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Objectives To examine rates and determinants of mother's own milk (MOM) feeding at hospital discharge in a cohort of infants born very preterm within the Canadian Neonatal Network (CNN).

Study design This was a population-based cohort study of infants born at <33 weeks of gestation and admitted to neonatal intensive care units (NICUs) participating in the CNN between January 1, 2015, and December 31, 2018. We examined the rates and determinants of MOM use at discharge home among the participating NICUs. We used multivariable logistic regression analysis to identify independent determinants of MOM feeding.

Results Among the 6404 infants born very preterm and discharged home during the study period, 4457 (70%) received MOM or MOM supplemented with formula. Rates of MOM feeding at discharge varied from 49% to 87% across NICUs. Determinants associated with MOM feeding at discharge were gestational age 29-32 weeks compared with <26 weeks (aOR 1.56, 95% CI 1.25-1.93), primipara mothers (aOR 2.12, 95% CI 1.86-2.42), maternal diabetes (aOR 0.79, 95% CI 0.66-0.93), and maternal smoking (aOR 0.27, 95% CI 0.19-0.38). Receipt of MOM by day 3 of age was the major predictor of breast milk feeding at discharge (aOR 3.61, 95% CI 3.17-4.12).

Conclusions Approximately two-thirds of infants born very preterm received MOM at hospital discharge, and rates varied across NICUs. Supporting mothers to provide breast milk in the first 3 days after birth may be associated with improved MOM feeding rates at discharge. *(J Pediatr 2021;236:21-7)*.

Mother's own milk (MOM) is the best nutrition for infants of all gestational ages; however, the nutritional, immunologic, and long-term neurodevelopmental advantages of MOM are more pronounced in infants born preterm.[1-3] Feeding MOM during the neonatal intensive care unit (NICU) stay has been shown to reduce the risks of feeding intolerance, necrotizing enterocolitis, nosocomial infection, bronchopulmonary dysplasia, retinopathy of prematurity, neurocognitive delay, and rehospitalization after discharge.[4,5] The benefits of feeding MOM are dose-dependent in infants born very preterm.[4]

Despite these health benefits of human milk for infants born preterm, there has been a slow incorporation of the evidence into best practices for MOM feeding during NICU hospitalization of infants born preterm.[6] For example, from 2004 to 2013 rates, of exclusive breastfeeding decreased in infants born preterm in Sweden, despite the implementation of family-centered care and provision of additional parental education and support.[7]

The use of MOM at discharge from the NICU is associated with higher rates of continued breastfeeding at home.[8] In a large cohort from 124 NICUs in the US, older gestational age, older maternal age, White race, and site of care were significant predictors of increased breast milk use at hospital discharge.[9] Among infants with very low birth weight from California, lack of prenatal care, young maternal age, African American race, and Hispanic ethnicity were associated with higher rates of formula feeding at discharge home.[10] Identifying factors influencing the use of MOM in NICUs could inform the development of programs promoting this feeding practice.[11] The best practices for optimizing human milk feeding among infants born preterm in the NICU have been described,[6,12] but there is limited population-based data on the rates and determining factors of MOM feeding among infants born very preterm. This study aimed to examine rates of MOM feeding at discharge from the NICU in a Canadian cohort of infants born at <33 weeks of gestation and to identify factors influencing these rates.

CNN	Canadian Neonatal Network
MOM	Mother's own milk
NICU	neonatal intensive care unit

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Methods

We conducted a multicenter, retrospective cohort study using data from the Canadian Neonatal Network (CNN). The CNN maintains a national database of admissions from tertiary-level NICUs in Canada. Trained research assistants at each participating NICU abstracted data following a manual of standardized operational definitions.[13,14] Data collection and transmission from each participating NICU were approved by each hospital's local Research Ethics Board or Quality Improvement Committee. Specific approval for this study was obtained from the University of Calgary Conjoint Health Research Ethics Board and the Executive Committee of the CNN.

Study Population

Infants born at <33 weeks of gestation who were admitted to participating NICUs from January 1, 2015, to December 31, 2018 and discharged home were included in the analysis. During the study years, the number of units participating in the CNN were 30 (2015-2016), 31 (2017), and 32 (2018). Only infants with available data about the type of feeding received at the time of discharge home were eligible for the study. We included infants born from the year 2015 because the CNN Abstractor's Manual was revised to report data on feeding at discharge home from 2015 onward.[13] Infants who had major congenital anomalies, did not survive to discharge, or were transferred to level II neonatal units were excluded from the analysis.

