and not included in the final sample were conducted on demographic characteristics using 2-sided Pearson chi-square tests or independent samples t-tests. All statistical analyses were conducted using SPSS (Version 22; SPSS Inc., Chicago, IL, USA).

Differences between healthy weight and overweight mothers on a range of demographic and perinatal characteristics (covariates) as well as breastfeeding variables (intentions, initiation, exclusively breastfeeding at discharge, and exclusively/fully breastfeeding at 4 months) were compared using 2-sided Pearson chi-square tests or independent samples t-tests. Binary logistic regression analyses were used to compare weight groups on the breastfeeding variables adjusting for selected covariates (where there were significant differences between groups, $P < .10$; see Table 2). Due to the very high proportion of women who initiated breastfeeding, an adjusted analysis was not conducted for this outcome.

Binary logistic regression analyses were conducted to examine the association between breastfeeding intentions and exclusive breastfeeding at discharge and exclusively/fully breastfeeding at 4 months stratified for healthy weight and overweight women. The same set of covariates (where there were significant differences between groups, $P < .10$) was adjusted for in these analyses.

Results

Of the 715 participants recruited, 582 (87%) provided a completed baseline questionnaire and anthropometric data. Of the 512 participants who remained active at

the final assessment (4 months postpartum), 402 women (56% of 715) had complete data on the variables of interest in this study (See Figure 1). Women included in the present study were more likely to be born in Australia (72% vs 64%, $P=.062$), have a university level education (52% vs 36%, $P=.008$) and be slightly older ($M=30 \pm SD=5$ vs 29 ± 6 years, $P=.008$) than those not included due to missing data, early delivery, withdrawal or being lost to follow-up. However, there were no differences between women included vs not included in terms of possession of a health care card, relationship status, pre-pregnancy weight status or parity (all P values $>.3$).

Less overweight women had a university level education, while more were born in Australia, and had a caesarean delivery compared to healthy weight women (Table 2).

Breastfeeding outcomes and weight status

The proportion of women with high breastfeeding intentions and who initiated breastfeeding was not statistically different across pre-pregnancy weight groups (Table 3). However, compared to healthy weight women a significantly lower proportion of overweight women were exclusively breastfeeding at hospital discharge ($P=.002$) and were exclusively/fully breastfeeding at 4 months postpartum ($P=.002$). At 4 months post partum 40% of women were exclusively breastfeeding, 20% fully breastfeeding, 17.5 % mixed feeding and 22.5% formula feeding only.

Infant feeding intentions and breastfeeding outcomes

Pre-pregnancy weight status was not a significant predictor of breastfeeding intentions, but significantly predicted feeding mode at discharge ($P=.042$) and at 4 months ($P=.035$) (Table 4).

The relationship between breastfeeding intentions and feeding mode at discharge and 4 months postpartum stratified by weight status group is shown in Table 5. Healthy weight women with high (compared to low) breastfeeding intentions had a greater odds of exclusively breastfeeding at discharge from hospital ($P=.002$). For overweight women breastfeeding intentions did not significantly predict feeding mode at discharge. For overweight women, caesarean delivery reduced the odds of exclusive breastfeeding at discharge; compared to those who had a vaginal delivery, those who had a caesarean delivery were 5.9 times less likely to be exclusively breastfeeding at discharge ($P<0.001$). Caesarean delivery also reduced to a smaller extent the odds of exclusive breastfeeding at discharge for healthy weight women; compared to those who had a vaginal delivery, those who had a caesarean were 2.2 times less likely to exclusively breastfeeding at discharge ($P=.042$).

High (vs low) breastfeeding intentions was associated with higher odds of exclusive/fully breastfeeding at 4 months postpartum in both healthy weight (AdjOR=4.1 [2.4-7.2]) and overweight (AdjOR=6.5 [2.9-14.3]) women. Mode of delivery remained a significant predictor of breastfeeding at 4 months in the overweight group only; overweight women who had a caesarean were less likely to be exclusively/fully breastfeeding at 4 months ($P=.027$).

