

## ORIGINAL ARTICLE

# Direct breast-feeding in the neonatal intensive care unit: is it important?

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**Objective:** Rates of breast milk feeding at hospital discharge are low in premature infants due to the many associated challenges. Although there are many benefits associated with breast milk, the effects of direct breast-feeding in the neonatal intensive care unit (NICU) have not been identified. The purpose of this study was to investigate the relationship between direct breast-feeding (infant sucking directly from the breast) and duration and success with breast milk feedings until discharge in premature infants.

**Study Design:** This retrospective cohort was conducted on 66 very-low birth weight infants whose mothers initiated breast milk feedings in the NICU. Chart review revealed documented type (breast milk with or without fortifiers or type of infant formula), volume and mode (nasogastric tube, breast or bottle) of all gastric feeds for each day of NICU hospitalization. From this documentation, whether the mother initiated breast milk feedings, the number of times the mother put the infant to breast, the gestational age of the first direct breast-feeding, whether the first oral feeding was at the breast, the duration of breast milk feedings and whether breast milk feedings continued until NICU discharge were determined. Associations between breast-feeding participatory factors and breast milk feeding outcomes were investigated using linear and logistic regression.

**Result:** Positive associations were found between breast milk feedings at discharge and mothers putting their infants directly to breast in the NICU ( $P = 0.0005$ ). The duration of breast milk feedings was associated with: mothers putting their infants directly to breast ( $P = 0.0110$ ), whether the first oral sucking feeding was at the breast ( $P = 0.0108$ ) and the gestational age of the first breast-feeding attempt ( $P < 0.0001$ ).

**Conclusion:** Breast milk feedings are encouraged in most NICU's, but direct breast-feeding is often overlooked as an important area of research in the tightly controlled environment of the NICU. This study demonstrates a link between direct breast-feeding behaviors in the NICU and success with provision of milk at discharge, as well as how early participation can be an important factor in the breast-feeding process for

mothers of NICU infants. More research on the effects of direct breast-feeding is warranted.

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**Keywords:** NICU; breast-feeding; breast milk feedings; participation; intervention; premature infants

## Introduction

Breast milk feedings in premature infants have been a focus of research, and the multiple benefits of breast milk feedings for the premature infant have been established.<sup>1</sup> However, breast milk feeding the premature infant and making the transition to sucking feedings at the breast (direct breast-feeding) come with significant challenges.<sup>2</sup>

In the neonatal intensive care unit (NICU), there are many reasons why breast milk feedings fail to continue until hospital discharge. Fragile, vulnerable, medically compromised infants often cannot eat by mouth initially,<sup>3</sup> and their mothers must regularly express breast milk for gastric feedings, while maintaining their milk supply until direct breast-feedings are possible.<sup>4</sup> Transitions from tube to oral feeding may not be possible until the infant is several months old. In addition, the transition to full sucking feeds can be slow, as poor oral motor skills and inefficient feeding are common among premature infants.<sup>5</sup> Initial direct breast-feeding attempts may consist of skin-to-skin contact or nuzzling at the breast while gavage feedings continue. As an infant becomes more mature, this can progress to short, inefficient periods of suckling at the breast with partial gavage supplementation. Finally, the infant is able to engage in longer, more efficient periods of oral sucking with or without additional supplementation.

It is not uncommon for the mother of a premature infant to follow a rigorous pumping schedule for weeks or months without being able to put her infant directly to the breast. Declining milk supply is a common problem associated with expressing breast milk and is cited as one of the biggest barriers to breast milk feeding the premature infant.<sup>2,6</sup> Although barriers to breast-feeding

the high-risk infant have been studied and some treatments have been identified, there is a paucity of studies that have investigated environmental factors that can influence success with breast milk feedings until NICU discharge. Although the benefits of participation in breast-feeding in the NICU can be assumed, to date there have been no studies investigating the role of certain environmental factors or breast-feeding patterns in the NICU on breast-feeding success at discharge. The objective of this study was to investigate environmental or participatory factors associated with the duration of breast milk feedings and success with breast milk feeding at NICU discharge.