Outcomes and Study Variables

The primary outcome was the type of milk feeding on the day of discharge home, dichotomized as any MOM feeding or exclusive formula feeding. As per the operational definition from the CNN abstractor's manual, "breast milk" was recorded for any use of breast (mother's own) milk in the previous 24 hours of discharge.[13] The method of feeding was not differentiated and could include direct breastfeeding, bottle feeding, gavage feeding, or a combination. Infants receiving both MOM feeding and formula supplementation at discharge home were included in the breast milk feeding group.

Determinants of Breast Milk Feeding

The following characteristics of the mothers and infants were compared between the 2 feeding type groups: maternal age, gestational age, birth weight, parity, maternal diabetes, maternal hypertension, maternal illicit drug use, maternal cigarette smoking, multiple gestation, assisted pregnancy, mode of delivery, antenatal steroid use, maternal magnesium sulfate use, sex, small for gestational age status, outborn status, and Score for Neonatal Acute Physiology version II. Gestational age was defined as the best estimate based on obstetric history, obstetric examination, and first prenatal ultrasound examination. Antenatal steroid use was classified as none, partial course, or complete course defined as receipt of 2 doses of betamethasone 24 hours before birth. The Score for Neonatal Acute Physiology version II, a validated scoring system of illness severity during the first 12 hours after NICU admission, was dichotomized to <20 or ≥20.[15] Small for gestational age was defined as birth weight <10th percentile for the given gestational age and sex.[16] Outborn was defined as being born anywhere other than the admitting tertiary-level NICU.

Statistical Analyses

The study population was summarized descriptively. The rate of the primary outcome, any MOM feeding, was calculated for the study population. The Cochran-Armitage trend test was used to examine the trend in the rate of any breast milk feeding at discharge across gestational age and parity. To examine the determinants of the primary outcome, maternal and infant characteristics were compared between the 2 feeding type groups, any MOM feeding, and exclusive formula feeding, using the χ^2 test for categorical variables and the Student *t* test or Wilcoxon rank-sum test, as appropriate, for continuous variables. To further identify the independent determinants, we applied a multivariable logistic regression model with a generalized estimating equation approach to account for the clustering of infants within sites. The covariates included in the model were the potential determinants associated with the primary outcome in the univariate analysis. Birth weight was not included in the model because of significant collinearity with gestational age. The data management and all statistical analyses were performed using Statistical Analysis System, SAS 9.4 (SAS Institute). A 2-sided *P* value of <.05 was considered statistically significant.

Results

Of the total 14712 infants who survived, 6404 infants were discharged home from NICU and 8308 were transferred to another facility (non-CNN hospital). We compared the baseline characteristics of infants discharged home directly and those transferred to another facility in **Table I** (available at www.jpeds.com). Of the 6404 infants included in the study, 4457 (70%) received MOM on the day of discharge home. **Figure 1** (available at www.jpeds.com) is a flow chart of the study population. The rates of breast milk feeding at discharge varied across Canadian NICUs, from 49% to 87% with a mean of 70% overall (**Figure 2**). The mean rates were similar across study years: 72% in 2015, 69% in 2016, 68% in 2017, and 70% in 2018. Results from the comparisons of maternal and infant baseline characteristics between the 2 feeding type groups are summarized in **Table II**.

Rates of MOM feeding at discharge increased significantly with gestational age at birth, from 65% for infants born at 22-25 weeks of gestation to 72% for those born at 29-32 weeks of gestation (**Figure 3**, A); and decreased significantly by 8.8% per unit increase in parity (**Figure 3**, B).

