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Hospital-wide breastfeeding rates vs. breastmilk provision for very low birth weight infants

Henry C. Lee, MD, MS[1,4], **Priya Jegatheesan, MD**[2], **Jeffrey B. Gould, MD, MPH**[1,4], and **R. Adams Dudley, MD, MBA**[3]

[1]Department of Pediatrics, Stanford University, Stanford, CA, USA

[2]Department of Pediatrics, Santa Clara Valley Medical Center, San Jose, CA, USA

[3]Departments of Medicine and Health Policy, University of California, San Francisco, CA, USA

[4]California Perinatal Quality Care Collaborative, Stanford, CA, USA

Abstract

Aim—To investigate the relationship between breastmilk feeding in very low birth weight infants in the neonatal intensive care unit and breastmilk feeding rates for all newborns by hospital.

Methods—This was a cross-sectional study of 111 California hospitals in 2007 and 2008. Correlation coefficients were calculated between overall hospital breastfeeding rates and very low birth weight infant breastmilk feeding rates. Hospitals were categorized in quartiles by crude and adjusted very low birth weight infant rates to compare rankings between measures.

Results—Correlation between very low birth weight infants and overall breastfeeding rates varied by neonatal intensive care unit level of care, from 0.13 for intermediate hospitals to 0.48 for regional hospitals. For hospitals categorized in the top quartile according to overall breastfeeding rate, only (46%) were in the top quartile for both crude and adjusted very low birth weight infant rates. On the other hand, when considering the lowest quartile for overall breastfeeding hospitals, 3 of 27 (11%) actually were performing in the top quartile of performance for very low birth weight infant rates.

Conclusions—Reporting hospital overall breastfeeding rates and neonatal intensive care unit breastmilk provision rates separately may give an incomplete picture of quality of care.

Keywords

Preterm infants; Neonatal intensive care; Breastmilk; Breastfeeding; Quality improvement

Introduction

Breastmilk is considered the optimal feeding choice for newborns, as it has proven short and long-term benefits for both the mother and infant.(1–5) Breastmilk feeding in very low birth weight (VLBW) preterm infants may be even more important than in term infants, as it may prevent serious morbidities such as necrotizing enterocolitis and late onset sepsis, and also optimize long term neurodevelopmental outcomes.(6, 7)

Corresponding Author: Henry C. Lee, MD, MS, Department of Pediatrics, Division of Neonatal and Developmental Medicine, Stanford University, 750 Welch Road, Suite 315, Palo Alto, CA 94304, Office: (650)723-5711 FAX: (650)725-8351 hclee@stanford.edu.

Due to its benefits, exclusive breastfeeding at discharge to home from the hospital has been endorsed as a quality measure by the National Quality Forum and the Joint Commission, and breastfeeding rates at California hospitals have been publicly reported, with other states initiating similar programs.(8–11) Data on breastmilk provision rates in preterm infants are not publicly available. In a previous study, we found large variations in breastmilk feeding rates among California neonatal intensive care units (NICUs) in the California Perinatal Quality Care Collaborative (CPQCC).(12)

As hospital-wide breastfeeding rates are dominated by rates among well babies, it cannot be assumed that breastmilk feeding rates in the NICU will mirror hospital-wide rates. Providing breastmilk to VLBW infants may be more challenging due to the circumstances surrounding preterm birth and the need to mechanically express milk for several weeks. If overall breastfeeding rates at hospitals do not correlate with breastmilk provision rates for preterm infants in the NICU, current breastmilk feeding quality assessment and reporting policies may not adequately address this population. A separate measurement specific to the NICU may be beneficial to promote quality care in the most vulnerable patients. At present, there is no literature on the hospital-specific correlation between NICU breastmilk provision and hospital-wide breastfeeding rates.

Therefore, the objective of our study was to determine to what degree the overall breastfeeding rate at a hospital correlated with the NICU VLBW breastmilk feeding rate during the same time period, and to investigate whether this varies with the level of neonatal care provided at the hospital. Through linkage of two contemporary datasets, we were able to assess the hospital-level relationship between breastmilk feeding rates of VLBW infants and hospital-wide breastfeeding rates in a statewide population-based cohort.

Methods

We linked data from the California Department of Public Health (CDPH) and data from the CPQCC, which collects detailed data on NICU admissions by hospital of birth for the years 2007 to 2008.

The CDPH collects breastfeeding data on virtually all newborns in the state through the newborn screen collection program. At the time of the universal newborn screen, data on feeding type for all infants is recorded, whether exclusively breastfed, infant formula fed, or mixture of the two. This data collection includes babies both in well baby nurseries and NICUs. Hospital-wide breastfeeding rates for all infants are recorded by hospital in which the newborn screen was obtained.