### Research questions

(1) Are there associations between breast milk feedings at NICU discharge and:

- The number of times an infant is put directly to breast in the NICU?
- Whether an infant is ever put directly to breast in the NICU?
- Whether the first oral sucking feeding is at the breast?
- At what gestational age the infant is first put directly to breast?

(2) Are there associations between the duration of breast milk feedings in the NICU and

- The number of times an infant is put directly to breast in the NICU?
- Whether an infant is ever put directly to breast in the NICU?
- Whether the first oral sucking feeding is at the breast?
- At what gestational age the infant is first put directly to breast?

(3) Are there associations between the number of direct breast-feeds in the NICU and

- Whether the first oral sucking feed is at the breast?
- At what gestational age the infant is first put directly to breast?

### Methods

This study was a retrospective cohort, taking place in a 75-bed level II and III NICU in a midsized southern city. The study was approved by the human subjects committee at the study site. Informed consent was waived due to data collection being by a retrospective chart review of information not deemed to be sensitive.

The study sample consisted of subjects enrolled in a parent study investigating breast-feeding behaviors before and after a breast-feeding educational intervention. Subjects were consecutive new admissions admitted during an 18-month period. Parent study exclusion criteria were infants who weighed >1500 g at birth, infants who had a known congenital anomaly or other impairments that could contraindicate or impede oral feeding and infants who were admitted beyond the 7th day of life. For

this study, infants were also excluded if their mothers chose not to provide breast milk for the infant in the NICU or if the infant expired or was transferred to another hospital before discharge to home.

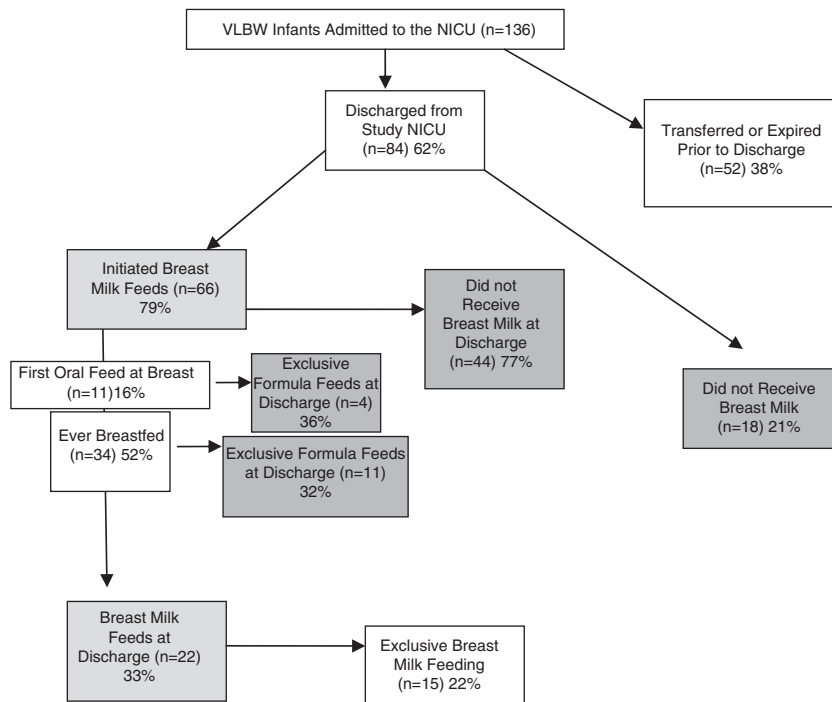
At the study site the type, volume and mode of infant feeding are consistently documented by the nursing staff in each infant's medical chart following each infant feed. Retrospective chart review was conducted by the principal investigator and was checked for reliability by another researcher, with 100% reliability. From the daily recordings of type, volume and mode of infant feedings, the following information was collected: duration of breast milk feedings (the last day of life in the NICU the infant received any breast milk by breast, bottle or tube), whether breast milk feedings continued until discharge (whether or not the infant received any breast milk by breast, bottle or tube in the 24 h before the discharge), the gestational age at the first breast-feed (number of completed weeks of gestation when the infant first suckled directly from the breast), whether the first oral sucking feeding was at the breast, whether the mother ever attempted direct breast-feeding during the NICU stay and how many times the mother put the infant to breast during the NICU stay.