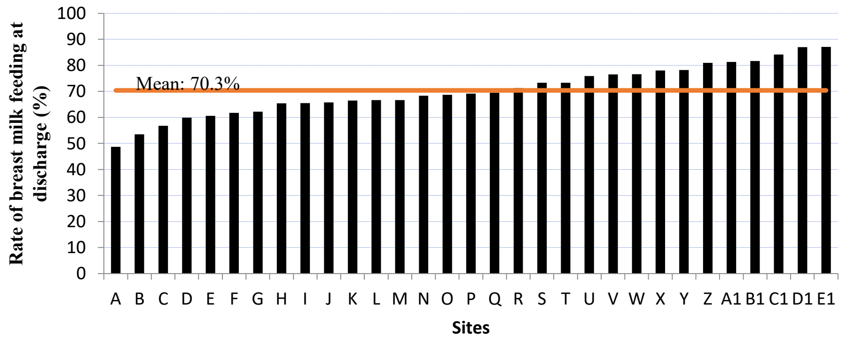

Figure 2. Variation in the rate of breast milk feeding at discharge across NICUs in CNN (χ^2 test: $P < .0001$).

Results from the multivariable analyses for determinants of MOM feeding at discharge are reported in **Table III**. These analyses suggested that infants born to primipara mothers and those born at higher gestational ages (29-32 weeks of gestation) had significantly higher odds of receiving MOM feeding on the day of discharge from NICU. Maternal diabetes and cigarette smoking were associated with significantly lower odds of MOM feeding at discharge. Male sex and higher maternal age were also associated with higher odds of breast milk feeding at discharge. Incidentally, receiving magnesium sulfate during labor was positively associated with MOM feeding at discharge. Feeding MOM by day 3 of age was associated with significantly higher odds of breast milk feeding at discharge (**Table III**). Maternal and neonatal characteristics of mothers and infants born preterm in low-performing (≤70% rate of breastmilk receipt) and high-performing (>70% rate of breastmilk receipt) NICUs are summarized in **Table IV** (available at www.jpeds.com).

Discussion

In this large, population-based cohort of infants born very preterm at <33 weeks of gestation, nearly two-thirds received MOM or MOM supplemented with formula at the time of hospital discharge. The rates of MOM feeding remained similar over the study period but varied between NICUs. The positive determinants of breast milk feeding at discharge were higher

Table II. Maternal and neonatal characteristics by feeding type at discharge from NICU

Maternal and neonatal characteristics	Formula only (n = 1947)	Any breast milk use (n = 4457)	*P* value
Maternal age (y), mean (SD)	30 (6.1)	31.7 (5.5)	<.001
Gestational age, median (IQR)	29 (27, 31)	30 (27, 31)	<.001
Gestational age (wk), n (%)			<.001
<26	293 (15.1)	543 (12.2)	
26-28	539 (27.7)	1116 (25.0)	
29-32	1115 (57.3)	2798 (62.8)	
Singleton, n (%)	1385 (71.1)	3202 (71.8)	.56
Assisted pregnancy, n (%)	54 (2.8)	142 (3.2)	.37
Primipara, n (%)	688 (36.6)	2299 (53.4)	<.001
Cesarean delivery, n (%)	1201 (61.8)	2763 (62.1)	.85
Maternal diabetes, n (%)	318 (17.2)	644 (14.9)	.021
Maternal hypertension, n (%)	345 (18.3)	913 (20.8)	.023
Illicit drug use, n (%)	69 (3.5)	39 (0.9)	<.001
Maternal cigarette smoking, n (%)	153 (7.9)	87 (1.9)	<.001
Antenatal steroid, n (%)			<.001
None	277 (14.5)	425 (9.7)	
Partial course	431 (22.6)	956 (21.8)	
Complete course	1202 (62.9)	3008 (68.5)	
Maternal $MgSO_4$, n (%)	1032 (55.2)	2584 (60.9)	<.001
Birth weight (g), mean (SD)	1318 (480)	1348 (458)	.017
Birth weight, n (%)			.004
<1000 g	585 (30.1)	1159 (26.0)	
1000-1499 g	664 (34.1)	1605 (36.0)	
≥1500 g	698 (35.9)	1693 (38.0)	
Small for gestational age, n (%)	161 (8.28)	427 (9.6)	.10
Outborn, n (%)	262 (13.5)	367 (8.2)	<.001
Male, n (%)	1026 (52.8)	2489 (55.9)	.02
SNAP-II >20, n (%)	249 (12.8)	481 (10.8)	.02
Breast milk receipt at d 3 of life	629 (32.3)	2773 (62.2)	<.001

$MgSO_4$, magnesium sulfate; *SNAP-II*, Score for Neonatal Acute Physiology version II.
Two group comparisons were performed using χ^2 tests for categorical variables and Student *t* tests or Wilcoxon rank-sum tests as appropriate for continuous variables.