Discussion

In this Australian sample of mothers, overweight women were less likely than healthy weight women to report high breastfeeding intentions at 36 weeks gestation, but this difference was not statistically significant, or to initiate breastfeeding in hospital before and after adjustment for education and country of birth. Nevertheless, less overweight women were exclusively breastfeeding at hospital discharge and

exclusively/fully breastfeeding at 4 months postpartum, independent of the measured demographic differences between groups. High breastfeeding intentions resulted in a three-fold increase in the likelihood of exclusive breastfeeding at hospital discharge for healthy weight women, but was not a significant predictor of feeding mode at discharge for overweight women. For both weight status groups there was a strong effect of high intentions compared to low intentions, with a four- and six-fold increase in healthy and over-weight women respectively on exclusive/fully breastfeeding at 4 months.

Intending to breastfeed is strongly associated with both breastfeeding initiation and duration (Rollins et al., 2016). However few studies have explored how intentions influence outcomes in women of different weight classifications. To our knowledge this is the first study to examine breastfeeding intentions according to pre-pregnancy weight status using a validated scale. The results reflect those found by Hauff et al (2014) and Newby and Davies (2016) who found no difference in breastfeeding intentions according to pre-pregnancy BMI category in 2824 US women and 155 Australian participants respectively. However this is in contrast to two small studies that found US obese women (n=114) planned to breastfeed for a shorter duration (Hilson et al., 2004) and in Belgium fewer obese women (n=200) intended to breastfeed (Guelinckx et al., 2012) when compared to healthy weight and pre-obese women. The studies used a variety of methods to assess breastfeeding intention, usually limited to a single item, and these differences in assessment methods may have contributed to these inconsistent findings. However, several other factors may play a role in the formation of intentions that were not assessed in the current study. The US, Australia and Belgium have differing access to maternity care and parental leave which are likely to play a role in the formation of intentions. Furthermore,

behavioural intentions are thought to be influenced by several other psychosocial factors, particularly perceived risk and capability to undertake the desired outcome (self-efficacy) (Schwarzer and Renner, 2000). It is likely that differences in these psychosocial constructs and social circumstances such as education and birth country contribute to infant feeding intentions and these may be related to weight status.

Interestingly, in our study for overweight women high intentions did not appear to play a role in exclusive breastfeeding at hospital discharge at hospital discharge whereas for healthy weight women they were a strong predictor of this breastfeeding outcome. It has been observed that infants of obese mothers who are breastfed lost more weight than their healthy weight counterparts (Mok et al., 2008); a potential medical reason for supplementation if weight loss is too great. Furthermore, this study by Mok et al (2008) identified obese mothers reporting more difficulties breastfeeding. While mode of delivery was not considered in the study by Mok et al (2008), it was in the current study. Further investigation is needed to determine why this differential effect of intentions on breastfeeding outcomes for healthy and overweight women in hospital exists.

Breastfeeding intentions are usually determined by the third trimester, with information provision during the antenatal period a strong influential factor (Rollins et al., 2016). In contrast to the findings during hospital stay, high breastfeeding intentions in the current study were strongly associated with continued breastfeeding at 4 months in both weight status groups. This suggests those women with strong desires to breastfeed may be more motivated to overcome early feeding difficulties experienced to continue breastfeeding than those with lower intentions. A systematic review by de Jager and colleagues (2013) suggest intention to breastfeed and self-

efficacy were highly correlated and both were consistently associated with a longer duration of exclusive breastfeeding. Targeted antenatal support to strengthen breastfeeding intention, increase self-efficacy (Kronborg et al., 2012) and provide anticipatory guidance on managing common difficulties or situations such as early separation from an infant following caesarean delivery may be important to increasing breastfeeding duration, particularly in women with a higher BMI. Combining this antenatal intervention with intensive support from health care professionals during the first few weeks postpartum may be important as this is a period where more difficulties may be experienced and crucial to building confidence in the breastfeeding experience.(de Jager et al., 2013)

Caesarean delivery is more common in overweight women (Poobalan et al., 2009) and is a risk factor for early breastfeeding cessation(Prior et al., 2012). Our results mirror both these outcomes: having a caesarean delivery had a negative impact on exclusive breastfeeding at hospital discharge for both healthy and overweight women.

Furthermore, the mode of delivery still had a statistically significant impact on breastfeeding at 4 months post-partum for overweight, but not healthy weight women.

