Sexual & Reproductive Healthcare 35 (2023) 100806

Contents lists available at ScienceDirect

Sexual & Reproductive Healthcare

journal homepage: www.elsevier.com/locate/srhc

Exclusive breastfeeding, breastfeeding problems, and maternal breastfeeding attitudes before and after the baby-friendly hospital initiative: A quasi-experimental study

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ARTICLE INFO

Keywords:
Breastfeeding
Attitude
Mothers
Postnatal care
Baby-Friendly Hospital Initiative

ABSTRACT

Background: Breastfeeding practices remain globally suboptimal despite many known maternal and neonatal health benefits and the Baby-Friendly Hospital Initiative as a global effort to support breastfeeding.
Objective: We aimed to evaluate the effects of the implementation of the Baby-Friendly Hospital Initiative for a proportion of mothers who exclusively breastfed during a 6-month period, including breastfeeding problems, and maternal breastfeeding attitudes.
Methods: Using a quasi-experimental non-equivalent two-group design, we recruited two independent samples of postpartum mothers in a maternity hospital to compare the situation before ($N = 162$) and after ($N = 163$) the implementation. We measured breastfeeding status and possible breastfeeding problems via text-message questions at 2 weeks, 1, 4 and 6 months after birth. We measured Mothers' attitudes toward breastfeeding at the maternity hospital and 4 months after birth using the Iowa Infant Feeding Attitude Scale.
Results: The implementation of the Baby-Friendly Hospital Initiative had no effect on the proportion of mothers who exclusively breastfed, and we found no significant differences in exclusive breastfeeding at 6 months (41.3 % vs 52.9 %, $p = .435$). The intervention did not influence the reported number of breastfeeding problems ($p = .260$) or maternal breastfeeding attitudes ($p = .354$). More favourable breastfeeding attitudes ($p < .001$) and less problematic breastfeeding ($p < .001$) were associated positively with exclusive breastfeeding.
Conclusion: Exclusive breastfeeding rates did not increase after the intervention; however, the rates at baseline were already high. Ensuring the Baby-Friendly Hospital Initiative practices through pre- and postnatal periods and preparing mothers to manage common breastfeeding problems might improve breastfeeding rates.
This trial was registered (0307-0041) with ClinicalTrials.gov on 03/03/2017.

Introduction

Breastfeeding practices remain globally suboptimal despite many known maternal and neonatal health benefits [1]. Breastfeeding rates vary depending by part of the world, but according to the World Health Organization (WHO), only 44 % of newborns are breastfed within the first hour after birth, and only 40 % of all newborns are exclusively breastfed for 6 months. [2]. In the Nordic countries, breastfeeding initiation rates have traditionally been higher, over 90 % [3,4], but the exclusive breastfeeding rates at six months range between 2 and 25 % [5–7].

The Baby-Friendly Hospital Initiative (BFHI) is a global effort to assist in implementing practices that protect, promote and support both 6 months exclusive breastfeeding [2], as well as continued breastfeeding with appropriate complementary foods up to 2 years [8]. To receive BFHI accreditation, maternity units must restrain the use of breastmilk substitutes in accordance with the International Code of Marketing of Breast-milk Substitutes, implement "10 steps" to support successful breastfeeding, and create ongoing internal monitoring of adherence to clinical practices [2]. A unified expanded version of the BFHI steps, the NeoBFHI, was established in 2015 to meet the special needs of preterm and low birthweight infants and their mothers [9,10]. In previous research, the rate of early breastfeeding initiation as well as the duration of exclusive and overall breastfeeding have been the most common

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https://doi.org/10.1016/j.srhc.2022.100806
Received 30 June 2022; Received in revised form 2 November 2022; Accepted 5 December 2022
Available online 9 December 2022

outcome measures of the BFHI. Recent reviews have identified BFHI implementation as an effective intervention for improving early breastfeeding initiation as well as duration and exclusivity of breastfeeding globally [11,12]. Full implementation of the BFHI has resulted in improvements in some hospital practices such as rooming-in and skin-to-skin contact (SSC) [13–15]. Implementation of the original BFHI has also been beneficial in neonatal ward practices for increasing the use of SSC and support for milk expression [10]. However, not all studies have identified an effect of the intervention [11,14,16] and its effects in well-resourced environments is unclear [16].

Many women experience difficulties in breastfeeding [17] such as pain and nipple scarring [18,19]. Other common challenges are the mother's perception of inadequate milk volume [18,20] and excessively crying babies [20]. Although many mothers feel well supported by health professionals [17], over one-third state that the help they received in the hospital did not solve their breastfeeding issues [21]. Mothers in BFHI accredited hospitals have reported increased breastfeeding support [11], but support may not always be optimal [2]. Mothers need evidence-based support with appropriate resources [1] to face challenges and continue breastfeeding because breastfeeding is not just feeding the baby, but an essential part of motherhood [7]. However, interventions in birth hospitals are not enough; the promotion of breastfeeding is a collective societal responsibility [22].