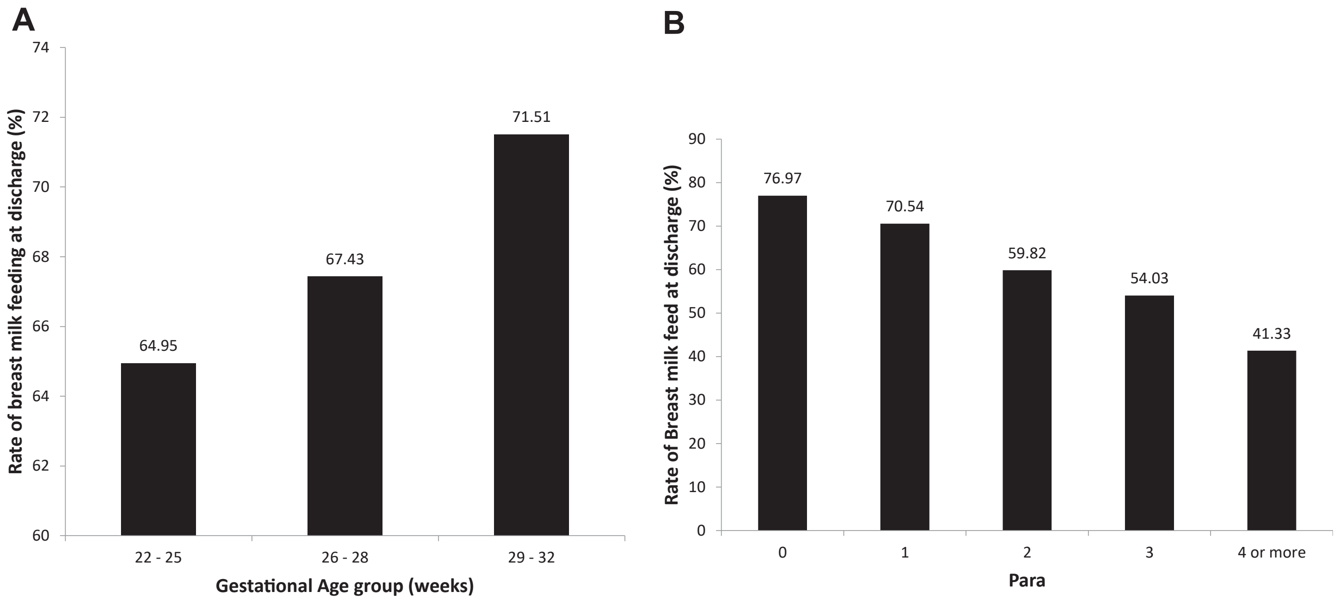

Figure 3. Rates of breast milk feeding at discharge **A,** by gestational age group (Cochran-Armitage trend test: $P < .0001$) and **B,** by parity group (Cochran-Armitage trend test: $P < .0001$).

gestational age at birth, primiparity, feeding MOM at 3 days of age, and higher maternal age, male sex, and receiving magnesium sulfate during labor; negative determinants were maternal diabetes and cigarette smoking during pregnancy.

Previous studies have reported similar variations in the rates of breast milk feeding at the time of discharge home among NICUs. In the California Perinatal Quality Care Collaborative cohort of 6790 very low birth weight infants born in 2005 and 2006, the rates of breast milk feeding varied widely, ranging from 19.7% to 100%, with a mean of 61.1% at hospital discharge.[10] Similarly, in a cohort from 11 countries in 19 European regions, 58% of infants born at <32 weeks of gestation received MOM at discharge, with a significant variation between regions that ranged from 36% to 80%.[17] In an earlier population-based cohort of 3006 infants born at <32 weeks of gestation and discharged home from neonatal units in 8 European regions in 2003, rates of breast milk feeding varied from 19% in Burgundy, France, to 70% in Lazio, Italy.[18] In a large cohort of 29 445 infants born at <37 weeks of gestation in Sweden, the rate of exclusive breast milk feeding at discharge decreased significantly over time, from 59% in 2004 to 45% in 2013.[7] Our study showed no change in the breast milk feeding rate over time; however, it was limited to a period of just 4 years.

