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Disparities in Donor Human Milk Supplementation among Well Newborns

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Abstract

Background: Donor human milk supplementation for healthy newborns has increased. Racial/ethnic disparities in such supplementation have been described in the neonatal intensive care unit but not the well newborn setting.

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Conflict of Interest Statement

All authors attest that they have no conflicts of interest relevant to this work to disclose.

Research Aim: To identify maternal characteristics associated with donor human milk versus formula supplementation in the well newborn unit.

Methods: This retrospective cohort study includes dyads of well newborns and their mothers who breastfed and supplemented with formula or donor human milk during the birth hospitalization at a single hospital in the midwestern United States. Maternal characteristics and infant feeding type were extracted from medical records. Chi-square and logistic regression were used to examine associations between maternal characteristics and feeding type.

Results: Of 678 eligible dyads, 372 supplemented with formula and 306 with donor human milk. Non-White women were less likely to use donor human milk. Compared to non-Hispanic White women, the largest disparity was with Hispanic (adjusted OR 0.28, 95% CI 0.12, 0.65), then non-Hispanic Black (adjusted OR: 0.32, 95% CI 0.13, 0.76) and Asian women (adjusted OR 0.34, 95% CI: 0.16,0.74). Lower donor human milk use was associated with primary language other than English and public versus private insurance.

Conclusions: Non-White, non-English-speaking, and publicly-insured women were less likely to supplement with donor human milk than formula. The goal of improving public health through breastfeeding promotion may be inhibited without targeting donor human milk programs to these groups. Identifying the drivers of these disparities is necessary to inform person-centered interventions that address the needs of women with diverse backgrounds.

Introduction

Breastfeeding helps confer optimal maternal and infant health. Mother's own milk is the best feeding source for newborns, as breastfed infants have lower risk of allergic and infectious diseases in childhood and longer term have lower rates of chronic diseases, including diabetes and certain cancers, than those who are not breastfed (American Academy of Pediatrics Section on Breastfeeding, 2012). When mothers' own milk is not available, pasteurized donor human milk (DHM) is increasingly being recommended as next best, especially for very preterm infants (<32 completed gestational weeks). Among very preterm infants, DHM has been associated with a reduced risk of necrotizing enterocolitis compared to formula use (Quigley & McGuire, 2014; Trang et al., 2018). Therefore the American Academy of Pediatrics recommends pasteurized DHM be used instead of formula, when medically necessary, for very preterm and very low birth weight infants (American Academy of Pediatrics Section on Breastfeeding, 2012).

The World Health Organization/Unicef's Ten Steps to Successful Breastfeeding Step 6 (Supplementation) was revised in 2018 and now recommends "prioritizing donor human milk when a supplement is needed" (World Health Organization, 2018). Likewise the Academy of Breastfeeding Medicine supports the use of banked donor human milk, when it is needed (Chantry, Eglash, & Labbok, 2015). Evidence of benefits of DHM is less robust for term and late preterm infants, but many view DHM as the preferable option when supplementation is needed due to insufficient maternal supply, to prevent dehydration and severe hyperbilirubinemia. DHM retains some of the anti-infective components found in mother's own milk and may support a healthier gut microbiome than infant formula (Parra-Llorca et al., 2018; Underwood et al., 2015). Qualitative studies have also shown that some

mothers find it to be a more natural option and a more comfortable way to supplement their infant while establishing their mature milk supply (Kair & Flaherman, 2017; Rabinowitz, Kair, Sipsma, Phillipi, & Larson, 2018).