The CPQCC prospectively collects clinical data on sick and preterm infants and their mothers at 128 member hospitals using an expanded version of the Vermont Oxford Dataset. (13) In the study period of 2007 to 2008, greater than 90% of California's NICU admissions were to CPQCC hospitals. At the hospital level, clinical data from CPQCC were linked to data collected by the CDPH. For both measures, we used the measure of any breastmilk being fed at the time of data collection.

The NICU study population included VLBW infants with birth weight 500 to 1,500 grams and gestational age ≥23 weeks who were inborn and remained in the birth hospital until discharge to home. VLBW infants who were not born at CPQCC hospitals were not included in the study. Free-standing children's hospitals that did not care for any inborn patients and CPQCC hospitals that did not care for any inborn VLBW patients were not included as they had no eligible patients. Infants in CPQCC whose feeding type was unknown were excluded.

The relationship between VLBW infant breastmilk feeding at discharge home and overall hospital breastfeeding rates in the first 24 – 96 hours of life (at which time the newborn screening data is collected) was analyzed. Correlation coefficients were calculated for the whole cohort, and then stratified by NICU level of care based on California Children's Services (CCS) classification. The CCS classifies NICUs into three levels – regional, community, and intermediate NICUs—based on the services provided at each center. Regional NICUs provide mechanical ventilation and major surgery without restriction, and variably provide extracorporeal membrane oxygenation and cardiac surgery (equivalent to the American Academy of Pediatrics Levels IIIC and IIID).(14) Community NICUs provide unrestricted care and ventilation to infants of all gestational ages, but are limited to surgery of only stable infants or those with a patent ductus arteriosus (equivalent to American Academy of Pediatrics Level IIIA and IIIB).(14) Intermediate NICUs (equivalent to American Academy of Pediatrics Level II) provide care to a variably restricted population, ventilate only up to a specified number of hours and refer all complicated cases to a higher level of care.(14) A small subset of NICUs choose not to undergo CCS classification.

In order to assess differences in performance assessment, hospitals were categorized into quartiles of breastmilk provision rates for both overall hospital and NICU VLBW populations. Based on the population rate, hospitals were grouped into performance groups of lower quartile (< 25th percentile), middle quartiles (25th to 75th percentiles), and upper quartile (> 75th percentile). Alignment of performance was compared between the two groups. As each NICU may have different capabilities for caring for certain infants, we repeated this analysis using multivariable logistic regression to risk adjust NICU VLBW rates. Risk factors in adjustment included gestational age, birth weight, race / ethnicity, prenatal care, multiple gestation, mode of delivery, and maternal age.

Statistical analysis was performed with SAS version 9.2 (SAS Institute Inc, Cary, North Carolina). This study was reviewed and approved by the Institutional Review Boards of University of California, San Francisco and Stanford University.

Results

There were 6267 VLBW infants born in 111 CPQCC hospitals, with a corresponding overall 615,886 infants born at those hospitals. Nineteen VLBW infants did not have feeding type recorded and were excluded from analysis. The mean proportion of VLBW infants as births at each hospital was 1.0% with interquartile range of 0.6% to 1.2%. The distribution of hospitals, patients, and their breastfeeding rates are shown in Table 1. The majority of VLBW infants (61.1%) were cared for in Level IIIA/B NICUs during the study period. The mean VLBW breastmilk feeding rate ranged from 62% at hospitals with Level IIIA/B NICUs to 86% at Level II NICUs.

The overall correlation between breastmilk feeding of VLBW infants and hospital breastfeeding rate was low, with r-square of 0.257. However, when stratified by NICU level, the correlation was high in Level IIIC/D NICUs with r-square = 0.478 (Table 1 and Figure 1A (online)). Correlation was lower in Level IIIA/B NICUs (Figure 1B (online)) and lowest in Level II NICUs (Figure 1C (online)).

When grouped into quartiles of breastmilk provision rates, there were differences in categorization between the NICU VLBW rate and the overall hospital breastfeeding rate (Table 2). For hospitals categorized in the top quartile according to overall breastfeeding rate (% breastfeeding > 92.4%), only 12 of 26 (46%) were in the top quartile for NICU VLBW rates (% breastmilk feeding for VLBWs > 82.8%). On the other hand, when considering the lowest quartile for overall breastfeeding hospitals (% breastfeeding <

83.2%), 3 of 27 (11%) actually were performing in the top quartile of performance for NICU VLBW rates and only 63% of NICUs would have been identified as bottom quartile performers (Table 2). When breastmilk feeding rates for VLBW infants were adjusted for socio-demographic and medical factors, there were similar differences with 46% of the upper quartile for overall rates being found in the upper quartile for NICU VLBW rates (Table 3).

