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ORIGINAL ARTICLE

Antenatal breastfeeding self-efficacy and breastfeeding outcomes among mothers participating in a feasibility breastfeeding-support intervention

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Abstract

Background Breastfeeding rates in Ireland are among the lowest worldwide. A feasibility study of a breastfeeding-support intervention explored maternal characteristics associated with antenatal breastfeeding self-efficacy and with infant-feeding mode at 6 weeks postpartum among women giving birth in Ireland.

Methods We conducted a prospective study across two sites, urban and rural: The National Maternity Hospital (NMH), Dublin and Wexford General Hospital (WGH), Wexford. Nulliparous, pregnant women were recruited at approximately 32 weeks gestation from the hospitals' antenatal out-patient departments. Participants attended an antenatal class with a support partner, received a one-to-one session with a lactation consultant after delivery and had access to a breastfeeding-support clinic and telephone advice postpartum. Our aim was to understand maternal variables associated with breastfeeding self-efficacy and infant-feeding mode. We explored associations between continuous and categorical variables and any breastfeeding and exclusive breastfeeding using *t* tests and Chi-squared analyses.

Results One hundred mothers provided baseline data; 64 provided follow-up data. Lower maternal age and non-Irish nationality were associated with higher antenatal breastfeeding self-efficacy. At the rural unit, mothers with tertiary education were more likely to be exclusively breastfeeding than those with secondary education. Though not statistically significant, more normal-weight mothers from the urban unit were exclusively breastfeeding at 6 weeks than overweight/obese mothers.

Conclusions Breastfeeding outcomes differed by maternal education. Future interventions should target mothers with lower education and possibly also overweight and obese mothers. Increasing breastfeeding self-efficacy, particularly among older and Irish-born mothers, may be a mechanism for improving breastfeeding outcomes.

Keywords Breastfeeding · Breastfeeding self-efficacy · Feasibility study · Human milk · Intervention

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Introduction

The World Health Organisation (WHO) and the Irish Department of Health recommend exclusive breastfeeding for the first 6 months of life, with the introduction of appropriate solid foods thereafter, and continued breastfeeding until 2 years or beyond [1, 2]. Despite these national [1] and international [2] recommendations, breastfeeding rates in Ireland remain among the lowest in the world [3, 4]. The prevalence of any breastfeeding at time of hospital discharge (approximately day 2 of the infant's life) is just 57%, and the

prevalence of exclusive breastfeeding at hospital discharge is lower still, at 47% [1]. In general, breastfeeding success is associated with age, socioeconomic status, ethnicity, body mass index (BMI), parity and psychosocial variables including (i) support from partners, family and healthcare professionals and (ii) breastfeeding self-efficacy [5]. Breastfeeding self-efficacy refers to a woman's confidence in her ability to breastfeed [6] and mothers with higher breastfeeding self-efficacy are more likely to be breastfeeding at 1-week and 4-month postpartum than mothers with low breastfeeding self-efficacy [7]. A recent systematic review of interventions to improve breastfeeding self-efficacy concluded that breastfeeding self-efficacy is a modifiable factor that can be targeted to improve breastfeeding outcomes [8].

In Ireland, breastfeeding initiation is associated with higher maternal age, higher education level attained, higher socioeconomic status, such that those with private health insurance are more likely to initiate breastfeeding, and with nationality, with Irish women less likely to initiate breastfeeding than other nationalities [3]. Breastfeeding duration is associated with education level, having a public health nurse as a source of breastfeeding support and partner's encouragement to breastfeed [9]. Breastfeeding rates also vary significantly by geographic location, with those living in rural areas having a lower breastfeeding prevalence at the first postpartum visit from a Public Health Nurse (at approximately 3 days postpartum) and at the 3-month Public Health Nurse visit [10].

Internationally, maternal perception of insufficient milk supply is commonly cited as the primary reason for early cessation of breastfeeding [11–14]. This is in accord with a recent national longitudinal study of children and youth in Ireland—the Growing Up in Ireland study—where "not enough milk/hungry baby" was the most frequently reported reason for breastfeeding cessation, with "[I] planned to stop at this time" as the second most frequently cited reason [15]. However, other researchers studying breastfeeding in Ireland have reported that the most commonly cited reasons for early cessation of breastfeeding included tiredness/no sleep/lack of freedom [9] and having a busy lifestyle and/or managing care of other children [16]. Taken together, these data suggest that additional education on the recommendations regarding the optimal duration of breastfeeding may be warranted, that women in Ireland may have unrealistic expectations about breastfeeding and that they are perhaps not provided with sufficient support in other aspects of their lives to allow them enough time and energy to continue breastfeeding.

