

Human Donor Milk or Formula: A Qualitative Study of Maternal Perspectives on Supplementation

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Abstract

Background: Breastfeeding is fundamental to maternal and child health and is the most cost-effective intervention to reduce child mortality. Pasteurized human donor milk (HDM) is increasingly provided for term newborns requiring temporary supplementation. Few studies examine maternal perspectives on supplementation of term newborns.

Materials and Methods: We conducted semistructured in-person interviews with mothers of term newborns ($n = 24$) during postpartum hospitalization. Mothers were asked whether they had chosen or would choose to supplement with HDM versus infant formula, if medically indicated, and why. Data were gathered to saturation and analyzed inductively by consensus. Emerging semantic themes were compared between mothers who chose or would choose HDM and those who chose or would choose infant formula.

Results: Most mothers had concerns about HDM, including uncertainty regarding screening and substances passed through HDM. Experiences with prior children influenced decision-making. Mothers who chose or would choose HDM (56%, $n = 14$) praised it as “natural,” and some felt suspicious of infant formula as “synthetic.” Mothers who chose or would choose infant formula (44%, $n = 10$) did not know enough about HDM to choose it, and many viewed infant formula as a short-term solution to supply concerns. Mothers unanimously mistrusted online milk purchasing sources, although the majority felt positively about using a friend or family member’s milk.

Conclusions: Counseling regarding term newborn supplementation should focus on HDM education, specifically on areas of greatest concern and uncertainty such as donor selection, screening, transmission of substances, and mother’s milk supply. Research is needed to assess the long-term impact of attitudes and choices on breastfeeding.

Keywords: donor human milk, newborn supplementation, qualitative research, infant formula, breastfeeding promotion, Human Milk Banking Association of America

Introduction

BREASTFEEDING IS FUNDAMENTAL to maternal and child health and has been shown to be the single most cost-effective intervention to reduce child mortality and protect the health of the dyad.^{1,2} Exclusive breastfeeding for the first 6 months after birth is the standard recommendation from the American Academy of Pediatrics (AAP), the Academy of Breastfeeding Medicine, and the World Health Organization and United Nations Children’s Fund (WHO/UNICEF), among others.^{3–5} However, in certain clinical situations, early sup-

plementation is necessary to prevent or treat hypoglycemia, excessive weight loss, dehydration, and/or hyperbilirubinemia. The effects of early supplementation of term newborns on breastfeeding initiation and duration are not entirely clear.^{5–7}

Today, pasteurized human donor milk (HDM) from a milk bank is offered as an option for supplementation of term newborns in over 37 countries, including the United States.^{8,9} In premature infants, HDM has been associated with improved health outcomes and cost savings when maternal breast milk is unavailable or insufficient.^{3,10–13} When available, HDM is

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recommended by health authorities as the supplement of choice for term infants and is preferred over infant formula.⁷⁻⁹ Several studies have examined maternal attitudes and beliefs about HDM use for premature infants in the intensive care setting.^{11,14-15} Others have focused on mothers in the community who are engaged in either informal milk sharing or the unregulated sale or purchase of human milk through the Internet.¹⁶⁻¹⁹ Finally, Kair and Flaherman examined maternal perceptions of HDM and infant formula in mothers who were already supplementing their infant with one of these options.²⁰ To our knowledge, no studies have surveyed a group of mothers not already involved in supplementation of some type.

Our study aimed to describe all-comer maternal perspectives on different supplementation options, including HDM, infant formula, milk informally shared between friends or relatives, and milk purchased from an online seller. We intended to capture a wide breadth of maternal attitudes and beliefs, across the spectrum of exposure to supplementation counseling by a medical provider. Therefore, we sampled both mothers who were and were not already engaged in supplementation. As we support parents' infant feeding intentions and provide safe and evidence-based newborn care, it is necessary that we understand beliefs surrounding supplementation options to provide effective patient counseling and education.