The Joint Commission is an independent non-profit organization that accredits and certifies health care organizations and programs in the US as meeting quality care performance standards, including those pertaining to breastfeeding. Beginning in January 2014, hospitals with greater than 1,100 births annually in the US are required to submit data on the Joint Commission Perinatal Care Measure Set, which includes breastfeeding. The Joint Commission includes DHM in its definition of "exclusive breastmilk feeding," so hospitals seeking to improve on this quality metric can improve their rates by replacing formula with DHM (The Joint Commission, 2013). Hospitals using DHM for healthy newborns have reported higher exclusive breastfeeding at discharge compared to those that did not (Belfort et al., 2018). The use of DHM is increasing in newborn nurseries and neonatal intensive care units, but usage varies geographically, is inconsistent, and may be limited by health care providers' (HCP) lack of knowledge (Belfort et al., 2018; Colaizy, 2015; Hagadorn, Brownell, Lussier, Parker, & Herson, 2016; Parker et al., 2013; Perrine & Scanlon, 2013; Sen et al., 2018). Reported maternal barriers to DHM utilization include unfamiliarity, cost, and access issues (Kair & Flaherman, 2017; Rabinowitz et al., 2018). Racial and socioeconomic disparities associated with formula supplementation of breastfed babies during the birth hospitalization have been described (Nguyen, Dennison, Fan, Xu, & Birkhead, 2017). Additionally, racial disparities have been shown in DHM consent for infants cared for in the neonatal intensive care unit (NICU) (Brownell et al., 2014; Brownell et al., 2016); however, maternal factors associated with DHM supplementation of healthy term and late preterm infants during birth hospitalization have not been described.

The aim of this exploratory study was to investigate the maternal factors associated with DHM versus formula supplementation in the postpartum/well newborn care unit, with a particular focus on maternal demographic characteristics thought to be associated with other (not specific to DHM) maternal and neonatal healthcare disparities. We hypothesized that DHM use in this population would be independently associated with maternal race, as has been previously described in studies in the NICU setting.

Methods

Design

Mother/infant dyads who were admitted to the postpartum well newborn/mother unit at a midwestern US academic medical center were included in this retrospective cohort study. This design was used to investigate relationships between maternal demographic and clinical characteristics and the outcome of DHM versus formula supplementation of the infant.

Ethical Conduct of Research

This study was approved for full waiver of consent by the institutional review board. Data were retrospectively collected from both infant and maternal health records. The researchers who collected data were all nurses or physicians employed by the hospital and completed

training in the protection of human subjects through the Collaborative Institutional Training Initiative (CITI) program (CITI Program, 2019).

Setting

This institution is home to one of the oldest Human Milk Banking Association of North America (HMBANA) milk banks in the United States and has allowed DHM use for supplementation of breastfed infants in the well newborn unit since 2006 (Kair, Colaizy, Hubbard, & Flaherman, 2014). DHM is the first-line supplementation option recommended in the well newborn unit when supplemental feedings are medically-indicated. DHM is available for inpatient newborns by physician order, and the cost is covered by the inpatient unit as part of the food and nutrition budget and not reimbursed by insurance. Medical indications for supplementation are at the discretion of the prescribing physician. Parents have the ultimate choice and make the decision whether their child receives donor human milk or formula after reviewing risks and benefits and any questions they have with the provider. International board certified lactation consultants work every day of the week at this hospital, and they see all postpartum women unless they decline lactation services. Women who receive prenatal care at this institution are offered a prenatal breastfeeding class as well.

Sample

All infants included in this study were born at a single midwestern medical center where a total of 1,712 live births occurred in 2014. All infants in this study were clinically stable and had clinically-stable mothers, were born following at least 35 weeks' gestation and weighed at least 1750 grams at birth. This is the population who receives mother-baby, rooming-in care at the study site medical center; infants born prior to 35 weeks or lower than 1750 grams at birth are admitted directly to the NICU. Mother/infant dyads were included in this study if the mother breastfed and used either formula or DHM for supplementation during the birth hospitalization. The study sample size of breastfed newborns who supplemented with donor milk or formula but not both, from one year's worth of newborn deliveries, was 678 with 45% of infants in the donor milk group and 55% in the formula group, which we anticipated would provide adequate power to detect a difference in DHM versus formula use by race.

Measurement

Data collection instruments to collect clinical and demographic data systematically from infant and maternal charts were created for this study using REDcap (Research Electronic Data Capture) (Harris et al., 2019). These instruments are available as supplements.

