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Prevalence of use of human milk in U.S. advanced care neonatal units

Cria G. Perrine, PhD[1,2] and **Kelley S. Scanlon, PhD, RD**[1]

[1]Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, Atlanta, GA

[2]United States Public Health Service Commissioned Corps, Atlanta, GA

Abstract

Background—The American Academy of Pediatrics recommends all preterm infants receive human milk.

Objective—To describe the use of human milk in advanced care neonatal units of U.S. maternity hospitals.

Methods—We used CDC's national Maternity Practices in Infant Nutrition and Care (mPINC) survey from 2007, 2009, and 2011 to analyze 2 questions to describe the prevalence of U.S. advanced care (special/level 2 or intensive/level 3) neonatal units routinely providing human milk to infants, and the use of any donor milk in these units.

Results—In 2011, 30.8% of maternity hospitals reported that most infants (≥90%) were routinely provided human milk in advanced care units, compared to 26.7% in 2009 and 21.2% in 2007 (trend $p<0.001$). States in the northwest and northeast had a higher prevalence of hospitals routinely providing human milk to ≥90% of infants in advanced care units. In 2011, 22.0% of maternity hospitals providing advanced care used banked donor milk, compared to 14.4% in 2009 and 11.5% in 2007 (trend $p<0.001$). Most of this increase occurred in intensive care units (25.1% 2007 vs. 45.2% 2011; trend $p<0.001$). There was substantial geographic variation in the prevalence of advanced care units using donor milk; generally the prevalence was higher in the west and in states with a milk bank in the state or neighboring state.

Corresponding author: Cria G. Perrine, 4770 Buford Hwy NE, Mailstop K-25, Atlanta, GA 30341, cperrine@cdc.gov, 770-488-5183 (o); 770-488-5369 (f).

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The authors have no conflicts of interest relevant to this article to disclose.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Contributor's statement

Dr. Perrine had technical input on the analytic design, conducted the analysis, drafted the manuscript, and approved the final manuscript.

Dr. Scanlon had technical input on the study design, provided feedback on analysis and manuscript drafts, and approved the final manuscript.

Conclusion—The use of human milk in U.S. advanced care neonatal units is increasing; however, only one-third of these units are routinely providing human milk to most infants.

Keywords

special care; intensive care; NICU; hospital; human milk; donor milk

Background

Of the approximately four million infants born in the U.S. in 2010, 12.0% were born preterm (<37 weeks), 8.2% were low birth weight (<2500 g), and 1.5% were very low birth weight (<1500 g).[1] Many of these infants will have medical needs requiring advanced levels of care in specialized neonatal units. The American Academy of Pediatrics (AAP) provides guidance on designating levels of neonatal care, including the capabilities of the facility as well as the infants who should be cared for there.[2] Level 2 special care facilities are intended for infants born at ≥32 weeks or who weigh ≥1500g and are generally stable. Level 3 facilities are able to provide sub-specialty intensive care and intended for all infants born at <32 weeks, who weigh <1500g, or who have a critical medical condition.[2]

While breast milk is widely recognized as the best source of nutrition for healthy full-term infants, it also provides many benefits for infants born preterm. These include improved immune defenses, gastrointestinal function, and neurological development.[3] Some of these benefits are seemingly diminished when using donor milk instead of mother's own milk, due to the pasteurization and storage of the milk.[4] However, donor milk does likely retain some protective effects, and premature infants receiving donor milk have a reduced risk of necrotizing enterocolitis (NEC) compared to infants who are exclusively formula fed.[4, 5] AAP recommends that "all preterm infants should receive human milk. Mother's own milk, fresh or frozen, should be the primary diet, and it should be fortified appropriately for the infant born weighing less than 1.5 kg. If mother's own milk is unavailable despite significant lactation support, pasteurized donor milk should be used."[6]

Despite the noted health benefits of human milk for preterm infants and the AAP recommendation, there are limited data on the prevalence of using human milk in advanced care neonatal units. Our objective was to analyze data from the Centers for Disease Control and Prevention's (CDC) Maternity Practices in Infant Nutrition and Care (mPINC) survey to describe recent trends in the use of human milk (mother's own and donor milk) in U.S. maternity hospitals providing special and intensive neonatal care. Additionally we described the geographic variation in the use of human milk in U.S. advanced care neonatal units.

