British Association of Perinatal Medicine

The Use of Donor Human Milk in Neonates

A BAPM Framework for Practice

April 2023

Contents

Executive Summary

This revised BAPM Framework for Practice provides guidance on the use of donor human milk (DHM) for neonates in the UK. It takes into account:

- The existing evidence for DHM use.
- The ongoing uncertainties around DHM use, and need for further research.
- The growing demand for DHM.
- The acceptability of DHM to parents and healthcare professional.

The Framework makes a number of recommendations relating to DHM and human milk banking.

1. Recommendations for donor human milk use

a. DHM may be considered in babies born at <32 weeks gestation and/or <1500 grams to establish enteral feeding when mother's own milk (MOM) is unavailable or insufficient to meet their baby's requirements.
b. Parents must provide informed consent for the use of DHM, and as part of the consent process they should be counselled regarding the differences between both DHM and infant formula when compared to MOM, including benefits, risks and ongoing uncertainties.
c. DHM use must be supported by adequate lactation support and appropriate staff training.
d. There is insufficient evidence to make specific recommendations about duration of DHM use, fortification of DHM and use of DHM in moderate/late preterm and term babies.
e. Neonatal units and networks must work collaboratively to produce guidelines that ensure DHM use is consistent.

2. Recommendations to support the UK milk banking infrastructure

a. A national dashboard of DHM use should be established to enable human milk banks (HMB) to understand current and future demand for milk, and to identify potential gaps in supply.
b. A standardised approach to costing DHM should be established to allow transparency and understanding of cost effectiveness/funding requirements.
c. A national risk register should be agreed. Each HMB should have a local risk register which feeds into the national register.
d. A short life working group should be convened, including key stakeholders to critically review and future proof UK milk banking infrastructure.

3. Recommendations for the regulation/legislation of donor human milk/human milk banking

a. DHM should be viewed as a substance of human origin (SoHO) as per the forthcoming European Union recommendation, and should be legislated accordingly.
b. Within the SoHO legislation DHM should have a specific regulatory basis which recognises its own unique status.
c. All HMB should be enabled to provide annual NICE CG93 compliance data, and be audited within a regulatory framework which is fit for purpose and unambiguous.
d. The existing NICE guideline requires updating at the earliest opportunity.

4. Recommendations for the regulation/legislation of commercial for-profit human milk companies and their products

a. Commercial for-profit UK human milk companies should, at a minimum adhere to the same regulatory/legislative standards as not for-profit HMB.
b. Regulation is required to ensure *modified* human milk derived products meet strict safety standards and the optimal nutritional composition for intended use.
c. For-profit human milk companies must provide accredited lactation care/advice for all milk providers.
d. All claims made by for-profit human milk companies regarding their products must be transparent and evidence based.
e. Ongoing research is required to fully evaluate the clinical effectiveness of human milk derived products in preterm nutrition.

Members of the Working Group

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– see Appendix 1 for full bios including conflicts of interest.

Introduction

This revised BAPM Framework provides a position statement on the use of donor human milk (DHM) for neonates in the UK. It advocates for consistency of practice across neonatal units and networks, and also for equity of access to DHM across the four devolved nations. It aligns with the Neonatology Getting It Right First Time (GIRFT) Report recommendation that in the absence of sufficient mother's own milk (MOM) there should be ***"improved network guidance to support equal access to donor breastmilk across the region for the most high-risk infants"***[1].

The Framework is underpinned by the principle that MOM feeding is optimal for preterm and/or unwell neonates, and acknowledges that DHM is fundamentally different to MOM. The unique mother-baby dyad associated with MOM is lost with DHM, which also undergoes multiple processes e.g. freezing, transportation and pasteurisation prior to being fed. This processing has an impact on the biochemical, immunological and nutritional composition of DHM when compared to fresh and frozen MOM. Parents should always be counselled of the differences between MOM and DHM, highlighting that optimal outcomes are based on MOM, and that DHM is a bridge to achieving this. A detailed description of the compositional differences between MOM and DHM is presented in *Appendix 2* and an example of the information that should be shared with parents is given in *Appendix 3.*

The Framework acknowledges that there is a growing demand for DHM, with a high level of public and healthcare professional acceptability[2], but recognises that this demand must be balanced against the ongoing uncertainties around DHM, which will only be resolved by further well designed and collaborative research.

The Framework addresses the increasing commercialisation of human milk, and makes recommendations for the regulation/legislation of human milk banks (HMB) and for-profit human milk companies.

Who is this document for?