Data Collection

The study was conceptualized in 2014. Data were collected between 2015 and 2018 on all infants admitted to the well newborn/postpartum care unit at our hospital from January through December 2014. Data were analyzed in 2018. We excluded infants admitted to or transferred to or from the NICU, seeking to study supplementation practices specifically among otherwise healthy term and late preterm newborns. All data, including maternal

demographic characteristics and supplement method were manually extracted from infant and maternal electronic medical records by researchers who had been oriented to the records and data collection procedures; data were entered in a secure REDcap (Harris, et al., 2019) electronic database.

Data Analysis

Raw data were categorized for analysis, including maternal race categorized into Non-Hispanic White, Non-Hispanic Black, Asian, Hispanic, and other; gestational age categorized into preterm and term; maternal insurance categorized into private and public (including Medicaid and Medicare) and other (including self-pay and military insurance), primary language categorized into English, Spanish, and other; maternal age categorized into less than 18, 18 to 24, 25 to 35, and 36 or older; and parity grouped into 1, 2, 3, and 4 or more. We restricted our dataset for this analysis to only those infants who were breastfed and supplemented with either DHM or formula but not both. Chi square and Fisher's exact tests were used to examine differences in maternal characteristics of women who used DHM versus formula supplementation. Bivariate logistic regression was used to examine the association between supplement choice and maternal race/ethnicity. Finally, we examined this association in a logistic regression model adjusted for gestational age of the infant and the following maternal characteristics: maternal insurance, primary language, maternal age at delivery, mode of delivery, and parity. All analyses were conducted in SAS 9.4 (SAS Institute Inc., 2013).

Results

A total 678 infants met our inclusion criteria, of whom 372 supplemented with formula and 306 supplemented with DHM. Twenty-five had missing data for race/ethnicity, leaving 653 in the sample for the logistic regression.

Using Pearson Chi-square and Fisher exact test we found all explored maternal characteristic variables of women who used DHM compared to formula supplementation differed significantly. Overall demographic and clinical characteristics of mother-infant dyads are shown in Table 1. When examining the association of supplement choice and maternal race/ethnicity in the unadjusted analysis, we found non-Hispanic Black women were the least likely to use DHM, followed by Hispanic women, Asian women, and women who reported "Other" race . After adjusting for maternal characteristics, the disparity between supplement choice and race/ethnicity remained; the largest disparity was observed for Hispanic women, as they were 72% less likely to use DHM than non-Hispanic White women. In the adjusted model, Non-Hispanic Black, Asian, and women who reported race as "Other" were also less likely to use DHM than non-Hispanic White women (Table 2). Additional demographic characteristics associated with supplement choice included primary language and insurance type. We found women who were publicly-insured and non-English speaking were less likely to use DHM. Clinical characteristics associated with supplement choice were parity, delivery mode, and gestational age of the newborn (Table 2). Post-hoc we restricted the analytic sample to only those infants born at term (37 or more weeks' gestation), and findings were similar (data not shown).

Discussion

Disparities in who uses a given hospital intervention, in this case DHM rather than formula, can come from issues with the system, the HCP working within systems, or the patients. The Institute of Medicine (2003) defines healthcare disparities as “differences in the quality of care received by minorities and non-minorities who have equal access to care – that is, when these groups have similar health insurance and the same access to a doctor – and when there are no differences between these groups in their preferences and needs for treatment. Therefore, barring patient preference, use of DHM in the mothers in our sample in our single site would represent a healthcare disparity. Systems may not provide resources that specifically support the needs of particular groups of patients. HCP may discuss DHM differently with patients from different backgrounds. Implicit bias may contribute, leading providers to not offer patients an intervention in which they assume the patients will not be interested.