Methods

Beginning in 2007, CDC biennially implements the mPINC survey, which was designed as a national census of all U.S. hospitals and birth centers that provide maternity care.[7] Ninety-nine percent of all U.S. births occur in maternity hospitals, with less than 1% of births occurring at home or in free standing birth centers.[1] Each year the survey is implemented, a screening phone call is placed to each eligible facility to confirm that maternity care is provided, and to identify the key informant who should receive the survey. To identify the

key informant, the mother/baby manager at hospitals, or the director at birth centers, is asked to name the person most knowledgeable about infant nutrition, such as breastfeeding, use of formula by healthy newborns, and infant feeding routines. Since key informants are completing the survey on behalf of their facility, they are encouraged to seek the input of other key staff as needed to answer the survey questions. The response rate was 82% in 2007 and 2009, and 83% in 2011 (n=2690–2742 facilities). These participating facilities reported more than 3.2 million births, representing approximately 80% of all births in the U.S.

The majority of the mPINC survey focuses on routine care and feeding practices for healthy infants. However, two questions focus on the use of human milk in hospitals providing advanced neonatal care. Hospitals were categorized by the highest level of care provided: healthy newborns only, special care (level 2), or intensive care (level 3 NICU). Among hospitals providing advanced care (special care or intensive care), participants were asked to estimate the percent of infants who are routinely provided with human milk (mother's milk or banked donor milk) among all infants in the unit receiving milk feedings. Response options were "Few (0–9%), Some (10–49%), Many (50–89%), Most (≥90%) or Not sure." Across survey years, 7–10% of hospitals indicated they were "not sure" about the proportion of infants routinely receiving human milk; these facilities were excluded from the analysis of this question. Participants were also asked to indicate whether their hospital ever used banked donor milk in the advanced care unit (yes/no). We analyzed data from the 2007, 2009, and 2011 mPINC surveys to describe trends in the proportion of infants receiving human milk, and the use of any banked donor milk in U.S maternity hospitals providing advanced neonatal care. Birth centers were excluded (n=118–143) from the analysis as nearly all do not provide advanced care. All data were analyzed among hospitals with any advanced care, as well as stratified by level of care. Because mPINC is a census rather than a sample, statistical tests are not usually performed and any change in estimates is considered true change. However, since some hospitals did not participate in the survey and we excluded 7–10% of the data in analyzing the proportion of maternity hospitals providing human milk to ≥90% of infants receiving advanced neonatal care, we used the Cochrane-Armitage trend test to assess whether there was a significant trend across the three survey years in the proportion of hospitals providing human milk to ≥90% of infants, and in the proportion of hospitals using banked donor milk. Because p-values were highly significant, we did not further apply a finite population correction factor to our estimate. The correction factor would have further reduced the standard error of our measures and increased the significance of our trends.

Additionally, we mapped the 2011 data to describe the state-level prevalence of maternity hospitals with an advanced care unit providing human milk to ≥90% infants, and using banked donor milk. Cut-off values for categorizing states were driven by the distribution of the data. In order to explore the geographic association of the use of donor milk with the location of milk banks we additionally mapped the location of the 11 non-profit milk banks overseen by the Human Milk Banking Association of North America (HMBANA) that were active in 2011, and the one commercial milk bank, Prolacta Bioscience, Inc (Monrovia, CA).[8, 9] Mapping milk banks associated with the commercial milk bank was more challenging as they receive donor breast milk from around the country, often from "virtual" milk banks. Since all donor milk bank is shipped to California and processed there, and our

intent was to map milk banks in relation to hospital access, we only mapped the headquarter location.