The Framework relates primarily to DHM use in hospital environments rather than use in the community. Its recommendations are therefore applicable to:

- All healthcare professionals who look after babies in neonatal units, transitional care, postnatal and paediatric wards.
- Families of babies cared for in these environments.
- Commissioners and providers of neonatal and allied services.

Terminology

Throughout this document, we use the term *parent* to mean all parents, carers and legal guardians, and the term *mother* to mean all women and people who have given birth. *Donor human milk* refers to milk obtained from a HMB operating to accepted UK standards.

Clinical indications and evidence for donor human milk

The main clinical indications for DHM use are:

1. To establish enteral feeding in babies at increased risk of necrotising enterocolitis (NEC) when MOM milk is unavailable or insufficient.
2. To support the establishment of lactation in conjunction with breastfeeding support, avoiding the need for supplementation with infant formula (IF).

There is substantial global experience of using DHM, especially in the preterm population. Historically it was often used as the sole alternative to IF in the absence of MOM, but more recent practice is to use it to supplement MOM until lactation is established. This concept of DHM providing a "bridge" to lactation reinforces a narrative that breast milk feeding is highly valued and has been associated with an extension of DHM use within neonatal units, onto postnatal wards and into the wider community.

It must be acknowledged that high quality evidence of benefit from DHM is limited, although a consistent finding when compared to IF is that DHM reduces the incidence of preterm NEC. This is most evident when data are meta-analysed or systematically reviewed[3, 4]. No evidence of benefit from the use of DHM on any other preterm morbidities, longer term outcomes or mortality has been convincingly described, but neither does the use of DHM appear to be linked with poorer mid- and longer-term outcomes – see *Appendix 4* for a more comprehensive overview of the available literature.

A significant concern regarding the use of DHM is whether it is nutritionally adequate to meet the needs of a premature neonate, in particular to achieve optimal nutrient acquisition during the critical period of brain growth and development between birth and 34 weeks postmenstrual age. Early studies of unfortified DHM demonstrated a negative effect on weight gain, linear and head growth compared to IF, more recent work has suggested that fortified DHM may achieve better growth but IF, especially preterm formula (PTF) does appear to confer early growth advantage[4, 5].

Two North American trials have reported neurodevelopment as their primary outcome [5, 6]. O'Connor et al, 2016 compared the effect of fortified DHM versus PTF as a supplement to MOM on neurodevelopmental outcome at 18 months corrected gestational age (CGA) in 363 very low birth weight neonates[6]. Overall there were no statistically significant differences between groups, however all scores were noted to be lower in the DHM group. The Milk trial, studied 483 extremely low birth weight neonates recruited from 14 US centres[5], and their results were presented at the European Academy of Pediatrics meeting (Barcelona, October 2022). There were no statistically significant differences in the primary outcome (Bayley Scales of Infant Development (BSID) Cognitive Composite Score at 2 years CGA) or any adjusted categorical BSID outcomes. Those receiving fortified DHM had a significantly greater loss of weight Z-scores compared to PTF fed babies (i.e. weight gain was slower), but DHM fed babies had a lower rate of confirmed NEC (4.2% versus 9.0%). These results can be viewed online on the *ClinicalTrials.gov* website https://www.clinicaltrials.gov/ct2/show/results/NCT01534481?term=donor+milk&draw=2&rank=4

The potential NEC preventative properties of DHM in the preterm population have been extrapolated to a number of other clinical scenarios associated with an increased risk of NEC in more mature babies. These include certain bowel pathologies e.g. gastroschisis[7, 8], some congenital heart anomalies[9, 10] and the use of therapeutic hypothermia following hypoxic ischaemic injury. This is a disparate group, with a variety of pathological processes underlying their NEC, and for whom there is very little evidence beyond clinical experience.

In terms of effect on maternal lactation, supplementation with DHM has been associated with later increased volumes of expressed MOM and an increase in any breastfeeding at discharge[11-13]. However, it has also been described that introducing DHM with insufficient lactation support can decrease the volume of MOM available to preterm babies during their neonatal admission[14, 15] without necessarily negatively affecting the proportion exclusively fed with breast milk at discharge[15].

In more mature babies higher exclusive breastfeeding rates at discharge have been described but data of any sustained effects on breast milk feeding are lacking[16].

International recommendations for donor human milk use

Internationally the use of DHM in preference to IF is widely endorsed by professional bodies including the World Health Organisation (WHO), the American Academy of Pediatrics (https://www.aap.org/) and the European Society of Pediatric Gastroenterology Hepatology and Nutrition (http://www.espghan.org/).