The significant variations between Canadian NICUs in the rates of MOM feeding may be explained by differences in breastfeeding promotion practices, methods used to prevent mother-infant separation, access to support for milk expression, access to breast pumps, or availability of lactation consultants or programs for skin-to-skin contact or developmental care. The degree of variation across units suggests that higher rates of MOM feeding are attainable in many NICUs across Canada. As the circumstances faced by preterm or sick infants and their mothers are different than those of healthy infants and their mothers, NICUs require specific breastfeeding policies and education and lactation supports from multidisciplinary health care providers.

In our study, the rate of MOM feeding at discharge significantly increased with gestational age at birth. Our finding is in agreement with a similar study from California that reported a significant increase in the odds of breast milk feeding at

Table III. Factors associated with any breast milk feeding at NICU discharge using logistic regression analysis

Covariates	Unadjusted OR (95% CI)	aOR (95% CI)
Maternal age (y)	1.05 (1.04, 1.07)	1.07 (1.06, 1.09)
Gestational age (wk)		
<26	1	1
26-28	1.12 (0.94, 1.33)	1.16 (0.93, 1.46)
29-32	1.35 (1.16, 1.59)	1.56 (1.25, 1.93)
Primipara	1.98 (1.77, 2.22)	2.12 (1.86, 2.42)
Maternal diabetes	0.84 (0.73, 0.97)	0.79 (0.66, 0.93)
Maternal hypertension	1.17 (1.02, 1.35)	0.94 (0.79, 1.11)
Illicit drug use	0.24 (0.16, 0.36)	0.64 (0.38, 1.09)
Maternal cigarette smoking	0.23 (0.18, 0.31)	0.27 (0.19, 0.38)
Antenatal steroid		
None	1	1
Partial course	1.45 (1.20, 1.75)	1.15 (0.91, 1.45)
Complete course	1.63 (1.38, 1.93)	1.22 (0.98, 1.52)
Maternal $MgSO_4$	1.26 (1.13, 1.41)	1.24 (1.08, 1.43)
Outborn	0.58 (0.49, 0.68)	0.89 (0.71, 1.13)
Male	1.13 (1.02, 1.26)	1.15 (1.01, 1.30)
SNAP-II >20	0.83 (0.70, 0.97)	1.07 (0.86, 1.32)
Breast milk use at d 3	3.45 (3.08, 3.86)	3.61 (3.17, 4.12)

The unadjusted ORs (95% CIs) of having any breast milk feeding were estimated based on the univariate logistic regression model for breast milk feeding. The aORs (95%CIs) of having any breast milk feeding were estimated based on the multiple logistic regression model for breast milk feeding.

discharge with each weekly increase in gestational age.[10] Reasons for the gestational age-related differences could be multifactorial. Oral-motor and gastrointestinal tract immaturity may hinder enteral feeding (whether oral or via feeding-tube) for infants born very preterm as mothers may perceive their milk to be of lesser value if it is not used. Moreover, mothers of infants born at <26 weeks of gestation are more likely to have additional challenges related to their pregnancy complications or stressful care routines from infant's challenging health status that could limit their ability to produce enough breast milk. Several studies indicated that acute maternal physical and mental stress reduces the release of oxytocin and impair the milk ejection reflex in lactating women. Furthermore, the inability to provide skin-to-skin care because of physiologic instability of many infants born extremely preterm increases maternal stress and may have affected milk production.[19-21] All these issues suggest the need for additional lactation support and adequate hospital resources for infants born at extremely low gestational ages.

In our cohort, the rate of MOM feeding at discharge decreased significantly with increasing parity. This finding is similar to that reported for the Effective Perinatal Intensive Care cohort from 11 countries in Europe.[17] In contrast, a systematic review of 15 eligible studies showed that previous breastfeeding experience was associated with subsequent initiation and longer duration of breastfeeding.[22] The higher rates of breast milk feeding among infants born preterm of first-time mothers in our study may be related to the increased lactation support these mothers typically receive. It is also possible that health care providers have the perception that mothers who successfully breastfed their previous infants have enough experience and need less attention in this area than primipara mothers. Furthermore, multipara mothers are likely to be busier looking after the other children in the family and have less time to spend in the NICU. Additional studies would be helpful to understand the effects of parity on breast milk feeding in infants born preterm, as these effects could be different in infants born preterm vs infants born at full-term.