Although women in Ireland who report positive encouragement from their partner to breastfeed are more likely to be breastfeeding at hospital discharge and to continue breastfeeding for ≥ 6 weeks [9], many fathers in Ireland report that they lack the necessary knowledge to support their breastfeeding partners [17]. The fathers in a cross-sectional study conducted by Bennett et al. reported wanting more information about ways to make breastfeeding easier for their partner [17]. Thus, the authors concluded that fathers should be provided with information on ways to support women experiencing breastfeeding challenges, both physically and emotionally and information on practical forms of support, including cooking, doing housework and caring for other children [17].

To address the issues of inadequate breastfeeding education, unrealistic expectations about breastfeeding and insufficient information available for support partners, we developed a multicomponent breastfeeding-support intervention package. The purpose of this package was to provide additional breastfeeding education and support to mothers, and their support partners, and assess the feasibility of implementing this intervention package in a rural and urban hospital in Ireland. We considered this study a feasibility study as our primary purpose was to answer the question "[c] an this study be done?" This was not a pilot study, as we did not include a control group. A paper describing the feasibility of implementing this intervention has been published [18]. The aim of the present paper is to describe the maternal characteristics associated with antenatal breastfeeding self-efficacy and the maternal characteristics associated with any breastfeeding and exclusive breastfeeding at 6 weeks postpartum among women in Ireland who had access to significant breastfeeding education and support.

Methods

Design and setting

This is a prospective study conducted across two maternity hospital sites in Ireland: The National Maternity Hospital, Dublin (NMH) and Wexford General Hospital, Wexford (WGH). The NMH is a large, tertiary university maternity centre with approximately 9000 deliveries/year. WGH is a smaller, regional hospital with approximately 2000 deliveries/year.

At each site, we piloted a multicomponent breastfeeding-support intervention, providing antenatal and postnatal breastfeeding education and support. The intervention has been described in detail elsewhere [18]. Briefly, it included a breastfeeding-specific antenatal class to be attended at approximately 36 weeks gestation by the pregnant woman and a support partner of her choosing, a one-to-one consultation with the lactation specialist in the hospital after they delivered their infant and the option to attend a weekly breastfeeding support clinic. At NMH, these weekly clinics are available to all mothers up to 6 weeks postpartum and those participating in the study were encouraged to attend. At WGH, a new weekly breastfeeding clinic was started specifically for the

study that was not available to all mothers who delivered their infants in WGH.

This study received ethical approval from the Research Ethics Committee of NMH (Dublin, Ireland) and the Research Ethics Committee of the Health Service Executive South-Eastern Area (Dublin, Ireland).

Sample

Nulliparous, pregnant women were recruited at approximately 32 weeks gestation from the antenatal public out-patient's departments of NMH and WGH. Women were eligible for inclusion if they had not given birth previously, had not had previous breast surgery, were over the age of 18 and had decided to breastfeed or were considering breastfeeding. This was a convenience sample of mothers; however, efforts were made to ensure the sample reflected the population of women delivering in the two study hospitals in terms of age, nationality and body mass index. All mothers and their support partners provided written, informed consent to participate prior to the study-specific antenatal class.

Data collection

Baseline data were collected by paper questionnaire while participants were waiting for the antenatal class to begin. Data included demographic details, attitudes toward breastfeeding and a breastfeeding self-efficacy questionnaire. At 6 weeks postpartum, mothers were e-mailed a link to an online questionnaire about their current infant-feeding practices and their breastfeeding self-efficacy.