The WHO recently updated their evidence based recommendations for the care of preterm or low birth weight infants (https://reliefweb.int/report/world/who-recommendations-care-preterm-or-low-birth-weight-infant). These recommendations are developed using standardised WHO methodology involving an evidence synthesis team and an expert guideline development group. The recommendations are graded as: ***strong*** meaning they are generally applicable to all preterm or low birth weight infants or ***conditional*** meaning that the intervention is recommended under certain conditions.

Their recommendation for DHM is that "***When mother's own milk is not available, donor human milk may be considered for feeding of preterm or low-birth-weight infants, including very preterm (< 32 weeks' gestation) or very low birth weight (< 1500 gram) infants***". This is based on moderate-certainty evidence and is conditional on shared decision making with parents, who must be made aware of the benefits, risks and need for further research. The WHO guideline development group concluded that on balance the potential harm of NEC from IF was more clinically important than the benefit of increased growth.

Ongoing uncertainties around donor human milk and need for further research

It is clear that there is a growing acceptance of and international endorsement for the use of DHM, despite a number of uncertainties. It is important to acknowledge these evidence gaps which include but are not limited to:

- The short and longer term health benefits for recipients.
- The role of DHM in supporting the establishment of lactation and on subsequent breast feeding rates.
- The impact on maternal health and wellbeing.
- The physical, psychological and emotional effects for donors.
- The societal/public health impact of DHM.
- Cost-effectiveness of DHM, including the optimal configuration of HMB.
- Operational issues around milk handling and processing e.g. pasteurisation techniques and their impact on the nutritional/immunological composition of milk.

Further research is required to understand the impact of DHM in contemporary neonatal care, and examples of potential research questions are described in *Appendix 5*. However it is important to recognise that the introduction of DHM may be best considered as a complex intervention, meaning that it can influence a wider range of outcomes than those captured by traditional randomised controlled trial methodology – see Figure 1 below. Full evaluation of the introduction of DHM should therefore also include trials utilising complex intervention methodology and consideration of broader more complex questions/outcomes[17].

Figure 1. Evaluating donor human milk as a complex medical intervention

Context

DHM for high risk babies
- NICU outcomes
- Parent preferences
- Lack of universal access
- Populations – preterm, LMPT, LBW, 'surgical/cardiac' etc.
- Increasing demand for DHM

Parents/mothers
- Delay in establishing lactation
- Medical reasons (lack of MOM)
- Beliefs & behaviours including religion
- Concerns/anxieties

Healthcare professionals
- Uncertainty of optimal DHM role
- Beliefs & behaviours
- Costs & charges
- Variation in practice

NHS & wider society
- Attitudes to breastfeeding
- Commercialisation of human milk products
- Regulation of donor & commercial human milk sectors

Processes

Practice in NICU
- Guidelines, audit & quality improvement
- Storage, labelling, checking
- Fortification
- Optimal duration

Hospitals & networks
- Logistics
- Consistency of approach
- Networks & hubs

NHS & human milk banks
- HMB operation & NICE
- Support for donating mothers
- Configuration & integration of HMB
- NHS & charitable sector cooperation

Research
- Trial design & methods
- Prioritisation & questions
- Ethics & feasibility
- PPI – parents & society
- Clinical need for strengthening of evidence base

Outputs

Babies
- Greater intake of MOM
- Better feed tolerance
- Reduced PN use

Parents
- Awareness of breastmilk benefits
- Consistency of feeding approach
- Integration - FICare & KMC
- Satisfaction & empowerment

Healthcare professionals
- Education & training
- Information guides
- Practice guidelines
- Research

NHS
- Costs & charges – PN, length of stay, diseases
- Costs: equity, transparency, national targets, NNAP

Outcomes

Babies
- Less disease (NEC, BPD etc.)
- Growth & weight gain
- Length of stay/lower costs
- Long-term cognitive & metabolic

Mothers
- Improved physical health
- Improved chance of breast feeding
- Mental health/cancers
- Wellbeing

NHS & healthcare professionals
- Knowledge, skills & awareness
- Satisfaction & confidence
- Attitudes & behaviours
- Cost efficiency
- Practice & policy

Human milk banks
- Efficiency & safety
- Training & professionalisation
- Cost-effectiveness
- New methods of processing
- Novel products

LMPT = late & moderately preterm, LBW = low birth weight, DHM = donor human milk, MOM = mother's own milk, HMB = human milk bank, NICE = National Institute for Health and Care Excellence, PPI = patient public involvement, FICare = family integrated care, KMC = kangaroo mother care, NEC = necrotising enterocolitis, BPD = bronchopulmonary dysplasia, PN = parenteral nutrition, NNAP = national neonatal audit programme

What do we learn from recipient families and staff?