Feeding MOM by day 3 of age was the strongest predictor of breast milk feeding at discharge in our study. The role of early feeding with MOM in establishing breast milk feeding has been consistently reported in the literature. In a small prospective cohort study of 138 infants born between 23 and 31 weeks of gestation in Sweden, high provision of MOM at postnatal day 7 was associated with exclusive breast milk feeding at 36 weeks of postmenstrual age (OR 1.18 per 10 mL/kg increase in the MOM volume, 95% CI 1.06-1.32).[23] Similarly, high maternal milk feed at week 2 was increased exclusive MOM feeding at discharge in infants born at extremely preterm gestation in another study.[24] In a single-center cohort from the US, reaching a pumped MOM volume of ≥500 mL/day by day 14 was positively predicted MOM feeding at NICU discharge; however, low socioeconomic status and black race negatively affected the MOM feeding at discharge.[23-25] In a Danish national cohort of 1488 infants born at 24-36 weeks of gestation, the initiation of breast milk expression later than 48 hours postpartum was associated with the failure of exclusive breastfeeding at discharge.[26]

Studies have shown that early initiation of breast milk expression after very preterm birth is associated with earlier completion of lactogenesis II and better milk yield whereas mothers with critically ill infants are at increased risk of delayed secretary activation that is necessary to signal copious MOM production.[27,28] In the current study, regardless of the amount of MOM given, the use of breast milk at postnatal day 3 was associated with a higher rate of breast milk feeding at hospital discharge. Early breastfeeding support in the NICU is important for creating and maintaining breastfeeding-friendly environments and for optimizing the use of breast milk after hospital discharge. Strategies and quality improvement measures to promote early breast milk expression or pumping are critical for increasing breast milk feeding in NICUs with low rates.

The epidemiologic link between maternal smoking and breastfeeding is well established.[29] In support of this relationship, we identified that cigarette smoking during pregnancy was associated with lower rates of breast milk feeding at the time of discharge. The intention to breastfeed, the initiation of breastfeeding, and the duration of breastfeeding are reduced in women who smoke compared with nonsmokers, with a dose-response relationship between the number of cigarettes smoked each day and breastfeeding intention, initiation, and duration.[30] Our finding of lower odds of MOM at discharge among infants born to women with diabetes (gestational and pregestational) is in line with a population-based cohort study of 72 755 women from the US. In that study, the initiation and continuation of breastfeeding were lower among those who had pregestational diabetes mellitus, and the continuation of breastfeeding was lower among women with gestational diabetes mellitus.[31]

The positive association of magnesium sulfate during labor and MOM use at NICU discharge remains physiologically unexplained from the available literature. The association is significant after adjusting for possible confounders such as maternal age, maternal hypertension, and antenatal steroid use. Indications for magnesium sulfate use in Canadian centers vary between the treatment of severe preeclampsia, prevention of cerebral palsy, and to slow or stop preterm labor. The physiological mechanism of how magnesium sulfate use in mothers closer to birth could increase the use of breast milk remains unexplained. Improved vasodilation, fewer complications of severe preeclampsia, and the ability of the mother to be with her infant sooner may be contributing factors. Shorter duration or immediate discontinuation of magnesium sulfate after birth in mothers has been associated with earlier initiation of breastfeeding.[32,33] Therefore, we hypothesized that the lactation benefit of magnesium sulfate may be limited to its use before birth, however, the possibility of statistical interaction or residual confounding effect cannot be ruled out in our cohort. Future studies about the use of magnesium sulfate during pregnancy would require including breastfeeding as an outcome.

MOM feeding for infants born very preterm could be considered a vital quality improvement priority, particularly in NICUs with low rates. Our results shed light on the factors that hinder breast milk feeding in Canadian NICUs and should be considered when designing programs and quality improvement measures to promote breast milk feeding.