Materials and Methods

Definitions used in this study:

- *Supplemental feed*: A fluid other than the mother's breast milk provided to a breastfed infant under 6 months of age.⁶
- *HDM*: Expressed breast milk that has been screened, pasteurized, stored, and dispensed by a formal milk bank of the Human Milk Banking Association of North America (HMBANA) or a similar organization according to strict guidelines.
- *Formal milk donors*: Lactating individuals who donate their expressed breast milk without compensation to a milk bank for distribution as HDM. Donors are screened for disease, medications, and potentially harmful exposures.^{16,19}
- *Informal milk sharing*: The exchange of expressed breast milk without cost from a lactating individual to a family in need of human milk. Expressed milk is unregulated and is not institutionally screened. Rather, individuals perform their own risk assessment and screen according to the level of trust of the donor, their understanding of the risks, and the resources available for screening. Pasteurization of milk is uncommon.^{16,19}
- *Informal milk selling*: The sale of expressed breast milk from a lactating individual to a family in need of human milk, often through an online platform. Expressed milk is unregulated and is not institutionally screened. Rather, individuals perform their own risk assessment and screen according to the level of trust of the donor, their understanding of the risks, and the resources available for screening. Pasteurization of milk is uncommon.^{16,19}
- *Milk provider*: General term encompassing both formal milk donors and lactating individuals who provide breast milk through informal milk sharing or informal milk selling.

Setting and participant recruitment

We recruited mothers of term infants during their postpartum hospitalization at Oregon Health & Science University (OHSU), a large academic medical center in Portland, Oregon, between September and December 2016. We purposively sampled participants to reflect a diverse range of perspectives and demographics. In Oregon, breastfeeding initiation rates surpass national averages (92.5% versus 81.1% nationally), and in-hospital breastfeeding support is ranked among the highest in the nation.^{8,21} Our hospital contracts with the Northwest Mothers' Milk Bank (www.donatemilk.org), a HMBANA-certified milk bank. In 2011, OHSU began offering HDM to preterm or critically ill infants, and in 2013, began offering it to term infants requiring supplemental feedings in the setting of maternal intent to breastfeed.

One trained research assistant (M.R.) conducted all 24 one-on-one, in-person semistructured interviews with mothers in their postpartum hospital rooms. Chart review was used to collect sociodemographic information on all participants, to help contextualize findings and transferability (Table 1). Participants were enrolled until the point of obvious thematic redundancy (data saturation).²³⁻²⁵

Data collection

To understand mothers' knowledge and attitudes toward different supplementation options, mothers were asked about their prenatal feeding intent and their infants' current feeding regimen. If a mother was providing supplemental feeds in the hospital, her reasons for choosing HDM or infant formula were explored. Those exclusively breastfeeding were asked what they would choose if supplementation was to be recommended by their infant's physician. To understand mothers' knowledge and attitudes about informal milk sharing, mothers were asked their opinions on informal milk sharing with a friend or relative and informal milk selling from an online source. The interview guide is displayed in Table 2 and was developed collaboratively by the research team, guided by our research aims. We used the methodological strategies of purposive sampling, standardization of recording, and verbatim transcription by the research assistant (M.R.) to maximize validity.²³⁻²⁵ Interviews ranged from 4 to 10 minutes in length. Transcripts and study data were managed using REDCap electronic data capture tools hosted at OHSU in Portland, Oregon.²⁶

Data analysis

We conducted a thematic analysis of our data at the semantic level. We used negative case analysis and reflexivity to maximize validity.²⁷ Our data analysis team consisted of three pediatricians with expertise in qualitative research (I.L., C.P., L.K.), two of whom have additional certification in lactation (I.L., C.P.), one epidemiologist (H.S.), and one medical student (M.R.).