Results

The percent of U.S. maternity hospitals providing advanced neonatal care appeared mostly constant from 2007 to 2011 (42.2% and 41.0%, respectively), while the percent of hospitals providing intensive care appeared to increase slightly from 18.8% in 2007 to 23.3% in 2011 (Table 1). Among those hospitals providing advanced care, in 2007, 21.2% reported that they routinely provided human milk to ≥90% of infants who were receiving milk feedings (Table 2); this estimate was 20.2% among hospitals providing special care and 23.5% among hospitals providing intensive care. The prevalence of hospitals providing human milk to ≥90% of infants receiving milk feedings in advanced care units increased to 26.7% in 2009 (24.2% special care; 30.8% intensive care) and 30.8% in 2011 (28.1% special care; 34.9% intensive care). These increases were significant overall, and when stratified by care level (trend $p<0.001$). In 2011, in 5 states less than 15% of maternity hospitals with an advanced care unit routinely provided human milk to ≥90% infants in the unit (Arkansas, Mississippi, Nevada, South Dakota, and West Virginia), while in 8 states more than 45% of hospitals with an advanced care unit were routinely providing human milk to ≥90% infants (Idaho, Massachusetts, Montana, North Dakota, New Hampshire, Oregon, Utah, and Washington) (Figure 1).

The use of banked donor milk in U.S. advanced care neonatal units has increased from 11.5% in 2007 to 14.4% in 2009, and 22.0% in 2011 (trend $p<0.001$; Table 3). While the use of banked donor milk has increased in special care units from 5.4% in 2007 to 8.9% in 2011 (trend $p=0.002$), the majority of the increase has occurred in intensive care units, from 25.1% in 2007 to 45.2% in 2011 (trend $p<0.001$). In 2011, in 13 states, less than 10% of hospitals with an advanced care unit used banked donor milk (Figure 2; Alabama, Arkansas, Kentucky, Maine, Maryland, New Jersey, New Mexico, Oklahoma, Rhode Island, Virginia, West Virginia, Wisconsin, and Wyoming). Meanwhile, in 12 states more than 30% of hospitals with an advanced care neonatal unit reported using banked donor milk (Alaska, California, Colorado, Iowa, Massachusetts, Nevada, North Carolina, North Dakota, Ohio, Oregon, Texas, and Utah). Generally, the prevalence of advanced care neonatal units using banked donor milk was higher in the west, and in states that had a milk bank in the state or in a neighboring state.[8] States with the highest prevalence of hospitals routinely providing human milk to most infants in advanced care units were not necessarily the same states with the highest prevalence of hospitals using banked donor milk.

Discussion

Our analysis shows that while there has been an increase in the use of human milk in advanced care neonatal units over the past several years, only about one third of these units are providing human milk to ≥90% of the infants who are receiving milk feedings. Since many infants in advanced care units will have complications that make it difficult to feed at the breast, their mothers must initially rely on expressing their breast milk in order to provide it to the infant. Early and frequent breast stimulation and emptying is important for

establishing milk production, even if the infant is not yet stable or able to consume the breast milk.[10] The risk of not producing adequate milk at 6 weeks postpartum is three times higher for mothers of preterm infants compared to mothers of term infants. Milk production at 6 and 7 days is predictive of milk output at 6 weeks, highlighting the important role of hospital staff in helping mothers establish early effective breast milk expression.[11] Breast milk expression is likely to be more successful when mothers and infants are practicing kangaroo skin-to-skin care, and when milk is expressed using a high quality electric breast pump.[10, 12] Additional support and implementation of evidence-based practices in advanced care units may help more mothers be able to breastfeed, in turn providing health-protective benefits for their medically fragile infants. In 2011 the World Health Organization published guidelines on optimal feeding for low birth weight infants, which may be useful to hospitals in establishing protocols for providing infants with human milk in advanced care units.[13]