Variable measurement

Maternal height and weight were measured by a midwife at each participant's first hospital visit in the first trimester of pregnancy. We used these data to calculate body mass index (BMI). We measured breastfeeding self-efficacy using the validated Breastfeeding Self-Efficacy Scale Short Form (BSES-SF) [6]. The BSES-SF contains 14 items, and participants respond to each item using a 5-point scale from strongly disagree to strongly agree. Potential scores range from 14 to 70, with a higher score indicating higher self-efficacy. The questionnaires captured feeding information from birth to 6 weeks postpartum, so that feeding status could be determined. We assessed infant feeding at 6 weeks by asking mothers about what their infant was consuming (human milk vs. formula) and mode of consumption (at the breast vs. from a bottle) at that time. We also asked whether the infant had ever consumed anything other than human milk, and, if so, when that occurred. Other variables were categorised as follows: women were classified as employed or unemployed based on their response on the antenatal questionnaire, age was collected as a continuous variable and then transformed to a dichotomous variable (< 30 years vs. ≥ 30 years), education level was classified as having completed primary, secondary or tertiary education, marital status was classified as single, married, cohabiting/in a relationship, divorced or widowed and smoking status was assessed by asking if women were current smokers, had stopped smoking when they found out they were pregnant or had never smoked.

Variable creation

Using early-pregnancy BMI, participants were categorised as underweight (< 18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2) or obese (≥ 30 kg/m^2). Due to the small number of underweight ($n = 1$, BMI = 17.9 kg/m^2) and obese ($n = 9$) women, BMI category was dichotomised as under/normal weight (hereafter referred to as normal weight) and overweight/obese. We categorised our dependent variables, any and exclusive breastfeeding, as any or exclusive human milk (HM) feeding at 6 weeks postpartum (yes/no), regardless of whether HM was provided at the breast, from a bottle or a combination of the two.

Data analysis

We explored associations between continuous and categorical variables and any and exclusive breastfeeding using *t* tests and Chi-squared analyses, respectively. Where expected cell counts were less than five for categorical analyses, we used Fisher's exact test to determine significance. We also explored changes in self-efficacy from baseline to 6 weeks postpartum using paired-sample *t* tests. Statistical analyses were conducted with SAS version 9.4 (SAS Institute). Findings were considered statistically significant if $p < 0.05$.

Results

Demographic characteristics of the sample

One hundred women, 77 at NMH and 23 at WGH, participated in this study. Participants had a mean age of 31.5 years and 68% were over 30 years of age. The majority (> 70%) were Irish, married or in a relationship, had tertiary education and were employed (Table 1). At baseline, 59% of women were normal weight and 41% were overweight/obese and there were no current smokers. Mean (standard deviation (SD)) self-efficacy score at baseline among participants from NMH was 43.5 (8.5) and among those from WGH was 46.1 (9).

Mothers in NMH were more likely to have tertiary education compared with those from WGH (88.3% vs. 68.2%, $p =$

Table 1 Demographic characteristics of participants in the breastfeeding support feasibility study

Characteristic	The National Maternity Hospital ($n = 77$)	Wexford General Hospital ($n = 23$)	Total ($n = 100$)
Age (years)			
< 30	21 (27)	11 (48)	32 (32)
≥ 30	56 (73)	12 (52)	68 (68)
Irish nationality			
Yes	54 (70)	17 (74)	71 (71)
No	23 (30)	6 (26)	29 (29)
Marital status			
Single	5 (6)	0	5 (5)
Married	47 (62)	10 (43)	57 (57)
In a relationship	24 (32)	13 (57)	37 (37
Missing	1	0	1
Education			
Secondary	9 (12)	7 (32)	16 (16)
Tertiary	68 (88)	15 (68)	83 (84)
Missing	0	1	1
Employment status			
Employed	71 (93)	16 (89)	87 (93)
Unemployed	5 (7)	2 (11)	7 (7)
Missing	1	5	6
Planned pregnancy			
Yes	60 (80)	18 (78)	78 (80)
No	15 (20)	5 (22)	20 (20)
Missing	2	0	2
Smoking status			
No, never	63 (83)	17 (74)	80 (81)
No, stopped in pregnancy	13 (17)	6 (26)	19 (19)
Missing	1	0	1
Support person in study			
Partner	63 (85)	21 (91)	84 (87)
Mother figure	7 (10)	2 (9)	9 (9)
Both	4 (5)	0	4 (4)
Missing	3	0	3
Body mass index category			
Under/normal weight	47 (61)	11 (50)	58 (59)
Overweight/obese	30 (39)	11 (50)	41 (41)
Missing	0	1	1
Self-efficacy score above the median for whole group			
Yes	41 (54)	15 (65)	N/A
No	35 (46)	8 (35)	N/A
Missing	1	0	

Note: Values are *n* (%)

0.02); there were no major differences in any other baseline characteristics between the mothers recruited from the two different hospitals. Forty-nine mothers from NMH and 15 mothers from WGH responded to the 6-week questionnaire. Those who responded to the 6-week questionnaire were more likely to have tertiary education and were more likely to be of non-Irish nationality. There was no difference in baseline self-efficacy score or any other of the maternal characteristics measured between those who responded to the 6-week questionnaire and those who did not.