To maximize the credibility and confirmability of our analysis, we used a systematic process with multiple investigators repeatedly cycling through five phases of thematic analysis.^{20-22,24} First, four researchers (M.R., L.K., H.S., I.L.) read transcripts multiple times, noting initial impressions. Second, two researchers (M.R., I.L.) independently

TABLE 1. SOCIODEMOGRAPHICS AND CHOSEN SUPPLEMENT

<i>Sociodemographic characteristics</i>	<i>All participants, N=24</i>	<i>Chose HDM (N=1) or would choose HDM (N=13) if supplementation was medically indicated, N=14 (58%)</i>	<i>Chose formula (N=5) or would choose formula (N=5) if supplementation was medically indicated, N=10 (42%)</i>
Age, year			
Mean \pm SD	29.75 \pm 6.5	29.07 \pm 6.4	30.70 \pm 6.7
Min-Max	16–39	19–38	16–39
Race, <i>N</i> (%)			
White	13 (54)	8 (57)	5 (50)
Latina/Hispanic	4 (16.5)	2 (14)	2 (20)
Asian	3 (13)	1 (8)	2 (20)
African American	0 (0)	0 (0)	0 (0)
American Indian	0 (0)	0 (0)	0 (0)
“Multiracial”	4 (16.5)	3 (21)	1 (10)
Highest educ, <i>N</i> (%)			
HS/GED or less	9 (38)	6 (43)	3 (30)
Some college or more	15 (62)	8 (57)	7 (70)
Insurance type, <i>N</i> (%)			
Public	11 (46)	5 (36)	6 (60)
Private	7 (29)	5 (36)	2 (20)
Unknown	6 (25)	4 (28)	2 (20)
Total household income in 2016, <i>N</i> (%)			
\$20,000 or less	9 (38)	5 (36)	4 (40)
\$20,001–\$40,000	3 (12)	2 (14)	1 (10)
\$40,001–\$80,000	0 (0)	0 (0)	0 (0)
\$80,001 or more	7 (29)	4 (29)	3 (30)
Don't know/decline	5 (21)	3 (21)	2 (20)
Marital status, <i>N</i> (%)			
Single, never married	5 (21)	2 (14)	3 (30)
Living with partner	5 (21)	3 (22)	2 (20)
Married	12 (50)	7 (50)	5 (50)
Separated/divorced	1 (4)	1 (7)	0 (0)
Other	1 (4)	1 (7)	0 (0)
Delivery type, <i>N</i> (%)			
Vaginal	14 (56)	7 (50)	7 (70)
Cesarean section	10 (42)	7 (50)	3 (30)
Infant sex, <i>N</i> (%)			
Male	12 (50)	7 (50)	5 (50)
Female	12 (50)	7 (50)	5 (50)
Parity, <i>N</i> (%)			
Nulliparous	10 (42)	6 (43)	4 (40)
Multiparous	14 (56)	8 (57)	6 (60)
Intention to exclusively breastfeed for ≥ 3 months, <i>N</i> (%)	19 (79)	11 (79)	8 (80)

HDM, human donor milk.

coded several transcripts in parallel to improve trustworthiness. We then met to develop a preliminary codebook using an inductive approach, without a preconceived coding frame.^{23–25,27} Then, four researchers (M.R., L.K., H.S., I.L.) independently coded transcripts by hand. Two researchers (M.R., I.L.) coded all 24 transcripts, such that all transcripts were triple coded. Researchers reconciled coding differences by consensus.

Third, researchers organized codes into preliminary themes grounded in the data themselves. Fourth, researchers reexamined the data for disconfirming evidence. Themes were assessed at the level of coded data excerpts, as well as at

the level of the data set as a whole. Fifth, themes were revised, collated, and restructured in an iterative process before they were paired with evidence from the data. Team discussions were documented in a research journal.²⁴

Researchers looked for patterns by dividing participants into two subgroups: (1) Mothers who were using or would choose HDM if supplementation was medically indicated, and (2) Mothers who were using or would choose infant formula. Themes were compared between these two subgroups. We used a chi-square test to compare the distribution of sociodemographic characteristics between the two groups, with an alpha level of significance of 0.05.