Associations between participation or environmental factors and success with breast milk feeding at discharge, duration of breast-milk feedings and the number of times breast-fed in the hospital were investigated using linear and logistic regression models with an  $\alpha = 0.05$ .

### Results

The initial cohort consisted of 136 admissions of very-low birth weight infants admitted during the study dates. Of these, 52 were transferred to another NICU in the community or expired before discharge to home. Of the 84 infants discharged directly from the study site, 66 (79%) infants were provided breast milk after birth. See Figure 1 for the patterns of breast milk feeding initiation and breast milk feeding at discharge among the 136 infants in the original cohort.

Data from 66 mother–infant dyads who initiated breast milk feedings and were discharged from the study site were collected for this study. The range of gestational age at birth was 24 to 35 weeks, with the mean gestational age at birth of this sample being  $28.1 \pm 2.7$  weeks. The birth weight of the study sample ranged from 550 to 1485 g with the mean birth weight being  $1023 \pm 271$  g. Seventy-four percent ( $n = 51$ ) of the infants were part of a singleton pregnancy, with 26% ( $n = 17$ ) being a multiple birth. Forty-three percent ( $n = 28$ ) of the sample was Caucasian, 47% ( $n = 31$ ) were African American and 9% ( $n = 6$ ) were Hispanic. Thirty-one ( $n = 20$ ) percent of the sample were Medicaid eligible and 51% ( $n = 34$ ) of mothers were married. The length of stay of the sample ranged from 10 to 108 days. The mean length of stay for the study sample was  $66.4 \pm 27.4$  days.



**Figure 1** Patterns of breast milk feeding initiation and breast milk feeding at discharge of the very-low birth weight sample.

Infants were first put to breast between 30 and 37 weeks gestation. The mean gestational age at the first breast-feeding was  $33.1 \pm 1.59$  weeks. Only 16.4% ( $n = 11$ ) of mothers who initiated breast milk feedings in the NICU had the first oral feeding at the breast. Among mothers who initiated breast milk feedings, fifty-two percent ( $n = 34$ ) breast-fed at least once during the NICU stay, with 48% ( $n = 31$ ) never breast-feeding in the hospital. Among mothers who initiated breast milk feeds in the NICU, the number of times the mother put her infant directly to breast while in the NICU was skewed toward 0. However, among mothers who put their infant to breast at least once during the NICU stay, the mean number of times breast-fed was  $13.8 \pm 15.1$  times. Of those who continued to provide breast milk until discharge, 100% had put their infants directly to breast at least once during the hospitalization.

The duration of breast milk feeds ranged from 12 to 108 days. The mean duration of breast milk feedings was  $35.56 \pm 26.88$  days. Of those who initiated breast milk feeds, 32.8% ( $n = 22$ ) continued to provide some breast milk at discharge (partial breast milk feeding), but only 22.4% ( $n = 15$ ) provided exclusive breast milk (100% of feeds were breast milk by breast or bottle) at discharge.

See Table 1 for factors associated with the outcome variables. Factors that were positively associated with breast milk feedings at discharge included number of times the infant was put directly to the breast in the hospital ( $P = 0.0005$ ), as well as, whether the infant was ever put to breast ( $P < 0.0001$ ). Although the first oral sucking feeding being at the breast ( $P = 0.0697$ ) had a trend

toward significance, gestational age of the first direct breast-feed ( $P = 0.4840$ ) failed to demonstrate associations with breast milk feedings at discharge. Factors associated with the duration of breast milk feedings included the number of times the infant was put directly to breast ( $P = 0.0110$ ), whether the infant was ever directly breast-fed ( $P = 0.0463$ ), the first oral sucking feeding being at the breast ( $P = 0.0108$ ) and the gestational age at the first direct breast-feed ( $P < 0.0001$ ). Factors associated with the number of times directly breast-fed in the NICU included: whether the first oral sucking feeding was at the breast ( $P < 0.0001$ ) and the gestational age of the first direct breast-feeding ( $P < 0.0001$ ).

