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EDITORIAL

Global neonatal care and access to human milk*

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Optimal nutrition in the first one-thousand days of life (conception to age two) is critical to long-term health and development. A crucial component of global neonatal care is access to human milk. This requires skilled lactation support for the breastfeeding dyad and the existence of human milk banks that can provide safe donor human milk to medically vulnerable populations like the low birth weight infant when their mother's milk is not available or is insufficient. The recent study, "Trends of Services Provided by Human Milk Banks Between 2010 and 2019 in Brazil," by Carrijo et al. reports impressive growth in lactation support (49% increase in group support and 62% increase in individual support) in the last decade, provided through Brazil's Network of Human Milk Banks (rBLH).[1] In addition, they report a 52% increase in the number of Brazilian milk banks and milk collection stations. These trends in Brazil are encouraging given the importance of breastfeeding support and access to donor human milk during the perinatal period.

Growth and models of human milk banking globally

Similar to the growth reported by Carrijo et al., there is evidence of substantial milk banking growth in other geographies. With the support of the Brazilian government, Guatemala opened eight milk banks between 2008 and 2017.[2] China opened its first 14 milk banks between 2013 and 2016, and the volume of donated milk increased more than 10-fold during this period (230L to 2740L).[3] Since 2016, Iran has opened 11 milk banks (personal communication with K. Mansen). The Human Milk Banking Association of North America (HMBANA) reported an almost 400% increase in the volume of donor human milk dispensed between 2010 and 2019,[4] and the number of milk banks increased from approximately ten to thirty. In addition, the first milk banks have opened in many countries including Vietnam, Kenya, Uganda, and Croatia, providing important capacity in low- and middle-income settings to improve infant nutrition.[5,6]

Currently, it is estimated that there are over 700 milk banks operating in 66 countries and providing donor human milk to over 800,000 infants each year, with Brazil operating the largest network of over 200 milk banks.[7] With an estimated 15 million preterm births globally each year and the importance of human milk for infant survival, there is a need to scale up milk banking with a focus on low- and middle-income settings.[8] Brazil's combined model of lactation support within human milk banking systems and infrastructure inspired the development of the *Mother-Baby Friendly Hospital Initiative Plus (MBFI+)* framework,[9] which envisions that milk banks are integrated into the maternity care system and play a critical role in breastfeeding support. This model can be described as being "process-focused" as it seeks to optimize the process of feeding human milk – through maternal breastfeeding support and the production of safe donor human milk. When MBFI+ was adopted by a hospital in India, the rate of exclusive human milk feedings increased from 60.5% to 80.7% among very low birth weight

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infants,[10] highlighting the effectiveness of an integrated, process-focused milk banking model. In contrast, milk banking in the US/Canada has evolved over time to serve a more "product-focused" model because many banks operate outside of the healthcare system, are regulated as food manufacturers, and primarily focus on the production of donor human milk. While there are currently no official global guidelines on donor milk banking, the recent report by Carrijo et al. provides additional insights into the impact of an integrated, process-focused milk banking model.

Breastfeeding support within donor milk banks

Support is critical to improving the rates and duration of breastfeeding. In a large randomized trial of breastfeeding support through the implementation of the Baby Friendly Hospital Initiative (BFHI), significantly more mothers giving birth in BFHI hospitals were exclusively breastfeeding at 3-months postpartum compared to those giving birth in non-BFHI hospitals (43.3% vs 6.7%; $P < 0.001$).[11] Continued support beyond the maternity hospital, which carries out step 10 of the BFHI, is also associated with improved breastfeeding duration, with the biggest impact in the first weeks postpartum.[12] Large networks of milk banks that have facilities in the community near maternity hospitals have the potential to reach many mothers during the critical postpartum period. Carrijo et al. reported that there were over 2.3 million lactation support visits (group and individual) provided by rBHL in 2019. Given the 2.8 million births in Brazil in 2019,[13] the ratio of lactation support visits through rBHL to annual births is approximately 0.82. This illustrates the profound reach that a milk banking model integrated within the maternity care system can have beyond the production of donor human milk and suggests strong synergies of embedding breastfeeding support services within a local network of human milk banks. A more centralized model of milk banking, with fewer local milk banks, may not have as large of a reach in providing breastfeeding support.