TABLE 2. INTERVIEW PROTOCOL

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- A. Feeding:
1. While you were pregnant, what were your plans for feeding your new baby?
 2. If you planned to breastfeed, for how long did you intend to breastfeed?
 3. How are you feeding your baby now? [*Proceed below, based on participant answer*]
- B. If currently exclusively breastfeeding [interviewer says: “*The rest of this interview will be about a hypothetical situation. Let’s say your doctor told you that your baby needed supplemental feedings today, for a health concern like too much weight loss or low blood sugar. The doctor isn’t sure how long you will need to keep supplementing. So, if your baby needed to start supplemental feeding today in the hospital...*”]
1. If given the choice between supplementing with formula or donated human breast milk from a milk bank, which would you choose? Why?
 2. How do you feel about formula?
 3. How do you feel about donated human breast milk?
 4. Who, if anyone, would help you make the decision about supplementing your baby with formula or donated human breast milk?
 5. *If participant chooses formula, ask:* What are your reasons for selecting formula? What, if anything, would make you feel more comfortable giving your baby HDM?
 6. Before having this baby, had you heard about donor breast milk or human milk banking?
 7. What do you think about giving your baby milk from a friend or relative?
 8. What do you think about giving your baby milk purchased online or from an advertisement?
- C. If currently breastfeeding AND supplementing with pasteurized HDM:
1. Before having this baby, had you heard about donor breast milk or human milk banking?
 2. What were your reasons for giving HDM to your baby?
 3. Who, if anyone, helped you decide to use HDM? What did they say?
 4. What do you think about giving your baby milk from a friend or relative?
 5. What do you think about giving your baby milk purchased online or from an advertisement?
 6. How do you feel about HDM?
 7. How do you feel about formula?
 8. How do you plan to feed your baby when you go home?
- D. If currently breastfeeding AND supplementing with formula OR exclusively formula feeding:
1. During your pregnancy, were you planning to give your baby formula?
 2. What were your reasons for giving your baby formula?
 3. Who, if anyone, helped you decide to use formula? What did they say?
 4. How do you feel about formula?
 5. How do you feel about donated human breast milk?
 6. What, if anything, would make you feel more comfortable giving your baby HDM?
 7. Before having this baby, had you heard about donor breast milk or human milk banking?
 8. What do you think about giving your baby milk from a friend or relative?
 9. What do you think about giving your baby milk purchased online or from an advertisement?
 10. How do you plan to feed your baby when you go home?
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Ethics

Study procedures were approved by the OHSU Institutional Review Board, and written informed consent was obtained from all participants before enrollment. For anonymity, participants were assigned ID numbers 1–24.

Results

We reached thematic saturation at 24 interviews. Most mothers ($n = 18$, 75%) endorsed exclusive breastfeeding as their feeding modality at the time of interview, while six were supplementing their infants at the time of interview (one with HDM and five with infant formula). Of the mothers we interviewed, 58% ($n = 14$) favored HDM, while 42% ($n = 10$) favored infant formula. In both subgroups, ~80% of mothers had the prenatal intention of exclusively breastfeeding for at least 3 months (Table 1). The average maternal age of participants was 30 years (± 6.5 years), 46% were non-white, 62% had at least some college education, and 46% were publicly insured.

The two subgroups were not significantly different (p -value > 0.1) with respect to age, race, total annual household income, education, parity, infant sex, delivery type, and marital status;

however, compared with mothers who favored HDM, mothers in the infant formula group were more likely to be publicly insured, although this difference was not statistically significant (60% versus 36%, p -value = 0.28) (Table 1).

We grouped themes into four categories as follows: (1) Overarching themes that arose from participants in both groups; (2) Themes specific to mothers who favored HDM; (3) Themes specific to mothers who favored infant formula; and (4) Themes about informal milk sharing between friends or relatives and informal milk selling from online sources (Table 3).