A mother's breastfeeding behaviour is influenced by a diversity of determinants, including breastfeeding attitudes and knowledge, personal attributes as well as professional and social support [12,23]. The attitude toward breastfeeding is defined as a perspective including feelings, moods, or emotions, and it is closely related to breastfeeding knowledge [23]. Previous studies have shown that a maternal attitude favouring breastfeeding strongly predicts a longer duration of breastfeeding [23,24]. The implementation of BFHI has resulted in improvements in maternal knowledge [11] but the impact on attitudes is not known as breastfeeding attitudes occasionally remain consistent [25].

We aimed to evaluate the effects of BFHI and NeoBFHI implementation on the duration of exclusive breastfeeding in the 6-month postpartum period as a primary outcome and the mothers' breastfeeding problems and breastfeeding attitudes as secondary outcomes.

Methods

Study design

A quasi-experimental non-equivalent two-group design comparing the situation before and after the implementation of BFHI and NeoBFHI practices. Before the intervention (Group 1) from April to August 2017 and after the intervention (Group 2) from April to August 2019.

Setting

We conducted the study at a Level-II hospital with approximately 1700 births per year and approximately 350 yearly admissions to a neonatal intensive care unit (NICU). The study wards were a maternity unit with 30 beds for pre- and postnatal women including six single-family rooms and a Level-II NICU with 12 single-family rooms. Based on the hospital statistics before the data collection, the average stay in the hospital was two days after vaginal birth and three days after caesarean section. However, in the NICU, mothers usually stayed with their newborns after their own discharge, and the average hospital stay of newborns in the NICU was five days. The hospital premises enabled newborns to "room-in" with their mothers 24/7 in the NICU. The nurses and midwives had the primary responsibility of providing breastfeeding support for parents at the hospital.

Participants

All Finnish-speaking mothers who (a) gave a live birth in the study hospital regardless of mode of birth (b) with a gestational age of 32 weeks or more were eligible for the study. We excluded mothers if (a) they did not have a mobile phone or (b) their newborns had been transferred to a Level-III hospital.

Intervention: implementation of BFHI and NeoBFHI

The BFHI and neoBFHI implementation project began in early 2017. The Ten Steps to Successful Breastfeeding [2,9] were implemented, starting with compliance with the International Code of Marketing Breast-Milk Substitutes, writing a hospital infant-feeding policy and establishing ongoing monitoring of hospital practices (Step 1). All professionals received education on breastfeeding and the code (Step 2). The hospital practices to support breastfeeding were standardized according to evidence-based practice (Steps 3–10) [26]. The hospital received BFHI and NeoBFHI designations in March 2019. The implementation process at the hospital is described more detailed in xxx et al. (2021).

Measurements and data collection

The same questionnaires and text message questions were applied in the pre- and post-intervention phases. We developed a background questionnaire for this study and included questions about sociodemographic characteristics (maternal age, education, marital status, and number of children in a family). These characteristics also included health (mother's smoking status), information about pregnancy, birth, and newborn (planned pregnancy, mode of birth, birth experience, and gestational age); unit after birth (maternity unit or NICU) and psychosocial factors influencing breastfeeding (previous breastfeeding experience, intent to breastfeed). Mothers completed the questionnaire at the hospital before discharge.

To follow up breastfeeding status and possible breastfeeding problems mothers received two text message questions four times after birth. We used a secured website to send the questions to mothers at 2 weeks, 1, 4 and 6 months after birth. Question 1: "Do you breastfeed your baby?" (1 = Yes, exclusively, 2 = Yes, partially, 3 = No). If a mother answered no, we asked her to describe briefly why she had ceased breastfeeding. We defined exclusive breastfeeding based on WHO standards as feeding a newborn breastmilk only, with no supplementary, water or additional food except medicines, vitamins, and minerals [8]. Question 2: "Are you breastfeeding without problems?" (1 = Yes, 2 = No). If a mother answered no, we asked her to describe briefly what kinds of problems she had encountered. If we did not receive a response from the mother, we resent the question as a reminder the next day. We sent no further questions if a mother did not respond to the reminder. The flowchart for data collection is shown in Fig. 1.