The reasons for the differential impact of caesarean delivery on breastfeeding outcomes for healthy and overweight women requires further in-depth research but examining whether caesarean births were elective or followed labour will be an important factor to consider. High quality evidence suggests that this negative relationship between breastfeeding and caesarean delivery is evident only when labour has not occurred (Prior et al., 2012). This meta-analysis (Prior et al., 2012) did not examine outcomes by weight status, but it is likely that more overweight women have elective caesarean deliveries compared to their healthy weight counterparts (Poobalan et al., 2009). A caesarean delivery without labour has been suggested to

disrupt the endocrine cascade important in establishing lactation (Prior et al., 2012), potentially exacerbating an already compromised hormonal response of overweight and obese women necessary to successfully establishing breastfeeding (Rasmussen and Kjolhede, 2004). Distinguishing the relative contributions of pregnancy and delivery complications, biological aspects and the weight status itself to breastfeeding cessation and the use of infant formula is an important question for future research.

The results of the current study indicate that the divergence between breastfeeding outcomes for healthy and overweight women occurs prior to hospital discharge, while accounting for intentions, country of birth and education, and thus hospital practices require attention to determine if they interfere with biological processes. With 25% of overweight women not exclusively breastfeeding on discharge compared to 15% of healthy weight women, weight status is a clear indicator requiring greater attention to support breastfeeding establishment. However this need is possibly under-recognised by health care professionals who may perceive obese women to be just as successful as their healthy weight counterparts (Garner et al., 2014). Few studies designed to increase the duration of exclusive breastfeeding report on maternal BMI (Skouteris et al., 2014) let alone differential intervention effects that might be observed. It is clear that overweight and obese women need more support to achieve similar breastfeeding outcomes to their healthy weight counterparts. However the four published interventions designed to support overweight and obese women establish and continue breastfeeding have shown mixed results (Rasmussen et al., 2011, Carlsen et al., 2013, Chapman et al., 2013). It may be that educating health professionals and changing hospital practices to offer more intensive support to overweight women antenatally and postpartum can protect the exclusive breastfeeding relationship. Furthermore, practices supportive of establishing breastfeeding post caesarean such as specialised

in hospital lactation consultant support and using donor milk if supplementation is required may have the potential to influence the establishment and duration of breastfeeding, particularly for overweight women. Further studies are needed to investigate if such interventions can reduce the differential between healthy and overweight women for breastfeeding outcomes.

Strengths of this study include the use of a validated tool to assess intentions for breastfeeding, the range of covariates considered and the longitudinal study design of women recruited early in pregnancy and followed into the postpartum period. The findings of this study need to be considered in the context of very high breastfeeding initiation rates in Australia, which were comparable to national estimates (Australian Institute of Health and Welfare, 2011). The intentions for breastfeeding in the study sample were very positively skewed and overall high in both the “high” intentions and “low” intentions groups (data not shown) potentially indicating a bias within the sample. The effects demonstrated within this study may have been more pronounced in a sample with lower intentions to breastfeed. While study participants were representative of the population from which they were recruited in early pregnancy, study attrition by 4 months postpartum meant remaining participants were more likely to be married and university educated. Importantly, though there were no differences in weight status between those who remained in the study at 4 months postpartum and those who did not. Further limitations include the use of self-reported feeding mode at 4 months postpartum and the combining of weight status groups. There were insufficient women who were underweight or obese for these groups to be examined separately. Combining underweight with healthy weight and pre-obese with obese participants for the subgroup analysis, although commonly done (Campbell et al.,

2006, Olson et al., 2009), may have masked differences unique to being underweight or obese.

Conclusions for practice

Breastfeeding intentions were not different between healthy and overweight women and hence do not explain differences in the observed breastfeeding outcomes for overweight vs healthy weight women. Higher breastfeeding intentions predicted greater likelihood of exclusive breastfeeding at hospital discharge for healthy weight women only but was associated with exclusively/fully breastfeeding at 4 months postpartum for both weight status groups. Women who experienced a caesarean delivery were at a significant risk of giving formula supplementation by the time of hospital discharge, for overweight women this impact is much greater and was independent of their breastfeeding intentions. Whilst interventions designed to increase breastfeeding intentions prenatally may positively influence longer-term breastfeeding outcomes (de Jager et al., 2013) of healthy weight and overweight women alike, investigation of early hospital practices that support and hinder the establishment of successful breastfeeding in overweight mothers may help to identify effective strategies to protect breastfeeding relationships between mother-infant dyads, particularly those who have experienced a caesarean delivery. Having high intentions for breastfeeding may help overweight women overcome difficulties experienced early on and continue breastfeeding for longer than those who have lower intentions.