In an example of how system and HCP factors may interact, in our study, information about DHM was available in both English and Spanish; however the retrospective nature of this study precluded us from determining whether HCP spoke the patients’ native languages and whether interpreters were used when discussing DHM and formula as supplementation options. The patients from different racial, ethnic, or socioeconomic backgrounds may have had different personal and family experiences with formula supplementation. It is possible that the same factors driving the racial/ethnic and socioeconomic disparity of increased formula supplementation in breastfed infants (Nguyen et al., 2017) were not mitigated by making DHM available. For example, in some previous studies, women viewed DHM as “gross” (Kair & Flaherman, 2017; Rabinowitz et al., 2018), and it is possible that familiarity with and acceptability of DHM as a supplementation option varied across racial, ethnic, or socioeconomic backgrounds.

With respect to our finding that mothers with public insurance were less likely to give DHM than those with private insurance, one potential reason for this difference may be differences in ongoing coverage of DHM for outpatient use. During the newborn hospitalization at our facility, the cost of DHM is covered by the hospital unit, but after discharge ongoing DHM supplementation is billed to insurers or patients directly. Therefore mothers with public insurance may not have had access to DHM after discharge, as some private but not public insurers in the state where the study occurred cover ongoing donor milk supplementation (Kair, Colaizy, Hubbard, & Flaherman, 2014). Kair and Flaherman (2017) conducted a qualitative study exploring DHM and formula supplementation in the well newborn population at our hospital and found that lack of access to DHM for ongoing supplementation is a barrier to its use during the newborn hospitalization, despite the cost being covered while inpatient, for some women.

Our findings, if replicated in other settings, have implications for the health of infants in addition to their significance for healthcare utilization. Differential increased use of pasteurized DHM for White infants and those from higher socioeconomic backgrounds may widen health disparities in a number of ways. If supplementation with DHM rather than formula leads mothers to resume exclusive breastfeeding and to breastfeed for a longer

duration or has direct benefits on infant health as have been shown in preterm infants (Dritsakou et al., 2016; Mannel & Peck, 2018), then non-White infants and/or those with public insurance who are less likely to use DHM than formula are receiving these benefits at lower rates than White mothers and/or those with private insurance. If there are no direct benefits to healthy term mother-infant dyads from DHM supplementation (Kair, Flaherman, & Colaizy, 2019), then the money spent on these programs has opportunity costs that must be considered. DHM from the Mother's Milk Bank of Iowa cost $15/100 mL at the time the data for this study were collected and was costing $1,000–2,000 per month in the well newborn unit's nutrition budget annually.

Limitations

Our study must be placed in the context of various factors. This was a retrospective study using data from infants in one hospital in the midwestern United States, and the results may not be generalizable to other hospitals within the US or globally. The data for this study were collected from the electronic medical record, and, it is unclear from the available retrospective data whether parents were offered donor milk and declined it or if they were not offered it. We were limited by the maternal racial/ethnic and primary language categories listed in the birth mother's medical record and did not have data on race or language for the infant's father, other parent, or caregiver. We collected data from one year only, so the study sample is relatively low at 678. We did not collect data regarding multiple births, so it is possible in some cases that twins were both included in the analysis. We also do not know mothers' exclusive breastfeeding intention; we attempted to collect this data but it was not reliably recorded in the electronic medical record. It is, therefore, very likely that at least some of the women who supplemented with formula did so because they intended to feed their baby both their own milk and formula. We also do not have data on indications for supplementation and the lactation support individual mothers received.

Recommendation for Future Research

Our study was an exploratory analysis of electronic medical record data collected retrospectively. Therefore, our findings, highlight the need for future prospective research to determine whether and to what extent healthcare disparities and/or patient preferences relatively contribute to the disproportionate lower use of DHM by mothers of other race/ethnicity when compared to non-Hispanic White mothers. Studies examining differences in infant health outcomes from DHM versus formula supplementation are also needed to help determine the prudence of working toward increasing uptake among families from diverse backgrounds versus de-implementation of DHM in well newborn/postpartum care units. If DHM is not found to have appreciable benefits for this population over infant formula, then money currently being spent on DHM in well newborn/postpartum units could be reallocated toward other, evidence-based interventions to support breastfeeding mother-infant dyads from diverse backgrounds.