We measured maternal breastfeeding attitudes using the Iowa Infant Feeding Attitude Scale (IIFAS) [27]. The IIFAS is a validated and widely used instrument featuring 17 items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Total possible scores ranged from 17 to 85, with higher scores indicating a favourable attitude toward breastfeeding. We calculated scores for breastfeeding attitude as a sum of items and grouped them into the following three categories: positive to breastfeeding (>70), neutral to breastfeeding (49–69), and negative to breastfeeding (<48) [28]. The scale has been psychometrically tested and found to be a valid and reliable measure in different contexts. Cronbach's alpha scores have ranged from 0.71 to 0.86. [23,24,27]. Participants completed the IIFAS twice—at hospital before discharge (A1) and at 4 months after birth (A2). We mailed the 4-month questionnaire to mothers with a pre-paid return envelope.

We recruited and measured the independent groups 2 years apart, and we followed both groups for a 6-month period. We set the sample size at 160 mothers per group to cover 10 % of the hospital's annual births, to provide a representative sample, and to indicate possible changes in selected outcomes. We instructed all midwives and nurses

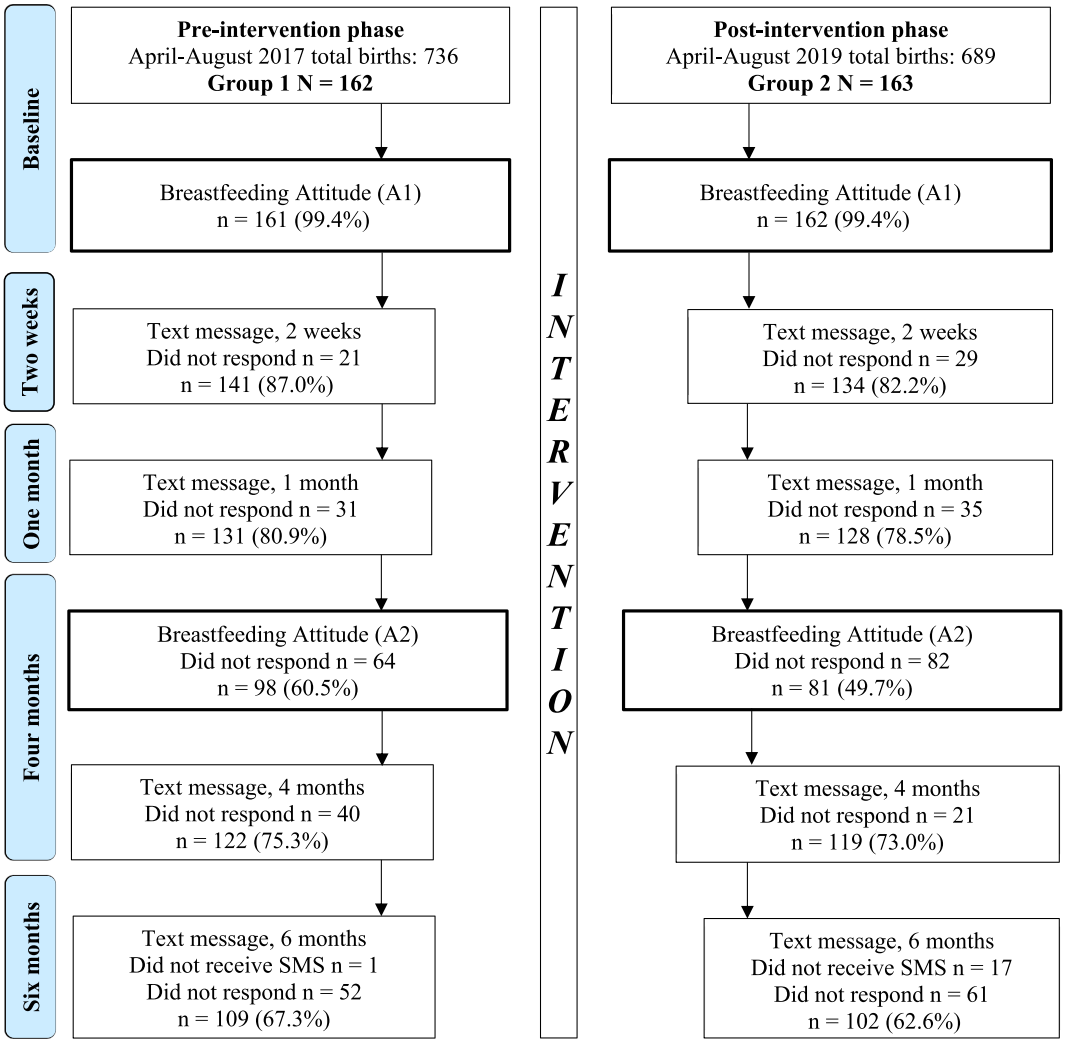

Fig. 1. The flowchart of the data collection. Participation and response rate presented in *n* and (%).

working at the study units to recruit the mothers. Nearly all mothers were eligible, and we provided them with both written and verbal information about the study and informed them that they could withdraw their participation at any time. The mothers had time to consider participation, and we obtained written informed consent before participation. We provided mothers willing to participate with study questionnaires and instructions for the text message questions. We asked mothers to return the completed questionnaires in closed envelopes to a locked case in the unit before discharge.