Associations between demographic characteristics and baseline breastfeeding self-efficacy score

Among the whole group, there was no difference in baseline breastfeeding self-efficacy score by maternal marital status, maternal education level, maternal employment status, maternal body mass index category, the support partner accompanying the mother or whether the pregnancy was planned. However, women under the age of 30 had a significantly higher breastfeeding self-efficacy score than those 30 years of age and older (47.6 (8.1) vs. 42.4 (8.5), $p = 0.005$) and those of non-Irish nationality had a significantly higher breastfeeding self-efficacy score than Irish women (49.3 (9.2) vs. 42.1 (7.6), $p < 0.0001$). There was also an association between maternal smoking status and baseline breastfeeding self-efficacy score such that mothers who gave up smoking when they discovered they were pregnant had higher self-efficacy scores than those who had never smoked (49.8 (8.8) vs. 42.7 (8.2), $p = 0.001$).

Infant feeding outcomes

All 100 mothers recruited into the study initiated breastfeeding. Of the 49 mothers from NMH who responded to the online questionnaire at 6 weeks, 20 were providing their infant HM solely at the breast, 14 were providing HM at the breast and from a bottle, 10 were providing both HM and infant formula and 5 were providing infant formula only. Thus, 34 were exclusively providing HM and 15 were not. Of the 15 mothers from Wexford General Hospital who responded to the online questionnaire at 6 weeks, 3 were providing their infant HM solely at the breast, 8 were providing HM at the breast and from a bottle, 1 was providing both HM and infant formula and 3 were providing infant formula only. Thus, 11 were exclusively providing HM and 4 were not.

Associations between maternal characteristics and human-milk feeding outcomes at 6 weeks

Any human-milk feeding

Among the whole group, there were no associations between any maternal characteristic and any human-milk feeding at 6 weeks postpartum (Table 2). Although not significant, of those with a baseline self-efficacy score above the median for the whole group, 92% were feeding human milk at 6 weeks compared with 81% of those with a baseline self-efficacy score below the median.

Exclusive human-milk feeding

Although not significant, more mothers with at least tertiary education were exclusively feeding human milk at 6 weeks than mothers with a secondary education only (74 vs. 33%, $p = 0.06$). Eighty-three per cent of mothers of non-Irish nationality reported to exclusively feed human milk at 6 weeks postpartum compared with 63% of Irish mothers (Table 2). There was no association between baseline self-efficacy score or other maternal characteristics and exclusive human-milk feeding at 6 weeks.

Associations between maternal characteristics and human-milk feeding outcomes at 6 weeks, stratified by hospital from which women were recruited

When stratified by hospital from which women were recruited, women in WGH with tertiary education were more likely to be exclusively feeding HM at 6 weeks compared with those with secondary education only (Table 3). At NMH, more women who were normal weight were exclusively feeding human milk at 6 weeks compared with overweight/obese mothers, though this was not statistically significant at the a priori cut-off value (79 vs. 50%, $p = 0.05$, Table 3).

Change in breastfeeding self-efficacy over time

Mean breastfeeding self-efficacy significantly increased from baseline to 6 weeks postpartum among the 63 participants with self-efficacy data at both baseline and 6 weeks (44.1 (8.1) vs. 50.1 (13.5), $p = 0.001$). For the eight participants who were no longer feeding any HM when completing the 6-week questionnaire, the breastfeeding self-efficacy score is difficult to interpret. This is because the items on the BSES-SF scale are written in the present tense and eight participants were answering at a time when they were no longer feeding HM. Excluding these eight participants, mean breastfeeding self-efficacy among the remaining 55 participants significantly increased from 44.8 (8.3) at baseline to 52.6 (11) at 6 weeks postpartum ($p < 0.0001$). Of these women, those with a baseline breastfeeding self-efficacy above the median ($n = 33$) reported a significant increase in breastfeeding self-efficacy from 50.1 (6.3) to 54.3 (11.8) ($p = 0.04$, Fig. 1). Of these women, those with a baseline breastfeeding self-efficacy below the median ($n = 22$) reported a significant increase in breastfeeding self-efficacy from 37 (3.5) to 50.1 (9.6) ($p < 0.0001$, Fig. 2).