Overarching themes

Mothers felt uneasy about formal milk donor selection

Many participants expressed concerns about formal milk donors and wondered how they are screened and selected. One mother worried about “who it’s coming from” (#5, would choose HDM). Another mother suggested that knowing the donor’s identity would help her to understand “how they took care of themselves, make sure they don’t do nothing bad, like drugs, or if their eating super unhealthy, ‘cus I heard that’s bad” (#20, would choose formula). While milk donor

TABLE 3. THEMES REGARDING SUPPLEMENT CHOICES

Overarching themes (<i>N</i> =24)	
Mothers felt uneasy about formal milk donor selection	"I feel like it's less safe if I don't know the people, I'd just be more comfortable with my own [milk] or [milk from] somebody I knew." (#23, chose)
Mothers were unsure of what can be passed through breast milk	"I don't know what all is passed through breast milk." (#16, chose HDM)
Prior infant feeding experiences influenced decision-making	"I had a really good experience with my son and he's now six, he's healthy. We formula fed and it was excellent." (#6, chose formula) "The difference between the two I've seen [with] my son [formula-fed] and my daughter [exclusively breastfed]. He gets sick more often, and when he gets sick it takes longer to get better. And with my daughter she barely gets sick and if she gets sick, it's like a day, then she's over with it. And who really knows what's in [formula] anyways." (#3, chose HDM)
Themes specific to mothers who favored HDM (<i>N</i> =14, 58%)	
Mothers who chose HDM felt that it is "natural"	"[HDM] would be a lot healthier for the baby, just more well-rounded... [it's] from the source and what I plan to do anyway" [to exclusively breastfeed]. (#10)
Some mothers who chose HDM felt suspicious of formula as "synthetic"	"I don't really like [formula], because I don't feel that anybody actually knows what a baby needs when they're actually born, enough to reproduce it, and I'm not really sure about what they're using in formula that I'm feeding to my baby." (#5)
Themes specific to mothers who favored formula (<i>N</i> =10, 42%)	
Mothers who chose formula did not know enough about HDM to choose it	"I just don't know very much about it." (#8) "It would just be more of a logistics issue, I'd probably prefer it if it was easy logistically... like something you could pick up at the store, or somewhere easily accessible as a store." (#19)
Many mothers who chose formula viewed it as a short-term solution to supply concerns	"[It's been] 2 days [that I've had] not too much milk... today I feel more than before. [I'm] breastfeeding now, but not too much so sometimes we'll give her some formula. So I still feed her [at the breast] first, then if it's not fine I give a little bit [of] the formula, cus she's crying a lot... yeah because she's crying a lot and she didn't sleep." (#14) "The milk [has] not come in yet, so I'm trying to let him suck and trying to have the milk come more faster but still not yet. I tried formula in between... just in case it's not enough, mother[s] milk." (#15)
Themes about informal milk sharing between friends or relatives and informal milk selling from online sources (<i>N</i> =24)	
Mothers mistrusted online milk sellers for many reasons	"[Milk from an online seller] definitely wouldn't be an option, I don't think I'd, no. People do crazy things on the Internet, I mean I wouldn't drink milk that isn't out of a store or that I didn't milk the cow myself, like I wouldn't buy milk for myself off Facebook, so I wouldn't wana buy milk for my baby off Facebook either." (#21, chose HDM)
Mothers had mixed attitudes about using a friend or relatives' milk	"From family I would [use donated milk], but no not from a friend... I don't like that really, I feel weird if I would give [my baby] somebody else's milk that wasn't mine, from me. I'd feel more comfortable [with family]." (#20, chose formula) "[Milk from a friend or relative] would be the type of donor milk I'd prefer. I guess helping your neighbor and your family is just, I'd rather get it from someone I know just like as a reassurance for myself, just like okay I know that person, I kinda know what they do, I know that they don't smoke... that kind of thing." (#21, chose HDM)

diet was mentioned by this mother, concerns about milk donors' substance use were most common.