Ethical considerations

Our study was conducted in accordance with the Helsinki Declaration of 2013[29]. The study protocol received a favourable statement from the Ethics Committee at University of Turku (statement 18/2017) and was approved by the hospital administration (Grant No 9/2017 SATSHP/225/13.01/2017).

Data analysis

We used counts (*n*) and percentages to describe categorical data and Fischer's exact tests to examine the significance of the associations between classifications.

Maternal age was reported with mean and standard deviation (SD). We used analysis of variance (ANOVA) to compare groups. Planned breastfeeding duration and previous breastfeeding experience exhibited skewed distributions. Median and lower (Q1) and upper quartiles (Q3) were reported, and Wilcoxon rank sum tests were performed to assess intergroup differences.

We first focused on secondary outcomes IIFAS and breastfeeding problems. We modelled IIFAS scores using a hierarchical linear mixed model with repeated measures including one within-factor variable (time), between-factor variable (group), and their interaction (time × group). We used unstructured covariance for time and performed Kenward–Roger correction for degrees of freedom. Second, we calculated the possible associations between background characteristics and IIFAS scores. We also included all interactions with both time and group. After univariate analysis, we added all significant factors to the multivariate models; we gradually omitted non-significant factors from these models. We calculated Cronbach's alpha scores at baseline and at 4 months. We also modelled breastfeeding problems using the same strategy as IIFAS scores but using hierarchical linear mixed models with repeated measures for binomial data.

We analysed our primary outcome as breastfeeding itself using hierarchical linear mixed models with repeated measures for multinomial data. We approximated marginal likelihoods using Laplace's method. The initial model included a within-factor variable (time), between-factor variable (group), their interaction (time × group) and IIFAS scores and breastfeeding problems. While constructing the model's correlations, we evaluated between-factors relationships to avoid

collinearity. Because we found a statistically significant association between background characteristics and both IIFAS scores and breastfeeding problems, we added no other factors to the model. Odds ratios (ORs) with 95 % confidence intervals (CIs) were reported.

We performed sensitivity analysis using log-binomial models to evaluate participants who discontinued the study. We compared IIFAS scores, breastfeeding problems, and background characteristics using ORs with 95 % CIs between participants who discontinued and participants who continued the study until the end of the follow-up time. We also divided the data by the unit and repeated the analysis separately for mothers from the maternity unit and NICU. We compared the conclusions and the significance of the coefficients to justify pooling the data.

We classified and presented the SMS answers in which mothers described breastfeeding problems and reasons for cessation with frequencies and percentages. We performed all tests as two-sided tests with a significance level set at 0.05. We performed analyses using SAS (Version 9.4) for Windows.

Results

Mother and newborn characteristics

A total of $N = 162$ mothers participated in the study in Group 1 (pre-intervention phase) in 2017, and $N = 163$ mothers participated in Group 2 (post-intervention phase) in 2019. Upon 6-month follow-ups, $n = 109$ (67.3 %) and $n = 102$ (62.6 %) mothers, respectively, were still participating in the study (Fig. 1).

In both groups, we recruited most mothers in the maternity unit ($n = 138$ [85.2 %] in Group 1; $n = 144$ [88.3 %] in Group 2). The rest of the mothers ($n = 24$ [14.8 %] and $n = 19$ [11.7 %], respectively) were recruited in the NICU. Across both groups, 96.3 % of the newborns were considered full term. The characteristics of the participating mothers and their newborns did not differ between the pre- and post-intervention phases, except that Group 2 mothers were more highly educated ($p = .008$) and underwent significantly more caesarean sections ($p = .002$) than Group 1 (Table 1).

The characteristics of the study dropouts did not differ between the pre- and post-intervention phases ($p = .811$). Mothers who discontinued the study were younger than mothers who continued until the 6-month follow-up ($M_{age} = 28$ years [CI 95 % 28, 29] vs $M_{age} = 30$ years [CI 95 % 30, 31], $p < .001$). Mothers who had planned pregnancies had greater odds of continuing compared to mothers who did not (OR 1.6 [CI 95 % 1.11–2.39], $p = .013$). The breastfeeding problems encountered by mothers who discontinued in the study did not differ from those experienced by mothers who continued ($p = .735$).