Contributor Statement

Blinded

Ethical Statement

1) Conflict of Interest

The Authors declare no conflicts of interest

2) Ethical Approval

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Human Research Ethics Committee for the Royal Brisbane and Women's Hospital (HREC/10/QRBW/139) and Queensland University of Technology (10000058). Written informed consent was obtained from all participants.

3) Funding Sources

Project funding was provided by the Royal Brisbane and Women's Hospital (RBWH) Foundation for the New Beginnings Healthy Mothers and Babies Study; RBWH Research Advisory Committee and National Health and Medical Research Council (NHMRC) provided PhD Scholarship funding (SdeJ 1017169).

4) Clinical Trial Registry

The New Beginnings Healthy Mothers and Babies Study has been registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12616001278426)

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Table 1. Infant Feeding Intentions Scale (Nommsen-Rivers and Dewey, 2009)

questions and responses

	Very much agree	Somewhat agree	Unsure	Somewhat disagree	Very much Disagree
1. I am planning to only formula feed my baby (I will not breastfeed at all)	0	1	2	3	4
2. I am planning to at least give breastfeeding a try	4	3	2	1	0
3. When my baby is 1 month old, I will be breastfeeding without using any formula or other milk	4	3	2	1	0
4. When my baby is 3 months old, I will be breastfeeding without using any formula or other milk	4	3	2	1	0
5. When my baby is 6 months old, I will be breastfeeding without using any formula or other milk	4	3	2	1	0

Numbers within grid represent the point value for each response. Total score = (mean of items 1 + 2) + (sum of items 3, 4, 5) and ranges from 0 (very strong intention to not breastfeed at all) to 16 (very strong intention to breastfeed exclusively throughout the first 6 months)

Table adapted from Nommsen-Rivers and Dewey 2009 (Nommsen-Rivers and Dewey, 2009)

Table 2. Description of study sample and comparison between with healthy weight and overweight groups on maternal and infant characteristics (N=402)^a.

Variable	Total (N=402)	Healthy weight (n=267) % (n)	Overweight (n=135)	Difference ^b <i>P</i> value
<i>Maternal characteristics</i>				
Age (M ± SD)	30 ± 5	30 ± 5	30 ± 5	0.930
Body Mass Index (kg/m ²) (M ± SD)	24.1 ± 4.7	21.5 ± 1.9	29.2 ± 4.3	<0.001
Country of birth (Australia)	72 (290)	69 (184)	79 (106)	0.042
Education (non university)	52 (207)	47 (125)	61 (82)	0.011
Marital status (married/de facto)	95 (320)	95 (213)	96 (107)	0.860
Parity (nulliparous)	61 (243)	62 (163)	59 (80)	0.660
Health care card (yes)	16 (53)	16 (35)	16 (18)	0.920
Mode of delivery (vaginal [including assisted])	69 (279)	76 (202)	57 (77)	<0.001
Edinburgh Postnatal Depression Scale(Cox et al., 1987) Score ^{c,d} (M ± SD)	4.7 ± 3.9	4.7 ± 3.9	4.8 ± 3.9	0.680
Smoking status (non-smoker) ^c	93 (372)	94 (250)	91 (122)	0.350
<i>Infant characteristics</i>				
gender (boy)	51 (203)	51 (136)	50 (67)	0.370
Birthweight (grams) (M ± SD)	3468 ± 488	3462 ± 433	3479 ± 583	0.76
Gestational age at birth (weeks)	40 ± 2	40 ± 2	40 ± 1	0.240
Age at follow up (weeks)	17 ± 3	17 ± 3	17 ± 3	0.530

Healthy weight group: BMI <25 kg/m²; Overweight group: BMI ≥25 kg/m²

^a subset of women with complete data on all factors

^b Difference (*P* value) for Pearson Chi-Square statistic (categorical variable) or Independent samples t-test (continuous variable)

^c Self-reported at 4 months postpartum

^d score range from 0 to 30 (Cox et al., 1987)

Table 3. Description of breastfeeding intentions and practices, and comparison between healthy weight and overweight women