Mothers were unsure of what can be passed through breast milk

Several mothers expressed concerns about the transmission of various substances through breast milk, including "drugs or alcohol," infections, and unspecified substances. Although most mothers assumed that the HDM offered by the hospital went through a screening process, a few felt mistrustful of this screening. One mother expressed fears "about what could be passed through breast milk, even with testing I just worry" (#24, would choose formula).

Prior infant feeding experiences influenced decision-making

When faced with the decision of which supplement to choose for their infant, many multiparous mothers relied on prior experiences to help make their decisions. For example, one mother who had fed her older children with infant formula described having to make the decision about supplementation quickly and that "I just kind of went to what I knew" (#18, chose formula). A few mothers projected extended health benefits, connecting the frequency of illness in older children with what they had been fed as infants; this informed their current feeding choice (#3, would choose HDM).

Themes Specific to Mothers Who Favored HDM

Of mothers who favored HDM ($n=14$; 58%), one was supplementing with HDM, while 13 said they would choose it, if medically indicated. Two themes emerged among mothers who favored HDM: HDM is "natural," and infant formula is "synthetic."

Mothers who chose HDM felt that it is "natural"

Most mothers who chose HDM reasoned that it is "the natural path" (#11, would choose HDM). One mother stated "your body knows what a baby needs to eat... It's better than infant formula I believe because it actually came from the body" (#5, would choose HDM). Another mother suggested that HDM banks are probably "cleaner than the factories where they make the formula" (#4, would choose HDM). Mothers perceived HDM as the closest choice to their own breast milk and believed that HDM would allow them to adhere more closely to their prenatal intention to exclusively breastfeed.

Some mothers who chose HDM felt suspicious of infant formula as "synthetic"

Another major rationale for choosing HDM was a perception of infant formula as synthetic with unknown, untrusted, or inadequate ingredients. Some mothers simply disliked the idea of infant formula "factories," lamenting that "you don't know what you're gonna get in those cans" (#4, would choose HDM). One commented that "[babies] should not get something that's, like, genetically modified or made in the lab" (#21, would choose HDM). A few mothers worried about infant formula ingredients, noting that "a lot of

them have high fructose corn syrup" (#13, would choose HDM).

Themes Specific to Mothers Who Favored Infant Formula

Of mothers who favored formula ($n=10$; 42%), five were supplementing with formula while the other five said they would choose it, if medically indicated. Themes from mothers who favored formula included the following: mothers had insufficient knowledge about HDM, and mothers felt that infant formula was a temporary solution to supply concerns.

Mothers who chose infant formula did not know enough about HDM to choose it

Almost all mothers who chose infant formula mentioned gaps in their knowledge about HDM. Some participants spoke nonspecifically, citing general lack of knowledge as a barrier. Others reiterated their lack of information on "how the donors were screened" (#1, would choose formula). Several mothers identified access to HDM as a specific barrier, describing worries about "how expensive it was" and assuming that they would "have to drive all over town" to acquire it (#8, would choose formula).

Many mothers who chose infant formula viewed it as a short-term solution to supply concerns

Most mothers who chose infant formula expressed a plan to breastfeed for at least 3 months and felt that infant formula supplementation would be temporary. Several described their concerns about "making enough" (#18, chose formula) milk as their reason for choosing or potentially choosing infant formula. One mother noted, "I'm still waiting for my milk to come in so I'm pumping and trying to breastfeed but we're having to supplement [with] infant formula" (#9, chose formula). A few mothers commented that their current milk supply left their infants hungry or fussy.

Themes About Informal Milk Selling from Online Sources and Informal Milk Sharing Between Friends and Relatives

All 24 mothers were asked for their perspectives on three types of non-hospital-based supplementation as follows: using shared milk from a friend, using shared milk from a family member, and purchasing human milk from an online seller. Emerging themes were that mothers mistrusted online milk sellers and that attitudes about using a friend or relatives' shared milk were mixed.