The first U.S. milk bank was established in Boston in 1910. Over the last century the number of milk banks in the U.S. has oscillated, with a peak of 30 active milk banks reached in the early 1980's. HMBANA was established in 1985 to help develop standards of operation and safety for its member milk banks in North America. In the U.S. there are currently twelve active non-profit milk banks that are members of HMBANA, and one commercial milk bank. HMBANA reported a 17% increase in 2011 from the more than two million ounces of donor breast milk distributed by its member milk banks in 2010.[14] This increase is consistent with the increase in the percent of intensive care units using any banked donor milk we found in this analysis. Nevertheless, more than half of facilities with neonatal intensive care units were not using any donor breast milk in 2011. Additionally our state-level mapping analysis of the 2011 data indicates there is substantial geographic variability in the use of donor milk in advanced care units. Many states, particularly those without a milk bank nearby, had few facilities using banked donor milk. *The Surgeon General's Call to Action to Support Breastfeeding* outlines recommended actions for improving support for breastfeeding across the nation. Step 12 is to "identify and address obstacles to greater availability of safe banked donor milk for fragile infants." [15] Implementation strategies under this action item include establishing evidence-based clinical guidelines for the use of donor milk, such as prioritizing the distribution of banked donor milk. Such guidelines may help ensure more equitable access to donor milk for fragile infants.

This analysis has several strengths and limitations. The census design and high response rate of the mPINC survey provide valuable data on the national status of maternity care practices in the U.S. The mPINC survey only includes hospitals providing maternity care; hospitals that provide advanced neonatal care but not maternity care, such as some children's hospitals where high risk infants may be transferred after they are born, are not captured in our survey. We were unable to quantify how many infants are admitted to advanced care units in non-maternity care hospitals after birth. A single key informant is responsible for responding to the survey, and thus responses may not always accurately reflect true hospital practices. Additionally, the data on infant nutrition and feeding practices in the advanced care neonatal units are limited. In describing the proportion of infants routinely receiving human milk in these units, we were unable to assess the dose of human milk received, the

proportion of mother's milk versus donor milk given, or the timing of human milk administration, all of which may be important for optimizing health outcomes.[16] Additionally, 7–10% of facilities responded "not sure" to the question about the proportion of infants receiving human milk in the advanced care unit, and were excluded from the analysis. This exclusion may have introduced some bias into our estimates.

Conclusion

Our data show that the use of human milk in advanced care neonatal units of U.S. maternity hospitals is increasing. However, only about one-third of advanced care units are routinely providing human milk to most (≥90%) infants, suggesting many fragile infants are not receiving optimal protection from infections and other morbidities. Hospitals with advanced care neonatal units can further support the care of medically fragile infants by adopting policies and practices to support mothers in being able to provide their breast milk to their infants. These hospitals may also consider developing relationships with donor milk banks in order to make breast milk available to infants whose mothers are unable to provide their own.

Abbreviations

AAP	American Academy of Pediatrics
CDC	Centers for Disease Control and Prevention
HMBANA	Human Milk Banking Association of North America
mPINC	Maternity Practices in Infant Nutrition and Care survey

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What's known on this subject

The American Academy of Pediatrics recommends that all preterm infants receive human milk; however, little is known about the use of human milk in U.S. special care and intensive care neonatal units.

What this study adds

Routine use of human milk and the use of any donor milk in neonatal special care and intensive care units have increased from 2007 to 2011, particularly among units providing intensive care. There is geographic variation in the use of human milk in these units.

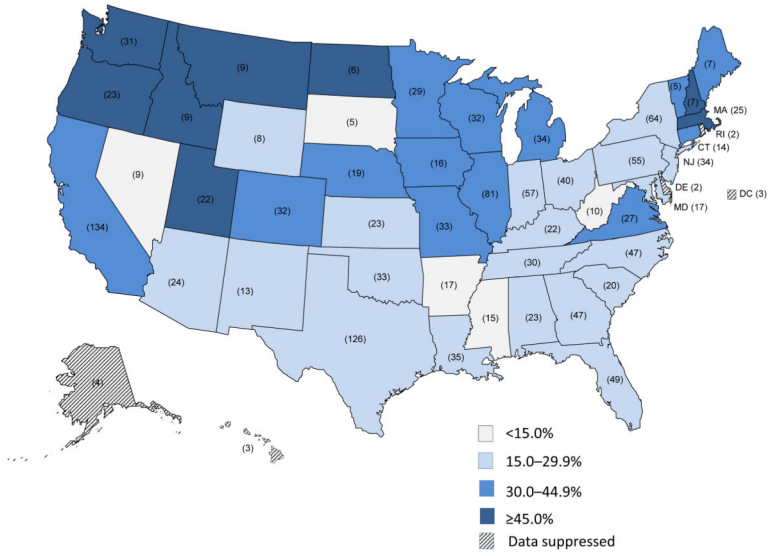

Figure 1.