The major strength of our study is that it included a large, population-representative, multicenter cohort. Moreover, the data collection and data entry validation were rigorous. We must also acknowledge some limitations of our study. First, we studied a retrospective cohort. We may have missed variables with important implications for the use of MOM during the NICU stay and discharge home. Second, our data were limited to breast milk or formula used at the time of discharge, and we did not collect the method or amount of breast milk feeding. Thus, infants who received even the smallest amount of MOM were classified in the breast milk feeding group, and MOM feeding was not necessarily delivered via breastfeeding. We elected to define our groups this way to identify the overall proportion of women continuing to provide some breast milk to their infants born preterm. Third, our study did not examine social factors such as mothers' race and ethnicity, education level, or socioeconomic status as these data are not collected by the CNN. Similarly, we did not study the structural and policy factors related to the breastfeeding environment such as accreditation of a unit as baby-friendly or a written protocol for breast milk feeding and human milk use, both of which are shown to promote breast milk feeding.[17]

Supporting mothers to provide breast milk in the first 3 days after birth may be associated with increased rates of MOM feeding at discharge. NICUs with lower rates of breast milk feeding may use quality improvement measures to support early MOM feeding particularly for mothers of younger gestation infants, and mothers with higher parity, who smoked cigarettes during pregnancy, or were diagnosed with diabetes. Further studies are required to explore the effects of health care environment-related factors on MOM feeding and examined the effects of magnesium sulfate on lactogenesis. ■

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Data Statement

Data sharing statement available at www.jpeds.com.

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50 Years Ago in *The Journal of Pediatrics*

Acute Hyponatremic Dehydration: A Tale of Two Compartments

Finberg L, Bernstein J. Acute hyponatremic dehydration. J Pediatr 1971;79:499-503.

There are few words to describe this fascinating article other than Dickens': "It was the best of times, it was the worst of times."[1] Here, we briefly review the pathophysiology and management of hyponatremia, defined as a serum sodium of <135 mEq/L, which remains one of the most common iatrogenic electrolyte abnormalities in children. The most-feared complication of this condition is hyponatremic encephalopathy, manifesting as mild as subtle cognitive dysfunction or as severe as seizures, coma, and death. Since the case description by Finberg and Bernstein was published, predisposing risk factors have been identified (underlying etiology, rate of change of sodium concentration, extent of hyponatremia, sex, and age) and management has changed.[2]

Extracellular hypoosmolality in the setting of acute hyponatremia leads to water flow from the extracellular to the intracellular compartment, causing cell swelling. Because the brain is constrained in a nonflexible space, cell swelling is most consequential there. There are 2 proposed brain adaptive mechanisms to acute hyponatremia[2]: (1) increased intracranial pressure drives water from the interstitium into the cerebrospinal fluid and from there into the systemic circulation and (2) electrolytes move from the intracellular to the extracellular compartment, thus lowering the osmotic gradient. Cerebral adaptative changes to chronic hyponatremia, such as decreases in intracellular taurine levels, differ and represent a management challenge. Fifty years ago, half-isotonic saline was used for aggressive fluid expansion, a practice that is now obsolete. Current recommendations include initial resuscitation with a 20 mL/kg isotonic saline or colloid fluid, until perfusion improves.[3] The treatment of hyponatremic encephalopathy as manifested in the case report aims to decrease the intracranial pressure and prevent brain herniation. The current management is to give 3% NaCl, targeting a serum sodium increase by 5-6 mEq/L or 125-130 mEq/L, or until symptoms (seizures) resolve.[2] Rapid correction of chronic hyponatremia can rarely trigger osmotic demyelination syndrome, owing to the adaptive changes described.

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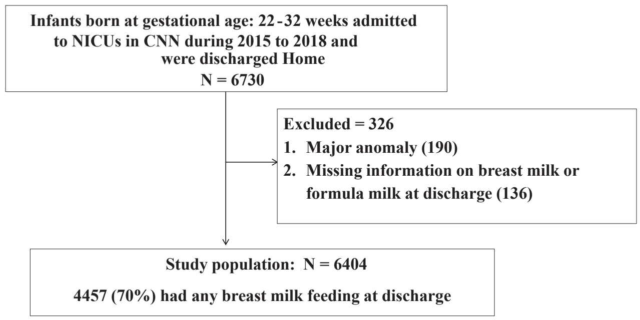

Figure 1. Flow chart of study population.