Discussion

At baseline, mothers who had quit smoking when they realised they were pregnant, mothers of non-Irish nationality and those under 30 years of age had higher breastfeeding self-efficacy scores. The association between quitting smoking and having a higher antenatal breastfeeding self-efficacy score may reflect a

Table 2 Bivariate associations between maternal characteristics and breastfeeding outcomes

	Any human-milk feeding at 6 weeks		*p* value	Exclusive human-milk feeding at 6 weeks		*p* value
	Yes	No		Yes	No	
Maternal age						
< 30	15 (79)	4 (21)	0.22	13 (68)	6 (32)	1[a]
≥ 30	41 (91)	4 (9)		32 (71)	13 (29)	
Irish nationality						
Yes	34 (85)	6 (15)	0.69	25 (63)	15 (37)	0.1[a]
No	22 (92)	2 (8)		20 (83)	4 (17)	
Marital status						
Single	2 (100)	0 (0)	1	1 (50)	1 (50)	0.7
Married	32 (86)	5 (14)		27 (73)	10 (27)	
In a relationship	22 (88)	3 (12)		17 (68)	8 (32)	
Education[b]						
Secondary	4 (67)	2 (33)	0.16	2 (33)	4 (67)	0.06
Tertiary	51 (89)	6 (11)		42 (74)	15 (26)	
Employment status[b]						
Employed	50 (89)	6 (11)	0.32	39 (70)	17 (30)	1
Unemployed	2 (67)	1 (33)		2 (67)	1 (33)	
Planned pregnancy						
Yes	46 (87)	7 (13)	1	37 (70)	16 (30)	1
No	10 (91)	1 (9)		8 (73)	3 (27)	
Smoking status						
No, never	46 (88)	6 (12)	0.64	36 (69)	16 (31)	1
No, stopped in pregnancy	10 (83)	2 (17)		9 (75)	3 (25)	
Support person in study[a]						
Partner	50 (89)	6 (11)	0.21	42 (75)	14 (25)	0.14
Mother figure	3 (60)	2 (40)		2 (40)	3 (60)	
Both	2 (100)	0 (0)		1 (50)	1 (50)	
Body mass index category[a]						
Under/normal weight	36 (88)	5 (12)	1	32 (78)	9 (22)	0.11[a]
Overweight/obese	20 (91)	2 (9)		13 (59)	9 (41)	
Baseline self-efficacy score above the median for whole group[a]						
Yes	33 (92)	3 (8)	0.27	27 (75)	9 (25)	0.30[a]
No	22 (81)	5 (19)		17 (63)	10 (37)	

Note: Associations determined using the Fisher's exact test, except when any cells had an expected count greater than five

[a] In cases where any cell had an expected count greater than five, the Chi-square test was used to determine significance

[b] Missing data for the following variables: education, $n = 1$; employment status, $n = 5$; support person in the study, $n = 1$; body mass index category, $n = 1$; baseline self-efficacy above the median, $n = 1$

conscious effort on the mother's part to adopt more healthful behaviours in general for the benefit of her infant. That non-Irish participants had higher breastfeeding self-efficacy scores is not surprising and is in accord with published literature describing higher breastfeeding rates among non-Irish nationals [19, 20]. However, our finding that breastfeeding self-efficacy was higher among younger mothers is novel. It is often reported in the literature that older mothers have greater success with breastfeeding [5]. However, contrary with what we report here, some studies have reported no association between maternal age and their confidence in their ability to breastfeeding [7, 21]. What we may be seeing in Ireland is the beginning of a culture shift, with the younger generation more open to breastfeeding. This may be because the younger women have travelled more and experienced other cultures where breastfeeding is the norm. It is also possible that young people in Ireland are more technologically savvy and are seeking out their own information online and doing more research on breastfeeding. However, this is not supported by the current literature as using the internet as a source of information on infant feeding [22]