Mothers mistrusted online milk sellers

Regardless of which supplement they favored, participants were nearly unanimous in their mistrust of online milk sellers and sales websites and gave a wide variety of reasons for this mistrust. Many echoed themes shown above. Most worried about safety, exclaiming that "I wouldn't feel comfortable with that, I would be worried about safety, lack of regulation, you can't buy other kinds of human... blood online, you know?" (#8, would choose formula) Another remarked that it "just seems a little sketchy" (#16, would choose HDM). Mothers cited lack of credibility, not knowing "what's in it or

what it's made with [or] who it's coming from," (#20, would choose formula) a lack of "quality assurance," (#19, would choose formula) and "there being exposure to drugs or alcohol" (#17, would choose HDM). A few mothers worried about "a really high risk of it not being what they said it is" (#17, would choose HDM) and wondered if purchased milk could be diluted with cow's milk or other substitutes. One mother also specified that her mistrust in "the Internet" made her skeptical of online milk sellers (#21, would choose HDM).

Attitudes about using a friend or relatives' milk were mixed

Milk from friends and milk from family were examined as a single type of non-hospital milk source. While the majority of mothers said that in general they would feel comfortable supplementing their infant's diet with breast milk from someone they knew (67%, $n=16$), others were strongly opposed (21%, $n=5$) or uncertain (12%, $n=3$). Sentiments on this topic did not follow sociodemographics or supplement choices. One mother who felt comfortable with this type of informal milk sharing described the naturalness of using milk from both friends and family, with the example that "in foreign countries, if the mom died at birth... and there was somebody in their tribe... who was already breastfeeding... they'd just jump in and take care, and I think that's beautiful" (#3, would choose HDM). Many mothers also felt comfortable because, unlike supplementation with pasteurized HDM, using a friend or relative's milk would mean "know[ing] a little more about who you're getting it from" (#24, would choose formula).

Still, several mothers disclosed significant discomfort with the idea of using a friend or relative's breast milk, using words like "weird" and "awkward." These mothers felt that knowing the milk provider personally would make them more mistrustful of the shared milk, because "I don't know exactly their medical background and [they haven't] been screened" (#16, would choose HDM). A couple of mothers expressed that they would feel comfortable using a family member's milk, but not a friend's milk. One mother explained that unlike milk from a friend, feeding her son with a family member's milk would be more similar to feeding him her own milk (#20, would choose formula).

Discussion

This is one of few studies to examine maternal perspectives on supplementation options for term infants and the first to include mothers who were not already supplementing or engaged in milk sharing or milk commerce. Our findings from this study in Portland, OR are complementary to those from a qualitative study of postpartum breastfeeding mothers in Iowa City, IA, suggesting that maternal perceptions about HDM and infant formula are similar in geographically and socioculturally disparate areas in the United States.²⁰ We found that mothers who favored HDM as a supplement were encouraged by its "naturalness" and deterred by the "synthetic" properties of infant formula. Many of these mothers felt that supplementing with HDM was better aligned with their prenatal intention to breastfeed. Those who favored infant formula viewed supplementation as short term and did not feel that they had enough information about HDM

to choose this option. Regardless of supplement choice, most mothers were unsure about formal donor selection, HDM processing, and the potential for disease or substance transmission.

Several studies have examined milk providers' motivations for sharing their own milk,^{16,19} as well as mothers' perspectives on receiving shared milk from friends, family, or online sources.^{28,29} Our results regarding milk sharing from friends and family duplicate many of these previous findings; some of our participants felt positively about receiving informally shared milk from family or friends, while others felt it would be "awkward" or "weird." Overall, concerns about informal milk sharing were very similar to those regarding HDM (e.g., donor selection, screening, and transmission of substances). Our study is unique in that most mothers had not heard of milk sharing previously, increasing the generalizability of prior findings. To our knowledge, no studies have surveyed a mixed group of mothers both involved and not already involved in supplementation of some type.