The prevalence of maternity hospitals with a special care or intensive care neonatal unit that routinely provide human milk to most (≥90%) infants in the unit, by state, mPINC 2011 (#) is the number of hospitals with an advanced care unit in each state included in the analysis; data were suppressed when this sample was less than 5.

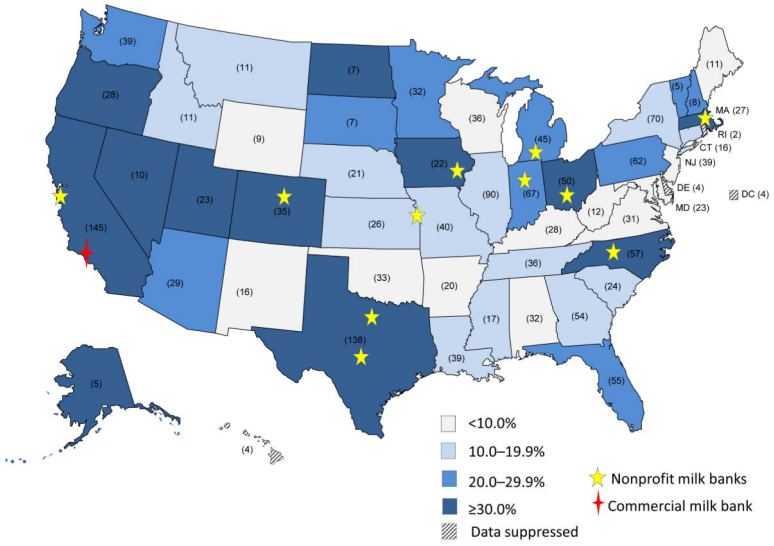

Figure 2.

The prevalence of maternity hospitals with a special care or intensive care neonatal unit ever using banked donor milk in 2011, by state, and the location of active milk banks

(#) is the number of hospitals with an advanced care unit in each state included in the analysis; data were suppressed when this sample was less than 5.

Table 1

Prevalence of U.S. birthing hospitals providing different levels of neonatal care, by year, Maternity Practices in Infant Nutrition and Care (mPINC) survey

	2007		2009		2011	
	N	%	N	%	N	%
Healthy newborn only	990	39.0	968	38.0	925	35.6
Special care	1072	42.2	1022	40.1	1065	41.0
Intensive care	477	18.8	556	21.8	606	23.3

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Table 2

Among U.S. hospitals with a special care or intensive care unit, the prevalence of infants in these units routinely provided human milk (mother's milk or donor milk) among infants receiving milk feedings, by year and unit level[a,b]

	2007			2009			2011		
	Total n=1304	**Special care n=882**	**Intensive care n=422**	**Total n=1366**	**Special care n=844**	**Intensive care n=522**	**Total n=1436**	**Special care n=875**	**Intensive care n=561**
0–9%	8.0	10.4	2.8	7.6	10.7	2.7	7.3	10.9	1.8
10–49%	19.4	21.1	15.9	15.1	16.8	12.3	12.7	15.7	8.2
50–89%	51.4	48.3	57.8	50.6	48.3	54.2	49.2	45.4	55.1
≥90%[b]	21.2	20.2	23.5	26.7	24.2	30.8	30.8	28.1	34.9

[a] Hospitals that responded "not sure" to this question were excluded from the analysis presented in this table

[b] Cochrane-Armitage test for trend across survey years for the proportion of hospitals reporting >90% of infants were receiving human milk was significant at the $p<0.001$ level for total, special care, and intensive care hospitals.

Table 3

Among U.S. hospitals with a special care or intensive care unit, the prevalence of ever using banked donor milk, by year and unit level

	2007		2009		2011		P-value for trend
	N	%	N	%	N	%	
Total	1525	11.5	1557	14.4	1662	22.0	<0.001
Special care	1054	5.4	1006	6.6	1060	8.9	0.002
Intensive care	471	25.1	551	28.7	602	45.2	<0.001