Production of donor human milk

In 2021, the 225 milk banks in the rBHL network distributed almost 170,000 L of donor human milk.[14] This translates to approximately 750 L per milk bank and 60 mL per infant born in Brazil. The 31 milk banks in the HMBANA network distributed approximately 270,000 L of donor human milk,[4] which translates to 8800 L per milk bank, and 70 mL per infant born in the US and Canada. Both models produced similar volumes of donor human milk on a per-infant basis, with a 10-fold difference in the average production volume on a per-bank basis. While there is limited information on the cost of producing donor human milk, several factors may be influenced by the scale of production including cost, access, product standards, and the capacity to provide additional services. Recent studies suggest that donor human milk may be highly variable in some micronutrients including vitamin C and sodium,[15,16] and well below current nutrient recommendations, suggesting that product standards for donor human milk may improve nutritional support. In terms of access, rBHL reports that almost 240,000 infants received donor human milk in 2021.[14] Recipient data is not readily available from HMBANA, highlighting a current challenge within many milk banking networks – the limited availability of centralized data for tracking and monitoring.[17]

Improving knowledge using integrated data management systems

The 10-year trends in rBHL services reported by Carrijo et al. is an example of the important knowledge that can be gleaned from having an integrated data management system within a milk banking network. Expanding this digital linkage globally could further strengthen the knowledge base around milk banking and the use of donor human milk. Examples of topics that could be explored with a robust and integrated data management system include:

- *Information on milk bank donors.* A recent scoping review on global milk bank donors identified limited information on donors' breastfeeding history, lactation support, and milk expression practices, along with limited information regarding barriers to donation.[18] Understanding what enables individuals to become milk bank donors can help to inform the expansion of human milk banks.
- *Information on donor human milk production.* Production of donor human milk requires important safety considerations at multiple steps in the process including donor screening, cold storage, time and temperature adherence during pasteurization, microbial screening, transportation, and more. An integrated data monitoring system would provide greater insights into opportunities for improving these processes.
- *Information on the composition of donor human milk.* There are major knowledge gaps in the nutritional composition of donor human milk, especially as it relates to micronutrients.[19] Given that donor human milk is provided to some of the most nutritionally vulnerable infants, robust data on the composition of donor human milk, including microbiological screening, could inform the development of standards which has the potential to improve the safety and effectiveness of donor human milk.
- *Information on the recipients of donor human milk and their health outcomes.* Donor human milk is recommended for the preterm infant due to evidence of reduced rates of necrotizing enterocolitis, but its use in other populations is also growing.[20] Systems that monitor donor human milk recipients, their feeding history, and associated health outcomes would inform guidance around equitable access and use of donor human milk.
- *Information on the supply and demand of donor human milk.* An integrated data management system would allow milk banking networks to monitor supply and demand and quickly respond to changes in specific geographies (e.g. natural disasters), similar to the monitoring and movement of other critical donations such as blood.

While human milk banking continues to grow around the world, technical, operational, and strategic areas deserve closer attention. The rBHL has made an important

contribution to infant nutrition through the development of a milk banking system that is integrated within the healthcare system and plays an important role in breastfeeding support. The report by Carrijo et al. enabled by the investment in a data management system provides evidence of the scale of lactation support that can be provided in this model. When a similar model was replicated in other settings, human milk feedings increased significantly, supporting the ultimate goal of donor human milk banking. More research is needed into milk banking model differences in cost, access, and nutritional quality of donor human milk which will further inform the development of global guidelines.

Conflicts of interest

MTP is currently being funded for research on donor human milk composition by the National Institute of Child Health and Development. KIB and KLM are currently being funded for human milk banking and newborn nutrition-related work by Bill and Melinda Gates Foundation, the National Institute of Child Health and Development, Philips Foundation, and the United States Agency for International Development. BGS has no conflicts to report.

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