Table I. Maternal and neonatal characteristics by feeding type at discharge from NICU to home or other facilities

Maternal and neonatal characteristics	Discharged to other facilities (n = 8308)	Discharged home (n = 6404)	*P* value
Gestational age, median (IQR)	30 (28, 31)	30 (27, 31)	<.001
Gestational age (wk), n (%)			<.001
<26	715 (8.6)	836 (13.1)	
26-28	1998 (24.1)	1655 (25.8)	
29-32	5595 (67.3)	3913 (61.1)	
Singleton, n (%)	5818 (70.0)	4587 (71.6)	.04
Cesarean delivery, n (%)	5228 (63.0)	3964 (62.0)	.20
Maternal diabetes (pre-existing and gestational), n (%)	1304 (16.2)	962 (16.0)	.36
Maternal hypertension,* n (%)	1606 (19.8)	1258 (20.1)	.74
Maternal cigarette smoking, n (%)	310 (3.7)	240 (3.8)	.96
Antenatal steroid, n (%)			.92
None	894 (11.0)	702 (11.1)	
Partial course	1810 (22.2)	1387 (22.0)	
Complete course	5458 (66.9)	4210 (66.8)	
Maternal $MgSO_4$, n (%)	4684 (59.0)	3616 (59.1)	.84
Birth weight (g), mean (SD)	1363 (425)	1339 (465)	.006
Birth weight (g), n (%)			<.001
<1000	1808 (21.8)	1744 (27.2)	
1000-1499	3333 (40.1)	2269 (35.4)	
≥1500	3167 (38.1)	2391 (37.3)	
Small for gestational age, n (%)	822 (9.9)	588 (9.2)	.16
Outborn, n (%)	1404 (16.9)	629 (9.8)	<.001
Male, n (%)	4521 (54.4)	3515 (54.9)	.56
SNAP-II >20, n (%)	951 (11.5)	730 (11.4)	.92

$MgSO_4$, magnesium sulfate; *SNAP-II*, Score for Neonatal Acute Physiology version II.
Two group comparisons were performed using χ^2 tests for categorical variables and Student *t* tests or Wilcoxon rank-sum tests as appropriate for continuous variables.
*Includes pre-existing maternal hypertension and pregnancy-induced hypertension.

Table IV. Maternal and neonatal characteristics by feeding type at discharge from high- or low-performing NICUs

Maternal and neonatal characteristics	Sites with ≤70% rate of breastmilk receipt at discharge (n = 3548)	Sites with >70% rate of breastmilk receipt at discharge (n = 2856)	*P* value
Gestational age, median (IQR)	30 (27, 31)	30 (27, 31)	.13
Singleton, n (%)	2530 (71.3)	2057 (72.0)	.53
Primipara, n (%)	1607 (47.1)	1380 (49.7)	.04
Cesarean delivery, n (%)	2186 (61.7)	1778 (62.3)	.63
Maternal diabetes (pre-existing and gestational), n (%)	500 (14.7)	462 (16.7)	.04
Maternal hypertension,* n (%)	690 (19.9)	568 (20.3)	.72
Maternal cigarette smoking, n (%)	131 (3.7)	109 (3.8)	.79
Antenatal steroid, n (%)			.06
None	417 (12.0)	285 (10.1)	
Partial course	754 (21.6)	633 (22.5)	
Complete course	2313 (66.4)	1897 (67.4)	
Maternal $MgSO_4$, n (%)	1952 (57.0)	1664 (61.7)	<.001
Birth weight (g), mean (SD)	1353 (468)	1321 (461)	.006
Small for gestational age, n (%)	310 (8.8)	278 (9.7)	.17
Outborn, n (%)	344 (9.7)	285 (10.0)	.70
Male, n (%)	1908 (53.8)	1607 (56.3)	.05
SNAP-II >20, n (%)	401 (11.3)	329 (11.6)	.78
Breast milk use at d 3 of life	1781 (50.2)	1621 (56.8)	<.001

Two group comparisons were performed using χ^2 tests for categorical variables and Student *t* tests or Wilcoxon rank-sum tests as appropriate for continuous variables.
*Includes pre-existing and pregnancy induced hypertension.