Variable	Total (N=402)	Healthy weight (n=267)	Overweight (n=135)	Difference ^a
		% (n)		<i>P</i> value
Infant feeding intentions at 36 weeks gestation (high) ^a	59 (237)	62 (165)	53 (72)	0.100
Breastfeeding initiation (yes)	97 (388)	96 (256)	98 (132)	0.330
Feeding mode at discharge (exclusive breastfeeding)	82 (329)	86 (230)	73 (99)	0.002
Feeding mode at 4 months (exclusive/fully breastfeeding)	60 (243)	66 (176)	50 (67)	0.002

Healthy weight group: BMI <25 kg/m²; Overweight group: BMI ≥25 kg/m²

^a high intention to exclusively breastfeed until 6 months indicated by a score of > 15 on the Infant Feeding Intentions Scale (Nommsen-Rivers and Dewey, 2009)

Table 4. Multivariable logistic regression analyses of relationships between pre-pregnancy weight status (healthy weight vs overweight) and breastfeeding intentions and feeding mode at discharge and 4 months postpartum (N=402).

Predictors	High Breastfeeding Intentions ^a at 36 weeks gestation		Exclusive Breastfeeding at discharge		Exclusive/Fully Breastfeeding at 4 months postpartum	
	AOR (95%CI)	P	AOR (95%CI)	P	AOR (95%CI)	P
Pre-pregnancy weight status (ref: healthy weight vs. overweight)	0.72 (0.47, 1.11)	0.133	0.57 (0.33, 0.98)	0.042	0.62 (0.40, 0.97)	0.035
Education (ref: non university level vs. university education)	1.86 (1.23, 2.81)	0.003	1.55 (0.90, 2.68)	0.12	2.15 (1.41, 3.29)	<0.001
Birth country (ref: Australia vs. other)	0.55 (0.35, 0.87)	0.011	0.88 (0.48, 1.60)	0.67	0.95 (0.59, 1.52)	0.820
Mode of delivery (ref: vaginal vs. caesarean)	--	--	0.29 (0.17, .50)	<0.001	0.50 (0.32, 0.78)	0.002
Nagelkerke R² (full model)	0.053	0.001	0.130	<0.001	0.100	<0.001

“Ref” indicates reference group

Healthy weight group: BMI <25 kg/m²; Overweight group: BMI ≥25 kg/m²

^a high intention to exclusively breastfeed until 6 months indicated by a score of > 15 on the Infant Feeding Intentions Scale (Nommsen-Rivers and Dewey, 2009)

Table 5. Multivariable logistic regression analyses of relationships breastfeeding intentions and feeding mode at discharge and 4 months postpartum in healthy weight (n=267) and overweight women (n=135).

Predictors	Exclusive breastfeeding at discharge			Exclusive/fully breastfeeding at 4 months		
	Healthy Weight	Overweight		Healthy Weight	Overweight	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Breastfeeding intentions at 36 weeks (ref: low vs. high)	3.24 (1.52, 6.89)	0.002	1.73 (0.75, 4.00)	0.203	4.13 (2.36, 7.21)	<0.001
Education (ref: non university level vs. university education)	1.04 (0.49, 2.18)	0.924	2.11 (0.86, 5.22)	0.105	1.66 (0.95, 2.89)	0.074
Birth country (ref: Australia vs. other)	0.75 (0.35, 1.60)	0.461	1.71 (0.58, 5.06)	0.336	1.08 (0.59, 1.95)	0.813
Mode of delivery (ref: vaginal vs. caesarean)	0.46 (0.22, 0.97)	0.042	0.17 (0.07, 0.41)	<0.001	0.62 (0.33, 1.15)	0.129
Nagelkerke R² (full model)	0.11	0.002	0.23	<0.001	0.18	<0.001

“Ref” indicates reference group

CI: confidence interval

^a high intention to exclusively breastfeed until 6 months indicated by a score of > 15 on the Infant Feeding Intentions Scale (Nommsen-Rivers and Dewey, 2009)