Discussion

In this population-based study, we assessed hospital-level correlation between any breastmilk feeding rates at discharge home for preterm infants in the NICU and publicly reported hospital-wide breastfeeding rates. Although we found a positive correlation, it was relatively weak, particularly in Level IIIA/B and Level II hospitals where more than 50% of VLBW infants received their care.

The World Health Organization's "Ten Steps to Successful Breastfeeding" (part of the Baby Friendly Hospital Initiative or BFHI) are evidence-based practices intended to be implemented in maternity hospitals to support and promote breastfeeding for all newborns, but are also applicable to preterm infants.(15, 16) The first five steps would presumably have a direct effect on initiation of breastmilk feeding in VLBW infants. Having a hospital wide policy on breastfeeding (Step 1), training of maternity staff on the skills to promote, support breastfeeding (Step 2) and to maintain lactation when separated from baby (Step 5), early initiation of expression of breastmilk when separated from the baby (Step 4), and prenatal counseling of mothers on the benefits of breastfeeding (Step 3) are all very important to promote early initiation of breastmilk feeding. The implementation of these steps under the "Baby Friendly Hospital Initiative" was shown to increase the rate of breastfeeding in the general well baby population at the hospital level.(17)

However, the BFHI principles may need careful adaptation to suit the special needs of preterm infants and their mothers, including the physical environment of the NICU, medical problems associated with prematurity, and increased challenges for establishing lactation. The WHO BFHI: Revised, Updated and Expanded for Integrated Care in 2009, addresses some of these gaps by additional strategies to promote mother-baby friendly hospitals and refers to Academy of Breastfeeding Medicine protocols for baby friendly NICUs.(18) A study that interviewed Swedish mothers of VLBW infants generated several suggestions for modifications to the BFHI including "respect and sensitivity" to maternal choices, supporting fathers' presence, and family centered physical environments to be integrated into BFHI steps to promote successful breastfeeding in NICUs.(19) A proposal to add 3 guiding principles to the BFHI includes the addition of focus on the individual mother, family-centered care, and continuity of care to the Ten Steps.(20) The impact of such programs on NICU patients may be positive.(21, 22)

A study of preterm breastmilk feeding rates in Europe found geographic correlation in overall breastfeeding rates to preterm breastmilk provision rates at discharge.(23) When data are collected across several countries, it is possible that similar social, cultural, and demographic factors within individual countries or even subdivisions of countries would lead to similar preterm and term breastfeeding rates in that region, thus contributing to a general correlation across regions. However, our analysis at the individual hospital level found that correlation was relatively low when comparing NICU and overall hospital rates during the same time period in a single state.

The current study and our previous research have demonstrated large variability in breastmilk feeding rates of preterm infants by hospital of birth.(24) We found that a hospital

identified as a high or low performer in breastmilk feeding did not always correlate with the same rating for that hospital in overall breastfeeding (Table 2). Findings were similar when NICU rates were adjusted for patient characteristics (Table 3). The lack of correlation between NICU and hospital-wide rates could provide a false sense of reassurance for any hospital that appears to be doing well in overall breastfeeding, but are having difficulty for preterm infants in the NICU.

The low correlation of these two measures may be due to the circumstances surrounding a preterm birth, including the NICU environment, stress of a preterm delivery, mother-infant separation, severity of the illness of the mother and infant pose multiple challenges to promoting breastfeeding in VLBW infants. In particular, we found no correlation between VLBW breastfeeding and the overall breastfeeding rate in Level II NICU hospitals. While overall breastfeeding rates and the mean VLBW breastmilk provision rates were relatively high in these hospitals, there was increased variation in VLBW rates compared to overall breastfeeding rates. More research is needed to understand the cause of this discrepancy.

There was higher correlation of hospital-wide newborn breastfeeding rates and VLBW provision rates in Level IIIC/D hospitals. It is possible that Level IIIC/D hospitals that have larger patient populations may have more resources that can be spread broadly across the hospital. Hospitals that choose to make lactation services for the general maternity population a priority may lead to benefit for NICU patients due to economies of scale. Quality improvement efforts to promote breastmilk in either the well-baby nursery or the NICU may benefit from an approach that involves both patient groups, rather than an isolated approach. Our study cannot directly answer these questions as we did not have data on actual practices at these hospitals.