By contrast, nearly all mothers in our study expressed an immediate strong aversion to purchasing breast milk from online milk sellers. Their discomfort is warranted; in one study, 90% of "breast milk" purchased from online milk sellers arrived above the recommended safe frozen temperature, and other studies have found both cow's milk and bacterial contaminants in samples purchased online.¹⁶ Further study to understand the perspectives of families who do purchase milk sold online may be helpful in modulating this risk and informing counseling regarding this practice.

Women receiving sufficient support from their providers, health systems, communities, employers, and governments have an increased chance of successfully breastfeeding.^{1,3,6} Providing evidence-based and timely education to mothers and families regarding short-term newborn supplementation may also be important for the promotion of breastfeeding.^{1,6} Research is needed to compare breastfeeding success, short- and long-term health outcomes, and cost between term infants supplemented with infant formula and those supplemented with HDM. Still, infant formula has been strongly associated with increased risks for developing acute infections, as well as lifelong chronic diseases.^{1-3,9} As such, promoting acceptance of HDM over infant formula for term infants requiring supplementation may be a logical strategy for supporting long-term breastfeeding and infant health.

Given that HDM is a limited resource, its use for term newborns must be weighed with regional availability so as not to cause a shortage for premature and critically ill newborns.²⁰ Weighing this consideration with the potential benefits of HDM will be an important consideration for hospital policy as milk bank prevalence continues to increase internationally.^{3,28} Greater availability of HDM could also influence providers' acceptance of HDM, impacting supplementation decisions made by patients. This warrants additional research on the role of provider perspectives and patient counseling on supplementation decisions.

Our results suggest a variety of parental perspectives and values on which to focus when describing supplementation options to parents in practice or when designing public health campaigns toward this effort. Additional research is needed to test whether counseling focused on the perspectives and values that we have identified improves parental acceptance of HDM.

Questions about the societal structural factors impacting mothers' supplementation choices remain. Health disparities exist in rates of breastfeeding initiation and duration worldwide.³ For instance, U.S. breastfeeding rates are significantly lower for mothers of color and those using public health insurance (a commonly used indicator of lower socioeconomic status [SES] in the United States³¹), than for white mothers and mothers with higher SES.^{8,21} While our study was not designed or powered to quantitatively compare mothers' choices between sociodemographic groups, within our small sample we found that mothers with public health insurance more often chose infant formula over HDM. If there are health benefits associated with supplementing with HDM instead of infant formula, this choice could further perpetuate existing health disparities for publicly insured low-SES families. Our study is the first to suggest that maternal perspectives on supplementation and maternal insurance type may be related. More research is needed with the goal of reducing health disparities by further distinguishing the societal and personal factors that influence mothers' perspectives on newborn supplementation.

Limitations

Although we attempted to enroll mothers with diverse perspectives, all mothers delivered at a single institution in a part of the United States with high breastfeeding rates and strong social promotion of breastfeeding, and therefore, results may not be generalizable to other settings. Partners and family members were not interviewed, although their perspectives may also influence decision-making. In addition, the presence of a community milk bank and the availability of free HDM in the inpatient setting limit the ability to generalize findings to settings with other resources. While online, no-cost milk sharing is a widespread phenomenon, it was not considered in this study and maternal attitudes around purchasing milk online and sharing milk between friends or relatives cannot be applied to online, no-cost milk sharing. Despite efforts to ground analysis in the data and follow a reflexive process, the research team's experiences, assumptions, and theoretical orientations are impossible to remove from our qualitative analysis.

Conclusion

Mothers in our study had limited understanding of HDM, despite high breastfeeding rates in the community and the presence of a local milk bank. Mothers were concerned about formal milk donor selection and about the potential for disease or substance transmission through human milk. These findings highlight the opportunity for improved prenatal and postpartum education regarding feeding options. Socio-demographic factors such as insurance type may influence maternal decision-making. Further research is needed to better understand the impact of newborn supplementation and to clarify the optimal supplement choice.

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