## Discussion

The key findings of this study are that although maintaining breast milk feedings until NICU discharge is a challenge for mothers, improved success is evident among mothers who have put their infants to breast during the hospital stay. In addition, having the first oral feeding be at the breast is associated with increased frequency of later breast-feeds, increased duration of breast milk feedings and trends toward increased success with breast milk feedings at hospital discharge. However, gestational age of the first direct breast-feeding was not associated with success with breast milk feedings at NICU discharge. Having the first oral feeding be at the breast and putting the premature infant to breast often in the NICU is important to enable breast milk feeding at NICU discharge and beyond, even when early breast-feeding is not possible.

**Table 1** Associations with outcome variables

Independent variables	Outcomes						
	Breast milk at discharge		P-value	Duration breast milk feeds (in days)	P-value	Number of direct breast-feeds in the hospital	P-value
	No	Yes					
Number of direct breast-feeds in hospital	Range: 0–10 Median: 0	Range: 1–57 Median: 18	<b>0.0005</b>		<b>0.0110</b>		
<i>First feed at breast</i>							
No	70%	30%	0.0697	38 ± 27.6	<b>0.0108</b>	Range: 0–17; median: 0	<b>&lt; 0.0001</b>
Yes	40%	60%		63.0 ± 27.7		Range: 1–57; median: 18	
<i>Ever breast-fed in the hospital</i>							
No	97%	3%	<b>&lt; 0.0001</b>	34.0 ± 19.0	<b>0.0463</b>		
Yes	38%	62%		52.5 ± 22.7			
Gestational age at first breast-feed	32.7 ± 1.77	33.4 ± 1.43	0.4840			<b>&lt; 0.0001</b>	<b>&lt; 0.0001</b>

Bold values signifies P<0.05.

One third of mothers, who intended to breast-feed and initiated the process of milk expression, succeeded with breast milk feedings until discharge. This is somewhat lower than previous studies that have reported rates of breast milk feedings at discharge between 36 and 61%.<sup>7–11</sup> The exclusive breast milk feeding at discharge rate of 22.4% was lower than previously reported rates of 31%.<sup>10</sup> However, these previous studies have different operational definitions of breast-feeding at discharge (feeding directly from the breast versus having breast milk feeds from a bottle), in addition to have different cut-offs for gestational age at birth and birth weight. In addition, many of the previous studies describe a rate of breast-feeding at discharge among all infants admitted to the NICU, whereas the current study reports breast milk feeds at discharge only among those infants who had breast milk feedings initiated, which should yield a higher rate.

Diminished milk supply is one of the most significant barriers to breast milk feeding and breast-feeding the premature infant.<sup>2,6</sup> Better understanding why and how milk supply diminishes among those who initiate breast milk feedings and determining effective interventions to promote improved breast milk feedings and breast-feeding in the premature infant is of great importance. Owing to its relationship with breast milk feedings at discharge, this research supports early and frequent participation in direct breast-feeding in the NICU. There are physiological and psychological reasons as to why participatory factors could be associated with whether a mother succeeds with providing breast milk through until NICU discharge.

A breast pump serves as a necessary substitution for direct breast-feeding in the early preterm infant, but the mechanism of milk expression differs from the infant suckling directly from the breast. An infant's wide open mouth position on the areola compresses milk out of the lactiferous sinuses and the rhythmic

suckling response at the breast stimulates pulsatile release of oxytocin resulting in the milk ejection response. Milk flows through the ducts, followed by stimulation of more milk production by the secretory cells. During infant suckling at the breast, a surge in prolactin also contributes to milk production. Manual milk expression fails to provide the compression that fully empties the sinuses, elicitation of the milk ejection response can be more difficult and there can be inadequate prolactin release.<sup>12</sup> Subsequently, milk production can be impeded in mothers who cannot engage in direct breast-feeding with their medically fragile, premature infants.

