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Waste not, want not:
Donor human milk discard in infants is related to container size

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Breast milk banking is the practice of collecting and storing donated human breast milk that is later consumed by unrelated infants commonly in a NICU setting. The European Society for Paediatric Gastroenterology Hepatology and Nutrition, the American Academy of Paediatrics and the World Health Organization have all recommended Donor Human Milk (DHM) as the gold-standard replacement for neonates if Mother's Own Milk (MOM) is unavailable (1). In line with this, DHM use has become widely accepted in NICUs across the world and infant feeding with DHM has been shown to be of significant benefit to premature or very low birth weight (VLBW) infants (2). When compared to preterm or term formula, MOM and DHM have been proven to decrease rates of sepsis, lengths of stay in hospital, the incidence of bronchopulmonary dysplasia, long-term hospital costs and, most notably, decrease the incidence of necrotizing enterocolitis in neonates (3).

DHM remains a relatively expensive nutritional option due to donor screening, milk collection, pasteurization, handling and storage processes necessary to create a safe product (4). In the UK, the cost of 1L of DHM has been estimated at €140.00-170.00, far exceeding the price of preterm formula by a factor of ten. Although guidelines for safe usage vary between networks, the milk must generally be stored at –20ºC until use, can only be thawed once, and the remaining excess must be stored at 4ºC and used within 24 hours. However, most hospital policies stipulate that DHM container can only be used to feed a single infant and cannot be shared. Since DHM is an expensive and limited commodity, the policies and procedures surrounding its distribution, storage and dispensing should be optimized so that this resource is not squandered.

DHM is frozen in a variety of different bottle sizes typically ranging between 30-100ml containers, depending on which human milk bank is accessed. It may seem logical that larger bottles incur greater wastage; however, this has yet to be formally documented. The present study aimed to address this knowledge gap in order to optimize the utilization of available DHM resources.

In this NICU-based retrospective cohort study, DHM bottles of 100ml were ordered from a human milk bank in Northern Ireland during the period of September 2017-April 2018, while DHM 50ml bottles were ordered from a human milk bank in mainland UK during the period of May 2018-October 2018. All infants receiving DEMB during the study period were included.

Candidates were first identified by name in the DHM logbook, a record containing the patient Medical Record Number, gender, birthdate, the time and date of DHM removal, and the batch number. Collected data was then reconciled with patient information in electronic medical records which specified how much DHM was fed to each neonate per day. The amount of DHM discarded per single feeding encounter was calculated by subtracting the daily intake from the recorded amount

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withdrawn. The average amount of DHM discarded per neonate during NICU admission was also calculated. A simple cost-effectiveness calculation was performed considering the waste per neonate over admission and respective unit pricings of 50ml (€7.16/unit; €143.28/L) and 100ml (€15.21/unit; €152.06/L) formulations. Data was analyzed by t-test, with $p < 0.05$ being considered statistically significant.

During the period of September 2017-October 2018, 58 neonates were monitored for DHM discard. In all, 39 neonates were fed DHM from 354x100ml containers, while 19 neonates received DHM from a total of 280x50ml containers. Females represented 59% and 63% of those receiving the 100ml and 50ml formulations, respectively. The mean number of 100ml and 50ml bottles signed out per neonate admission was 9.1 (range 1-37) and 14.8 (range 1-34) bottles, respectively. Five-fold more DHM was discarded per neonate-bottle encounter with 100ml bottles (47.7 ± 25.6ml) when compared to the 50ml formulation (9.3 ± 10.2ml; $p < 0.001$). In turn, significantly more DHM was discarded per patient admission in neonates receiving the 100ml formulation (364 ± 366.8ml) compared to the 50ml formulation (84.8 ± 84.7ml; $p < 0.01$; Figure 1). Cost-effectiveness analysis revealed a mean wastage of €55.36 and €12.15 per admitted neonate with 100ml and 50ml formulations, respectively (Figure 1).

Intelligent resource-use and cost-effective medicine is paramount to the delivery of equitable high-quality care. This is particularly pertinent in the absence of a human milk bank in the Republic of Ireland and our reliance on the generosity of our UK counterparts, who themselves occasionally experience stock shortages. In order to decrease wastage of this valuable and limited resource, it appears prudent for human milk banks and NICUs to use smaller container sizes. Indeed, an informal telephone survey conducted in February 2020 has revealed that, coincidentally to our findings, all but one UK-based human milk bank has moved to using 50ml or 30ml containers in order to avoid the wastage incurred with larger containers, which are available upon request only. Our findings should encourage the 226 human milk banks which are currently based in Europe to follow suit and adopt such practices, if they have not yet done so (5). Although not acceptable in some jurisdictions, implementation of policies which allows traced sharing of DHM bottles between a limited number of infants may also mitigate wastage of this resource.

In this cohort of 58 VLBW infants, we noted substantially less DHM discard when 50ml bottles were used as compared to 100ml bottles. These results suggest NICU and European human milk bank managers should consider ordering smaller bottles of DHM in order to ensure efficient and cost-effective use of this limited-availability product in premature and VLBW infants.

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Conflict of interest

The authors have no duality of interest to declare.

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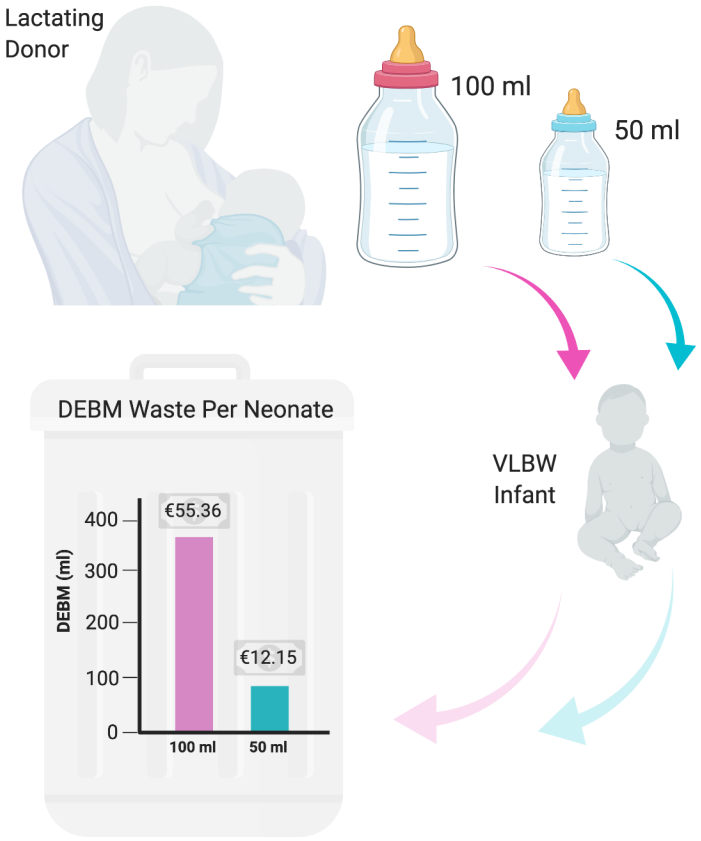
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Figure 1 | Discard and Cost Disparities Between 50ml and 100ml DHM Formulations. The use of 100 ml bottles led to far greater waste of DHM than did the use of 50 ml bottles, thereby resulting in substantially poorer cost-effectiveness. DHM, donor human milk; VLBW, very low birth weight. Figure created with Biorender.com.

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