Table 3 Bivariate associations between maternal characteristics and breastfeeding outcomes, stratified by hospital from which women were recruited

	NMH ($n = 49$)						WGH ($n = 15$)					
	Any human-milk feeding at 6 weeks		p value	Exclusive human-milk feeding at 6 weeks		p value	Any human-milk feeding at 6 weeks		p value	Exclusive human-milk feeding at 6 weeks		p value
	Yes	No		Yes	No		Yes	No		Yes	No	
Maternal age												
30	10 (83)	2 (17)	0.58	8 (67)	4 (33)	1	5 (71)	2 (29)	0.57	5 (71)	2 (29)	1
≥ 30	34 (92)	3 (8)		26 (70)	11 (30)		7 (88)	1 (12)		6 (75)	2 (25)	
Irish nationality												
Yes	26 (87)	4 (13)	0.64	18 (60)	12 (40)	0.07[a]	8 (80)	2 (20)	1	7 (70)	3 (30)	1
No	18 (95)	1 (5)		16 (84)	3 (16)		4 (80)	1 (20)		4 (80)	1 (20)	
Marital status												
Single	2 (100)	0 (0)	0.71	1 (50)	1 (50)	0.88	–	–	0.57	–	–	0.28
Married	25 (86)	4 (14)		20 (69)	9 (31)		7 (88)	1 (12)		7 (88)	1 (12)	
In a relationship	17 (94)	1 (6)		13 (72)	5 (28)		5 (71)	2 (29)		4 (57)	3 (43)	
Education[b]												
Secondary	3 (100)	0 (0)	1	2 (67)	1 (33)	1	1 (33)	2 (67)	0.09	0 (0)	3 (100)	0.01[a]
Tertiary	41 (89)	5 (11)		32 (70)	14 (30)		10 (91)	1 (9)		10 (71)	1 (9)	
Employment status[c]												
Employed	42 (89)	5 (11)	1	32 (68)	15 (32)	1	–		–	–	–	–
Unemployed	2 (100)	0 (0)		2 (100)	0 (0)		–	–		–	–	
Planned pregnancy												
Yes	35 (90)	4 (10)	1	27 (69)	12 (31)	1	11 (79)	3 (21)	1	10 (71)	4 (29)	1
No	9 (90)	1 (10)		7 (70)	3 (30)		1 (100)	0 (0)		1 (100)	0 (0)	
Smoking status												
No, never	36 (90)	4 (10)	1	27 (68)	13 (32)	0.7	10 (83)	2 (17)	0.52	9 (75)	3 (25)	1
No, stopped in pregnancy	8 (89)	1 (11)		7 (78)	2 (22)		2 (67)	1 (33)		2 (67)	1 (33)	
Support person in study[b]												
Partner	38 (90)	4 (10)	0.5	31 (74)	11 (26)	0.36	12 (86)	2 (14)	0.2	11 (79)	3 (21)	0.27
Mother figure	3 (75)	1 (25)		2 (50)	2 (50)		0 (0)	1 (100)		0 (0)	1 (100)	
Both	2 (100)	0 (0)		1 (50)	1 (50)		–	–		–	–	
Body mass index category[b]												
Under/normal-weight	29 (88)	4 (12)	1	26 (79	7 (21)	0.05	7 (88)	1 (12)	1	6 (75)	2 (25)	1
Overweight/obese	15 (94)	1 (6)		8 (50)	8 (50)		5 (83)	1 (17)		5 (83)	1 (17)	
Baseline self-efficacy score above the median for whole group[b]												
Yes	26 (96)	1 (4)	0.15	21 (78)	6 (22)	0.13[a]	7 (78)	2 (22)	1	6 (67)	3 (33)	0.6
No	17 (81)	4 (19)		12 (57)	9 (43)		5 (83)	1 (17)		5 (83)	1 (17)	

Note: Associations determined using the Fisher's exact test, except when any cells had an expected count greater than five

[a] In cases where any cell had an expected count greater than five, the Chi-square test was used to determine significance

[b] Missing data for the following variables: education, $n = 1$ (WGH); support person in the study, $n = 1$ (NMH); body mass index category, $n = 1$ (WGH); baseline self-efficacy above the median, $n = 1$ (NMH)

[c] Data regarding employment status was missing for five women from Wexford General Hospital so we have not included this variable in these analyses due to cell counts of insufficient size

and weaning [23] has been demonstrated not to differ by maternal age.