There can also be psychological benefits associated with direct breast-feeding. Oxytocin release has been identified before infant suckling at the breast, as a result of the maternal response to infant crying or in preparation for infant feeding.<sup>13</sup> This would suggest that there is a complex mechanism of mother–infant responses associated with the process of direct breast-feeding that perhaps has not been fully realized. In addition, stress has been shown to be associated with difficulty in achieving oxytocin release and the milk ejection response,<sup>14</sup> which can interfere with adequate milk expression in mothers experiencing the stress of having an infant in the NICU. Although stress can interfere with oxytocin release, the release of oxytocin associated with the infant suckling directly from the breast can mediate stress.<sup>15,16</sup> Finally, the NICU is an environment where parents have reported feeling like an outsider and not being able to parent their infant.<sup>17–19</sup> Through participation in breast-feeding, mothers are given an active and meaningful role in the NICU, which can build confidence and enable parents to handle and care for their infant.

The gestational age at which the infant is first put to breast and whether a mother puts her infant directly to breast for the first oral suckling feed can be multifactorial. By understanding a trend

toward improved breast milk feedings at discharge in infants who had the first oral feeding at the breast, health care professionals can better understand the importance of enabling the first oral suckling feeding to be at the breast. Although the gestational age that the infant is first put to breast is associated with the number of times the infant is breast-fed in the NICU, there was not an association with breast milk feedings at discharge. This can provide some hope for those infants who cannot be breast-fed early, as inability to engage in early breast-feeding does not make later breast milk feeds unobtainable. However, by fostering direct breast-feeding as early as possible and enabling the first oral feed to be at the breast, the number of times an infant is directly breast-fed can be fostered and potentially improve success with breast milk feedings until discharge.

This study demonstrates a link between direct breast-feeding behaviors in the hospital and the ability to maintain breast milk feedings until hospital discharge. All mothers who initiated breast milk feedings but did not put their infants to breast in the NICU were no longer providing breast milk for their infants at NICU discharge. The experience of ever breast-feeding the infant in the NICU, as well as the frequency of direct breast-feeds, can have positive effects on enabling the breast-feeding process until discharge and beyond. This supports other research that has identified predictive factors associated with breast-feeding in the NICU and described trends in improved duration of breast milk feeds among those who have infants directly suckling from the breast.<sup>20</sup>

Often the importance of direct suckling from the breast is overlooked in the NICU as mothers express their milk, and it is given through a gastric tube or bottle. However, the duration of breast milk feedings in premature infants is low, indicating that mothers often cannot continue to efficiently express milk indefinitely. The average duration of breast milk feedings was 36 days. Many very-low birth weight infants will necessitate gavage supplementation for longer than 36 days, however, this does not preclude direct breast-feeding. Participation in the direct breast-feeding process during the transition from gavage to oral feedings, while continuing manual milk expression and supplementation, could be a critical intervention that could foster success with breast milk feedings until discharge.

There were limitations to the current study. This study relied on when the infant was given breast milk, which did not necessarily define when the mother expressed milk and for how long she maintained her milk supply. Mothers who had excess, frozen milk from early milk expression could have had documented breast milk at discharge, even in the absence of this factor. The small sample size prevented investigating the effect of direct breast-feeding in specific demographic groups of mother–infant dyads. Another important limitation is related to variations in clinical condition and medical status, which can affect breast-feeding outcome. These variations in clinical condition may well have affected the success

or failure of direct breast-feeding and have obfuscated the actual effect of direct breast-feeding on subsequent success of breast milk feedings. Finally, although an association is evident, this study does not allow an interpretation of whether it is the participation itself that promotes success until discharge or if it is that mothers who are more likely to succeed participate in breast-feeding in the NICU.

## Conclusion

The findings of this study demonstrate a link between participation in direct breast-feeding in the NICU and duration of breast milk feedings, as well as success with continued breast milk feedings until NICU discharge. The gestational age of the first direct breast-feeding and the first oral suckling feeding being at the breast are associated with the duration of breast milk feedings, as well as with the number of times the infant is directly breast-fed in the NICU. Based on positive associations with breast milk feeding outcome, direct breast-feeding in the NICU could be a valuable breast-feeding intervention. Future studies are warranted to further investigate factors that can positively influence breast milk feedings in the NICU and to investigate the effects of direct breast-feeding on infant and mother.

## Conflict of interest

The author declares no conflict of interest.

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