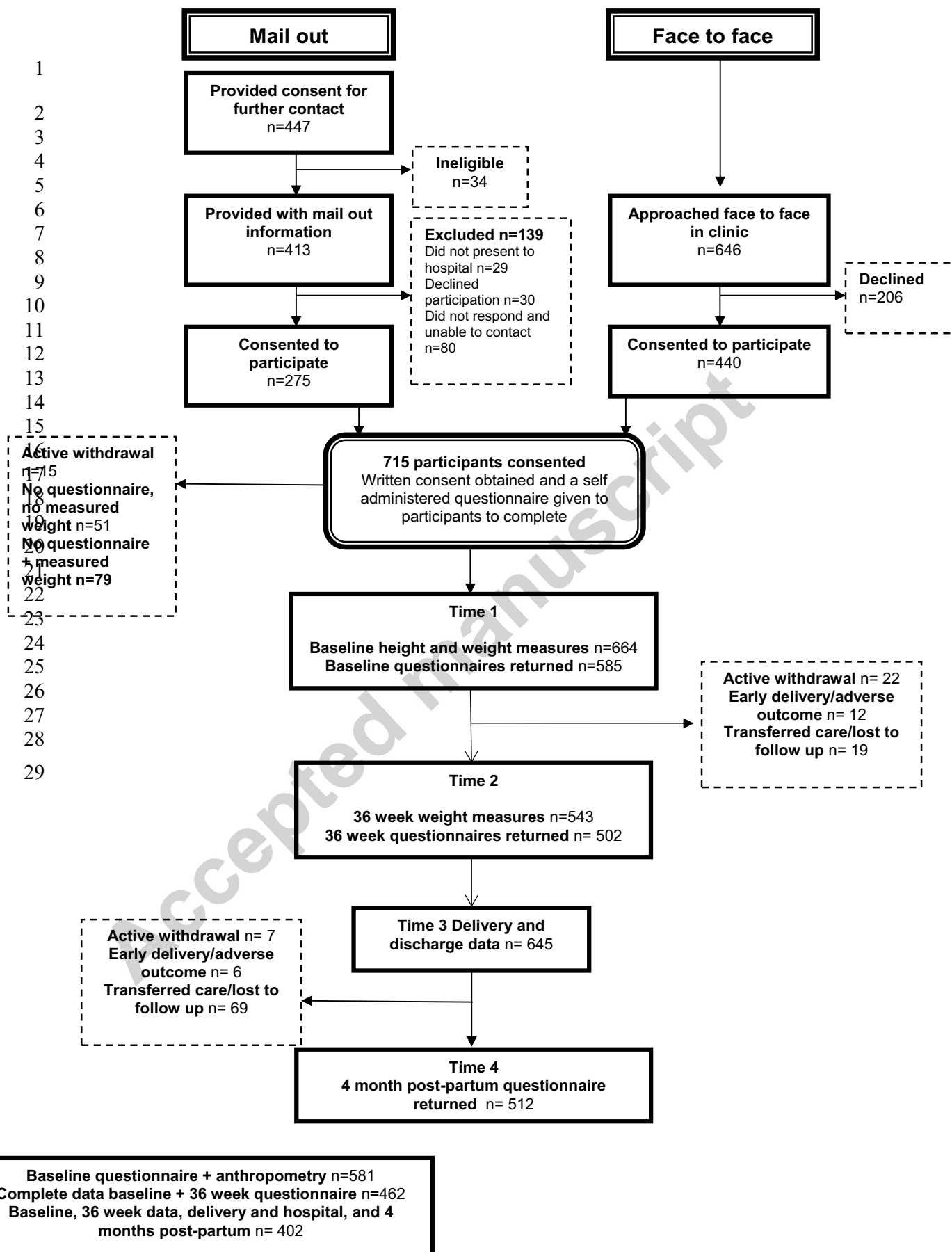


Figure 1 Progression of participants through the *New Beginnings* study time points from recruitment through to 4 month post-partum follow up

Highlights

- Despite no statistically significant difference in intentions for breastfeeding, this study showed a differential impact of intentions on breastfeeding for healthy weight and overweight women at hospital discharge and 4 months post-partum.
- High breastfeeding intentions was associated with exclusive breastfeeding in healthy weight but not overweight women at hospital discharge while high intentions was associated with exclusively/fully breastfeeding for both groups at 4 months post-partum.
- Women who experienced a caesarean delivery were at a significant risk of giving formula supplementation by the time of hospital discharge, for overweight women this impact was much greater and was independent of their breastfeeding intentions.