It is notable that the mean VLBW breastmilk feeding rates were lower than the overall rates for all types of hospitals. As breastmilk has known medical benefits for preterm infants, this finding supports ongoing quality improvement efforts to promote breastmilk in the NICU. There are numerous resources to support such efforts including evidence based reviews and practical toolkits for implementation.(25–31)

A limitation of our study is the difference in data collection methods for well babies and the NICU. Whlie data for VLBW Infants was collected at the time of discharge to home (potentially several weeks or months after birth), the data on term infants would have been collected soon after delivery – thereby being more a measure of initiation of breastfeeding. However, the purpose of our study was to evaluate whether these two potentially related measurements correlated at the hospital level for use as quality measures and therefore, were well suited for our study objectives. Also, CPQCC data collection is conducted prospectively by trained data abstractors, while the overall hospital data were collected in conjunction with the state newborn screening program. Errors in data collection at certain centers could have potentially skewed the results. Another limitation was our inability to exclude the VLBW population from the state data. Inclusion of the VLBW infants in the overall group would not be likely to significantly alter our findings, as the maximum proportion of VLBW to total infants was 1.4%.

Breastmilk provision to VLBW infants is a growing priority for neonatologists and is an important quality indicator. Our data suggest that hospital-wide breastfeeding rates should not be used as a surrogate for directly measuring NICU VLBW breastmilk feeding rates. Although overall breastfeeding rates may give some indication of a hospital's quality of care for infants, it may not always give an accurate depiction of the care delivered to VLBW infants in the NICU. High breastfeeding rates in the well baby population should not lead to a complacent attitude towards NICU patients who may face different challenges in

breastmilk provision. On the other hand, efforts to promote breastmilk provision in the NICU are likely to benefit from hospital-wide programs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Abbreviations

BFHI	Baby Friendly Hospital Initiative
CCS	California Children's Services
CDPH	California Department of Public Health
CPQCC	California Perinatal Quality Care Collaborative
NICU	Neonatal intensive care unit
VLBW	Very low birth weight

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Key notes

Hospital rates of breastfeeding was positively correlated with breastmilk provision for very low birth weight infants in corresponding neonatal intensive care units. However, correlation was weak in community and intermediate level hospitals where the majority of premature infants received their care. As both overall breastfeeding rates and breastmilk provision rates for premature infants are important healthcare measures, there may be benefit to reporting both in quality assessments.

Table 1

Hospital rates of breastmilk feeding in very low birth weight infants vs. overall hospital breastfeeding rates.

Level of care	Hospitals (n)	VLBW infants	Mean hospital VLBW breastmilk feeding rate (%)	SD	Overall number of infants	Mean hospital overall breastfeeding rate (%)	SD	r-square
Level IIIC/D (Regional)	18	1,882	65%	19%	105,468	88%	6%	0.478
Level IIIA/B (Community)	69	3,821	62%	19%	396,289	86%	8%	0.316
Level II (Intermediate)	14	267	86%	16%	68,075	88%	7%	0.125
Non-classified	10	278	79%	14%	46,054	87%	5%	0.016
Total	111	6,248	67%	20%	615,886	87%	8%	0.257

SD: standard deviation; r-square represents correlation between breastmilk feeding of very low birth weight (VLBW) infants and overall hospital breastfeeding rates.

Table 2

Variation between quartiles of hospital rates of breastmilk feeding in very low birth weight infants vs. overall hospital breastfeeding rates.

		Very low birth weight infant rates of breastmilk feeding at discharge home		
		Bottom quartile (rate < 50.0%)	**Middle quartiles (rate 50.0–82.8%)**	**Upper quartile (rate > 82.8%)**
Overall hospital breastfeeding rates	Bottom quartile (rate < 83.2%)	17	7	3
	Middle quartiles (rate 83.2–92.4%)	11	34	13
	Upper quartile (rate >92.4%)	0	14	12

Table 3

Variation between quartiles of risk adjusted* hospital rates of breastmilk feeding in very low birth weight infants vs. overall hospital breastfeeding rates.

		Very low birth weight infant rates of breastmilk feeding at discharge home		
		Bottom quartile (rate < 50.0%)	**Middle quartiles (rate 50.0–82.8%)**	**Upper quartile (rate > 82.8%)**
Overall hospital breastfeeding rates	Bottom quartile (rate < 83.2%)	14	10	3
	Middle quartiles (rate 83.2–92.4%)	13	33	12
	Upper quartile (rate >92.4%)	0	14	12

*Very low birth weight infant breastmilk feeding rates adjusted for gestational age, birth weight, race / ethnicity, prenatal care, multiple gestation, mode of delivery, and maternal age.