Proportions of exclusive breastfeeding

BFHI and NeoBFHI implementation did not affect exclusive breastfeeding rates at any measurement point (Table 2). The most common reason mothers reported for discontinuing breastfeeding was that their milk volume had faded out and ceased.

Mothers who had given birth vaginally (OR 6.7 [CI 95 % 1.56–29.15] $p = .011$), were more educated (OR 3.6 [CI 95 % 1.10–11.49], $p = .007$), had planned their breastfeeding during pregnancy (OR 8.1 [CI 95 % 2.71–24.06], $p < .001$), were married or cohabiting (OR 33.3 [CI 95 % 1.55–713.69] $p = .011$), or who did not smoke (OR 8.0 [CI 95 % 1.17–55.00]). $p = .018$) exclusively breastfed more often.

After the final multivariate modelling, breastfeeding attitudes ($p < .001$) and problems in breastfeeding ($p < .001$) remained as significant predictors for exclusive breastfeeding. Mothers with positive breastfeeding attitudes had higher odds of exclusive breastfeeding compared to mothers with neutral breastfeeding attitudes (OR 4.1 [CI 95 % 1.57–10.63]). Mothers who did not have problems with breastfeeding also showed significantly higher odds for exclusive breastfeeding compared to mothers who reported problems with their breastfeeding

Table 1
Background characteristics of the mothers in group 1 (N = 162) and in group 2 (N = 163).

Maternal characteristics	Group 1 n (%)	Group 2 n (%)	*p*
Unit after birth [a]			.416
Maternity unit	138 (85.2)	144 (88.3)	
NICU	24 (14.8)	19 (11.7)	
Maternal age (year) [b]	29.6 (4.91)	29.3 (4.66)	.471
Education [a, c]			.008
Comprehensive school	7 (4.7)	4 (2.7)	
Secondary school	74 (49.7)	57 (37.8)	
University of applied sciences	42 (28.2)	71 (47.0)	
University degree	26 (17.5)	19 (12.6)	
Marital status [a]			.436
Married / cohabiting	154 (95.1)	158 (96.9)	
Single	6 (3.7)	5 (3.1)	
Other	2 (1.2)	0 (0.0)	
Parity [a]			.655
Primipara	72 (44.4)	68 (41.7)	
Multipara	90 (55.6)	95 (58.3)	
Smoking status [a]			.728
Yes	9 (5.6)	6 (3.7)	
Yes, but not during pregnancy	11 (6.8)	12 (7.4)	
No	142 (87.7)	145 (89.0)	
Planned pregnancy [a]	143 (88.8)	142 (88.2)	.999
Type of birth [c]			.002
Vaginal	149 (93.1)	132 (81.0)	
Caesarian section	11 (6.9)	31 (19.0)	
Birth experience [a]			.816
Negative	9 (5.6)	7 (4.4)	
Neutral	22 (13.8)	25 (15.5)	
Positive	129 (80.6)	129 (80.1)	
Previous BF duration (months) [d]	10 (5-14)	8 (4-12)	.108
Made BF plans during pregnancy [a]	99 (61.5)	112 (68.7)	.200
Planned BF duration (months) [d]	9.5 (6-12)	11.5 (6-12)	.326

BF = breastfeeding.
[a] number (%), P-value from Fisher's Exact test.
[b] Mean (SD), P-value from Analysis of variance (ANOVA).
[c] Missing values: Education 2017n = 13, 2019n = 12; Type of birth 2017n = 2.
[d] Median (Q1-Q3), P-value from Wilcoxon rank sum test.

Table 2
Breastfeeding duration and exclusivity during the six months follow up period.

Breastfeeding	2017		2019		*p*
	N	n (%)	N	n (%)	
2 weeks	141		134		.961 [a]
Exclusive breastfeeding		108 (76.6)		101 (75.4)	
Partial breastfeeding		30 (21.3)		28 (20.9)	
No breastfeeding		3 (2.1)		5 (3.7)	
1 month	131		128		.725 [a]
Exclusive breastfeeding		106 (80.9)		97 (75.8)	
Partial breastfeeding		23 (17.6)		26 (20.3)	
No breastfeeding		2 (1.5)		5 (3.9)	
4 months	122		119		.204 [a]
Exclusive breastfeeding		87 (71.3)		85 (71.4)	
Partial breastfeeding		18 (14.8)		20 (16.8)	
No breastfeeding		17 (13.9)		14 (11.8)	
6 months	109		102		.435 [a]
Exclusive breastfeeding		45 (41.3)		56 (52.9)	
Partial breastfeeding		47 (43.1)		35 (34.3)	
No breastfeeding		17 (15.6)		13 (12.8)	

[a] Hierarchical linear mixed models with repeated measures for multinomial data.