Despite the observed differences in antenatal breastfeeding self-efficacy by maternal age and nationality, these characteristics were not associated with HM feeding at 6 weeks postpartum. The absence of an association between maternal characteristics and any HM feeding at 6 weeks postpartum may be due to an insufficient sample size to observe an association. It is also possible that our sample of mothers are those more likely to breastfeed (selection bias), making it difficult to observe statistical differences between those who were and were not feeding HM at 6 weeks. Indeed, all participants in this study commenced breastfeeding, suggesting that this study is likely affected by selection bias.

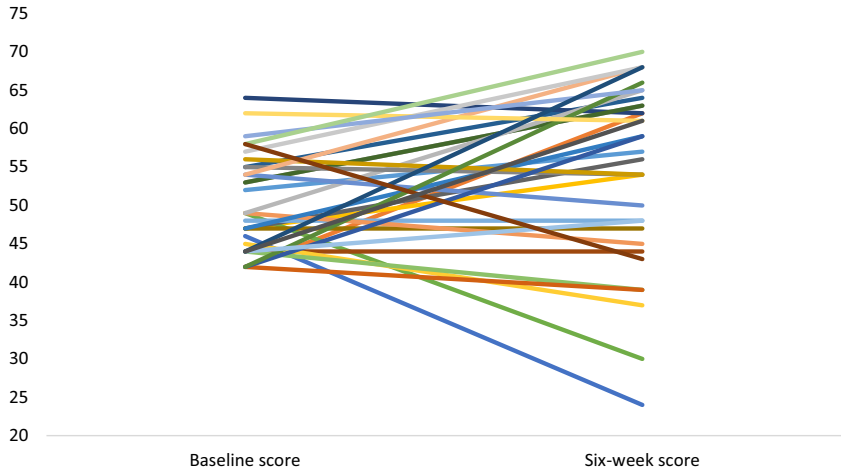

Fig. 1 Change in breastfeeding self-efficacy among those with a baseline score above the median

However, differences in maternal characteristics associated with HM feeding at 6 weeks postpartum were observed when the sample was stratified by geographic location (urban vs. rural). In the rural setting, those with lower education had poorer breastfeeding outcomes than those with tertiary education. Interestingly, mothers recruited from the rural setting were significantly less likely to have tertiary education than mothers recruited in the urban setting. Thus, there may be a larger population of women without tertiary education with potential to benefit from increased breastfeeding support in rural settings.

In the urban setting, despite similar antenatal breastfeeding self-efficacy, fewer overweight/obese were providing HM exclusively at 6 weeks postpartum than normal-weight women. Although this finding was not statistically significant in this relatively small sample, we feel that it is clinically relevant. The observed poorer breastfeeding outcomes among overweight/obese mothers could be because of psychological or physical reasons [24] or could reflect endocrine aberrations in the hormonal regulation of lactation [25, 26]. Interventions that specifically target overweight and obese mothers, focusing on their unique needs, may be required. Given the differences observed in the two populations studied, this research highlights the need for context-specific breastfeeding-support interventions. Qualitative research is essential to developing contextually appropriate interventions and, indeed, in understanding the processes that are key to successful breastfeeding-support interventions [27].

Over time, from pre-pregnancy to 6 weeks postpartum, breastfeeding self-efficacy increased. This is perhaps not surprising as it has previously been reported that breastfeeding self-efficacy increases over time among both mothers who received additional breastfeeding support as part of an intervention and those who did not [28]. Thus, it is possible that breastfeeding self-efficacy increased in our cohort over time simply because mothers were increasing in confidence with experience. Unfortunately, we cannot tease out the degree to which the change relates to the intervention, due to the absence of a control group. However, it is noteworthy that the increase in breastfeeding self-efficacy over time was steeper