Conclusions

Mothers of color, those who do not speak English, and those with public insurance were more likely to supplement with formula rather than DHM. Implementation of a DHM program in the well newborn setting that is not specifically targeted to these groups has the potential to widen health disparities despite the goal of improving public health through breastfeeding promotion. Further research is necessary to determine the underlying reasons for these disparities and from that, to provide focused, person-centered intervention to address the needs of low-income women, non-English speakers, and mothers of color.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Demographic Characteristics of Breastfeeding Mothers Supplementing with Donor Human Milk or Formula (N=678)

	Breastfeed + Formula (n=372)	Breastfeed + Donor Human Milk (n=306)		
	***n* (%)**	**n (%)**	**Chi Square[a]**	***p*-value**
Maternal Race			95.33	<.0001
Non-Hispanic White	146 (40.44)	226 (77.40)		
Non-Hispanic Black	53 (14.68)	9 (3.08)		
Asian	40 (11.08)	14 (4.79)		
Hispanic	48 (13.30)	10 (3.42)		
Other[b]	74 (20.50)	33 (11.30)		
Missing	11 (2.30)	14 (4.58)		
Primary Language			N/A	<.0001
English	267 (71.97)	296 (97.05)		
Spanish	41 (11.05)	4 (1.31)		
Other[b]	63 (16.98)	5 (1.64)		
	1 (0.003)	1 (0.003)		
Maternal Insurance			51.31	<.0001
Private	179 (48.12)	230 (75.16)		
Public & Other[b]	193 (51.88)	76 (24.84)		
Maternal Age			N/A	.0131
Less than 18 years	4 (1.08)	1 (0.33)		
18–24 years	85 (22.85)	46 (15.03)		
25–35 years	234 (62.90)	226 (73.86)		
36 or older	49 (13.17)	33 (10.78)		
Parity			54.86	<.0001
1	116 (31.18)	181 (59.15)		
2	117 (31.45)	66 (21.57)		
3	84 (22.58)	36 (11.76)		
4 or more	55 (14.78)	23 (7.52)		
Mode of Delivery			10.69	.001
Vaginal	254 (68.46)	171 (56.25)		
C-Section	117 (31.54)	133 (43.25)		
Missing	1 (0.003)	2 (0.01)		
Gestational Age			14.69	.0001
< 37 weeks	15 (4.07)	36 (11.96)		
>= 37 weeks	354 (95.93)	265 (88.04)		

[a] Fisher's Exact Test used when cell sizes fewer than 5

[b] Other is defined as non-missing data responses other than the other categories for that variable

Table 2.

Unadjusted and Adjusted Odds Ratios for Supplementing with Donor Human Milk (N=678)

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Maternal Race		
Non-Hispanic White[a]		
Non-Hispanic Black	0.11 (0.05–0.23)	0.32 (0.13–0.76)
Asian	0.23 (0.12–0.43)	0.34 (0.16–0.74)
Hispanic	0.14 (0.07–0.27)	0.28 (0.12–0.65)
Other	0.29 (0.18–0.46)	0.91 (0.47–1.76)
Maternal Insurance		
Public & Other[a]		
Private		1.91 (1.09–3.34)
Primary Language		
English[a]		
Spanish		0.17 (0.05–0.56)
Other		0.09 (0.03–0.27)
Maternal Age		
25–35 years[a]		
Less than 18 years		0.18 (0.02–2.08)
18–24 years		0.55 (0.31–0.98)
36 years or older		0.83 (0.45–1.52)
Delivery Mode		
Vaginal[a]		
Cesarean		1.58 (1.07–2.35)
Gestational Age		
> = 37 weeks[a]		
< 37 weeks		2.85 (1.36–5.99)
Parity		
1[a]		
2		0.29 (0.19–0.47)
3		0.23 (0.13–0.41)
4 or more		0.35 (0.17–0.71)

[a]Reference group for analysis