(OR 31.4 [CI 95 % 13.4–73.6]).

Breastfeeding problems

Implementing BFHI and NeoBFHI practices did not decrease mothers' breastfeeding problems. The frequency of breastfeeding problems did not differ (p =.260) between the groups (Fig. 2). Breastfeeding attitudes were not associated with breastfeeding problems (p =.119). Primiparous mothers reported four times more problems compared with multiparous mothers (OR 4.2 [CI95% 2.01–8.60], p <.001), and mothers with shorter previous breastfeeding duration had more problems compared with those who had had longer duration (OR 0.8 [CI 95 % 0.74–0.89], p <.001). Mothers whose newborns were in NICU after birth reported three times more problems compared with mothers who were in the maternity unit (OR 3.2 [CI 95 % 1.07–9.58], p =.037).

The problems reported were similar in both groups. The most common problem was the experience of inadequate milk volume (31.3 %). However, some mothers described problems with too much milk and newborns struggling to cope with it (12.4 %). Another common problem was newborns' fussing or refusal to suckle (21.7 %). Some mothers reported pain during breastfeeding (14.3 %); inadequate latch (10.7 %); sore, scarred, or inverted nipples (6.6 %); or blocked milk ducts or mastitis (8.5 %).

Breastfeeding attitudes

BFHI and NeoBFHI implementation did not appear to affect maternal breastfeeding attitudes. We found no significant differences between groups in the mothers' breastfeeding attitudes after birth at the hospital (A1; 65.5 vs 66.5, p =.216) or at 4 months after birth (A2; 66.9 vs 67.4, p =.603). We found no statistically significant differences regarding maternal attitudes towards breastfeeding during follow-up within the groups (from A1 to A2; p =.936) or between study groups (p =.354).

A majority (63.8–70.2 %) of mothers' IIFAS scores were in a range of 55–61 and could be considered as neutral regarding breastfeeding (Fig. 3). Mothers who were more educated (p =.012), had planned pregnancy (p =.005), had planned their breastfeeding duration during pregnancy (p <.001) or who had longer previous breastfeeding duration (p <.001) all presented higher IIFAS scores, indicating more favourable attitudes towards breastfeeding. There were no differences in attitude scores corresponding to maternal age, marital status, parity, mode of birth, birth experience, pregnancy weeks, or whether they had been in the maternity unit or NICU after birth. However, multiparous mothers' IIFAS scores (66.8) after birth at the hospital (A1), were more favourable to breastfeeding than primiparous mothers' scores (65.0), p =.029. However, after 4 months (A2), we noted no significant difference based on parity (65.9 vs 65.9, p =.974).

Discussion

Our results show that the implementation of BFHI and NeoBFHI practices had no effect on the proportion of mothers who exclusively breastfed, breastfeeding problems or maternal breastfeeding attitudes.

We observed no significant differences in partial or exclusive breastfeeding rates before and after BFHI and NeoBFHI implementation, which is contrary to many previous studies. Improvements in exclusive breastfeeding have been shown previously at different time points [11,12]. However, the evidence in high-income countries have questioned the maintenance of achieved breastfeeding rates [12,16]. In this study, the exclusive breastfeeding rates at 6 months increased from 41.3 % to 52.9 % indicating at least some changes to be confirmed in future studies. It is notable that breastfeeding rates exceeded the global mean of 40 % before the intervention[2]. Future work is needed to confirm whether BFHI is effective in supporting breastfeeding outcomes as well as the maintenance of breastfeeding in settings that reach the global mean.

Mothers, who were more highly educated or gave birth vaginally, exclusively breastfed more often. Previously, a caesarean birth [30]and lower educational level [23,31]have been detrimental factors leading to shorter breastfeeding duration. In our study the post-intervention group had significantly higher education and more caesarean sections compared with the pre-intervention group; these might partly explain why implementing BFHI and NeoBFHI had no effect on breastfeeding outcomes. Mothers undergoing caesarean birth need to be supported carefully when initiating breastfeeding. Attention should be paid to the implementation of Step 4; early skin-to-skin contact should be allowed also in the operation theatre to provide an optimal environment for the mother–infant dyad to early initiation of breastfeeding.