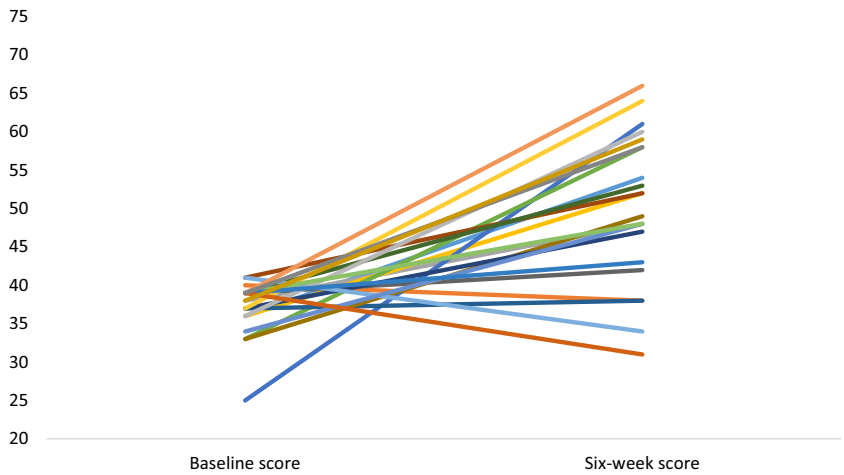

Fig. 2 Change in breastfeeding self-efficacy among those with a baseline score below the median

among those who had a self-efficacy below the median at baseline. It is plausible that women with lower antenatal breastfeeding self-efficacy could benefit more from a breastfeeding-support intervention, and this is worth exploring in future randomised controlled trials. Increasing breastfeeding self-efficacy is a worthwhile target for an intervention study as a recent meta-analysis has reported that interventions targeting breastfeeding self-efficacy improve breastfeeding outcomes at one and 2 months postpartum [8]. In addition, investigators who conducted a cross-sectional study in Ireland reported a significant positive association between breastfeeding self-efficacy and breastfeeding for as long as the mother had intended while pregnant [29].

Strengths and limitations

A strength of this study is that it was conducted at two different sites, one urban and one rural, allowing us to explore the needs of a diverse range of new mothers. This deepens our understanding of the characteristics associated with breastfeeding outcomes in a country with a large variation in breastfeeding success geographically. This study was also strengthened by the availability of dedicated lactation specialists to deliver the intervention, ensuring mothers enrolled in the study received all components of the intervention as intended. In addition, the inclusion of the support partner in the intervention is novel and well accepted by the participants. Finally, using the validated breastfeeding self-efficacy scale short form was an additional strength of this study that will enable comparisons to be drawn between our results and those of other investigators. Given that this was a feasibility study, it is not without limitations. The sample size was relatively small, which does limit the statistical analyses we conducted; however, we used conservative statistical methods appropriate for small sample sizes. Regardless, the associations described in this analysis should be interpreted with caution. Additionally, we recruited a convenience sample of mothers and it is probable that mothers volunteering for a breastfeeding-support intervention are already interested in breastfeeding. This selection bias may explain the lack of any observed association between maternal characteristics and any breastfeeding at 6 weeks postpartum. Finally, all participants enrolled in this study received the intervention, we had no control group, so we have not controlled for potential confounders. Thus, we cannot infer from our data that our breastfeeding-support intervention improved breastfeeding rates.

However, this well-accepted feasibility study has provided an important and informative base from which we can progress. We are planning to evaluate the effectiveness of this intervention in a large, multicentre randomised controlled trial, which will enable us to make causal inferences.

Conclusion

Increasing breastfeeding self-efficacy, particularly among older mothers and Irish-born mothers, is a potential mechanism for improving breastfeeding outcomes. Future interventions to improve breastfeeding self-efficacy and, thus, breastfeeding outcomes, must consider cultural context and the fact that there may be no one-size-fits-all intervention for improving breastfeeding practices. In Ireland, populations that may have increased potential to benefit from breastfeeding-support interventions include overweight and obese mothers, mothers with lower education and Irish-born mothers. A large, powered, multicentre randomised controlled trial is required next, to enable us to detect statistically significant associations and make causal inferences.

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflict of interest.

Ethical approval This study received ethical approval from the Research Ethics Committee of NMH (Dublin, Ireland) and the Research Ethics Committee of the Health Service Executive South-Eastern Area (Dublin, Ireland). All procedures performed were in accordance with the ethical standards of the research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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