The number of reported breastfeeding-related problems or the nature of the problems did not change after BFHI, and insufficient milk volume remained the most common problem [18–20]. The prevalence of breastfeeding problems shows the importance of high-quality breastfeeding support [32]. Based on this study, the BFHI may not prepare

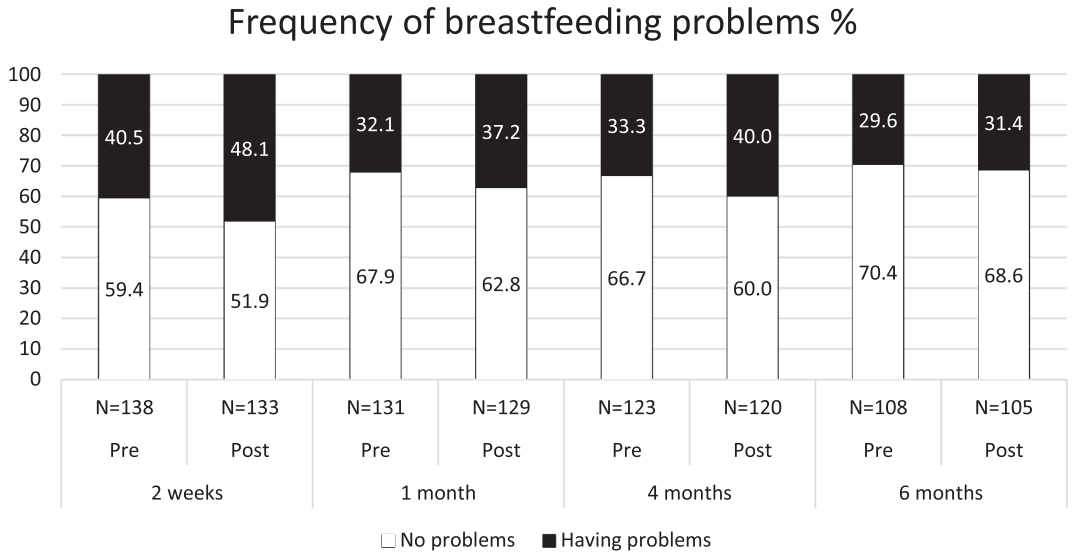

Fig. 2. Comparison of the frequency (%) of the breastfeeding problems on 2 weeks, 1, 4 and 6 months postpartum in pre- and post-implementation phase before and after the implementation of BFHI and NeoBFHI. The frequency of breastfeeding problems did not differ (p =.260) between phases.

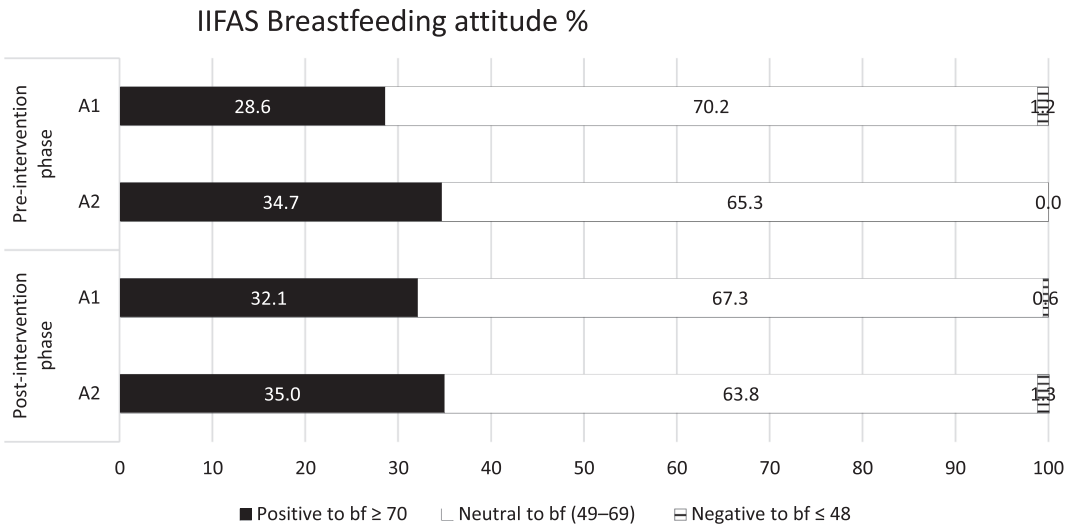

Fig. 3. Maternal attitude towards breastfeeding (%) grouped as positive, neutral, and negative. At hospital before discharge (A1) and at 4 months postpartum (A2). bf = breastfeeding.

mothers for common breastfeeding challenges which confirms the previous results [16,20,21]. Healthcare professionals should prepare mothers to deal with possible breastfeeding problems (for example, how to increase milk volume), because difficulties in coping with breastfeeding challenges may lead to early or unintended cessation of breastfeeding[33]. It is important that mothers are taught to observe and identify newborns' behavior and feeding cues (Step 8), as well as the signs of successful breastfeeding and adequate milk volume. Responding to infant's behavioral cues has been shown to increase maternal confidence in breastfeeding [2]. Because postnatal hospital stays are only a few days, BFHI practices need to be applied during pre- and postnatal periods to ensure the continuity of adequate support. This underlines the importance of the BFHI Step 10 (timely access to ongoing support and care)[2] to be crucial for supporting breastfeeding after hospital discharge [12,16].

Newborns' admittance to the NICU was associated with the increased occurrence of breastfeeding problems in this study. However, the implementation of the NeoBFHI improved practices regarding breastfeeding and increased exclusive breastfeeding rates in the NICU [26]. In order to prevent breastfeeding problems in the NICU environment, NeoBFHI provides many concrete tools to overcome the well-known barriers for breastfeeding. For example, minimizing parent-newborn separation by enabling rooming-in 24 h a day (Step 7), and increasing early and prolonged skin-to-skin contact (Step 4) provide optimal environment for the initiation of breastfeeding. Moreover, supporting early initiation of breastmilk expression (Step 5) and decreasing the use of nipple shields and pacifiers (Step 9) prevent problems related to inadequate milk volume [24,34].

BFHI and NeoBFHI implementation has changed hospital practices and professionals' breastfeeding attitudes in favour of breastfeeding [26] but does not appear to have influenced maternal breastfeeding-related attitudes. The core of the BFHI program focuses on supporting practices that promote breastfeeding [8]; therefore BFHI might not be an optimal intervention to change maternal breastfeeding attitudes, which this study confirmed. It is notable that mothers who are more educated seem to have more favourable attitudes towards breastfeeding [35]. The mothers in the post-BFHI group were significantly more highly educated, which may partly explain why implementing BFHI and NeoBFHI practices had no effect on maternal breastfeeding attitudes in this study. However, it is understandable that a short exposure to BFHI practices in the birth hospital did not change maternal attitudes as changing attitudes demands more complex influence[23] and breastfeeding attitudes often remain consistent [25]. Changing maternal attitudes would require change at the entire care pathway.

The main limitation of our study was that the design lacked randomization. The intervention was implemented in the whole study hospital to change the care culture of the hospital. Therefore, a randomized controlled study design within a hospital was not applicable. However, data collection procedures were similar in both measurement points. The strength of the study is the validated breastfeeding attitude scale IIFAS [27], which showed acceptable internal consistency, $\alpha = 0.75$ at baseline (A1) and $\alpha = 0.78$ at 4 months (A2). Previous psychometric testing of this instrument has shown good content validity [27].

Instead of power analysis, we chose a sample size of 160 mothers to meet 10 % of annual births at the hospital so that we could complete the data collection in a reasonable amount of time. Although nearly all mothers were eligible, less than a fourth (22 % and 24 %) of them participated in the study. Despite the small sample size the statistical analyses performed were appropriate. One limitation in our study was potential selection bias, as the mothers who had positive breastfeeding attitudes (OR 1.2 [CI 95 % 1.05–1.44], p =.033) were more likely to continue in the study compared to mothers with neutral attitudes. However, we observed no difference in dropout rates between groups, there is no reason to believe that dropouts would have biased the main outcome.

Many confounders may have influenced the results, as the women in both groups could have been exposed to different amounts of breastfeeding information. Although we evaluated the data from the maternity unit and the NICU to justify the pooling, the NICU environment may pose more challenges concerning breastfeeding.

We experienced some technical difficulties in delivering text messages. By 6 months, $n = 1$ participant in Group 1 and $n = 17$ participants in Group 2 were lost due to technical problems in delivering SMSs, which resulted in missing data. This may have affected the breastfeeding results, especially in Group 2 at 6 months.

Conclusion

The implementation of the BFHI and NeoBFHI did not increase the proportion of mothers who exclusively breastfed or decrease the number of reported breastfeeding-related problems or changed maternal breastfeeding attitudes. However, non-problematic breastfeeding and breastfeeding-favourable attitudes were strongly associated with the continuity and exclusivity of breastfeeding. There is a need to understand better how to support the maintenance of breastfeeding to reach a longer duration in areas where breastfeeding initiation rates are high.

Changes at the organisational level such as BFHI and NeoBFHI could be supplemented with more personalized interventions to support breastfeeding of every individual.

Funding

This study is funded by the Government Research Financing of the Satakunta Hospital District (decision 189/2021 code 320191115). The funder has no role in the design, data collection, analysis, and interpretation of the study findings.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to thank the mothers who participated in this study and the members of the hospital work group and the nurse leader Tuula Kuivalainen. This study could not have been possible without their work.

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