Given the complexity of DHM as an intervention, and the potential for it to impact on a number of outcomes (see Figure 1 above), the opinions of recipient families and the wider multidisciplinary team are very important. The following link and quotes provide examples of their perspectives on the benefits of DHM (Figures 2 & 3).

The link is to the section of the European Milk Banking Association (EMBA) website dedicated to the celebration of World Day of Human Milk Donation 2021. The stories as related by families from across Europe highlight the diversity of use of DHM although, as in the UK, the vast majority of DHM is provided to neonatal units and fed to preterm babies.

Every donation tells a story – and every story brings a glimmer of hope – Europe | EMBA

Figure 2. Examples of quotes from parents of donor milk recipients

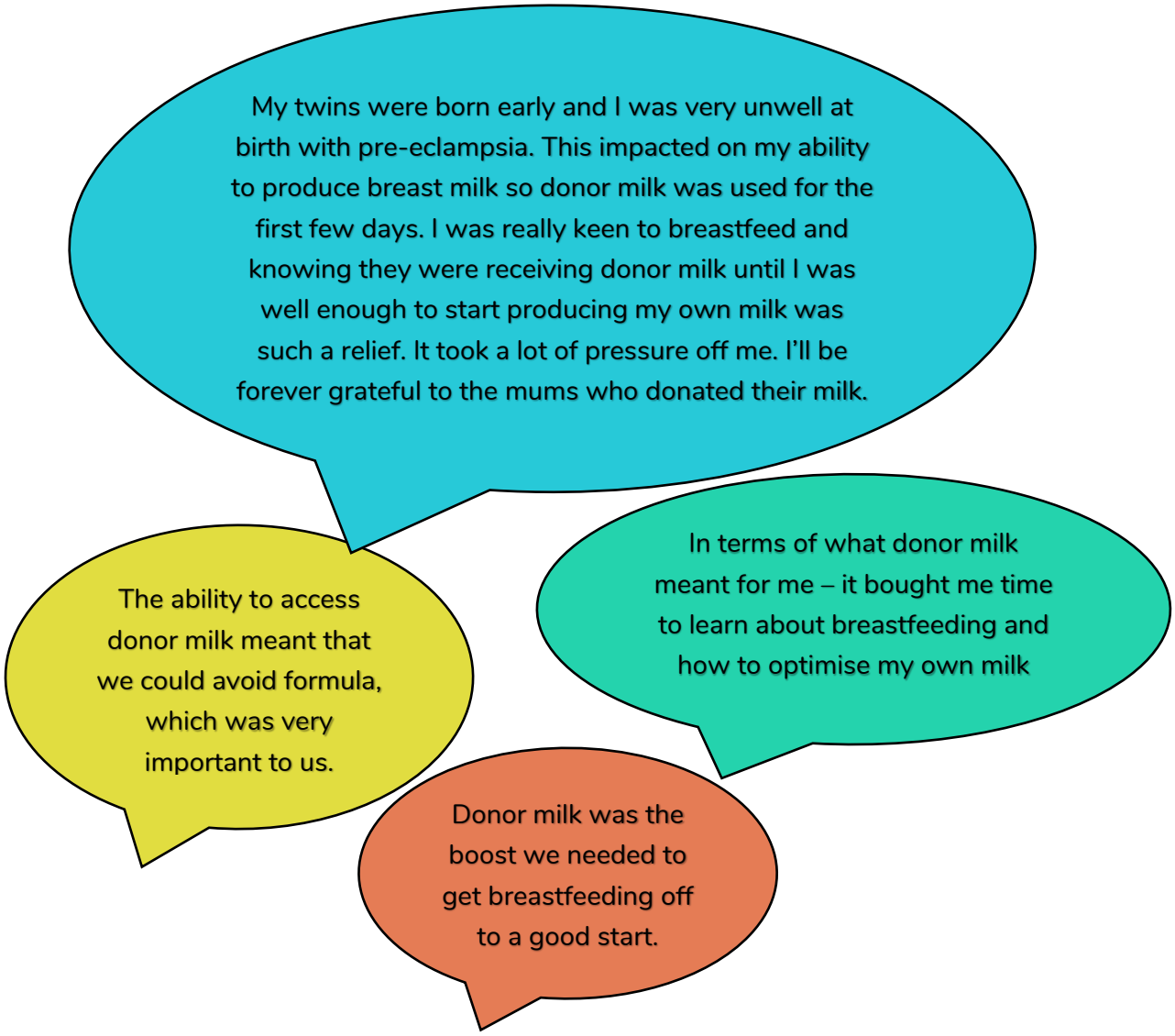
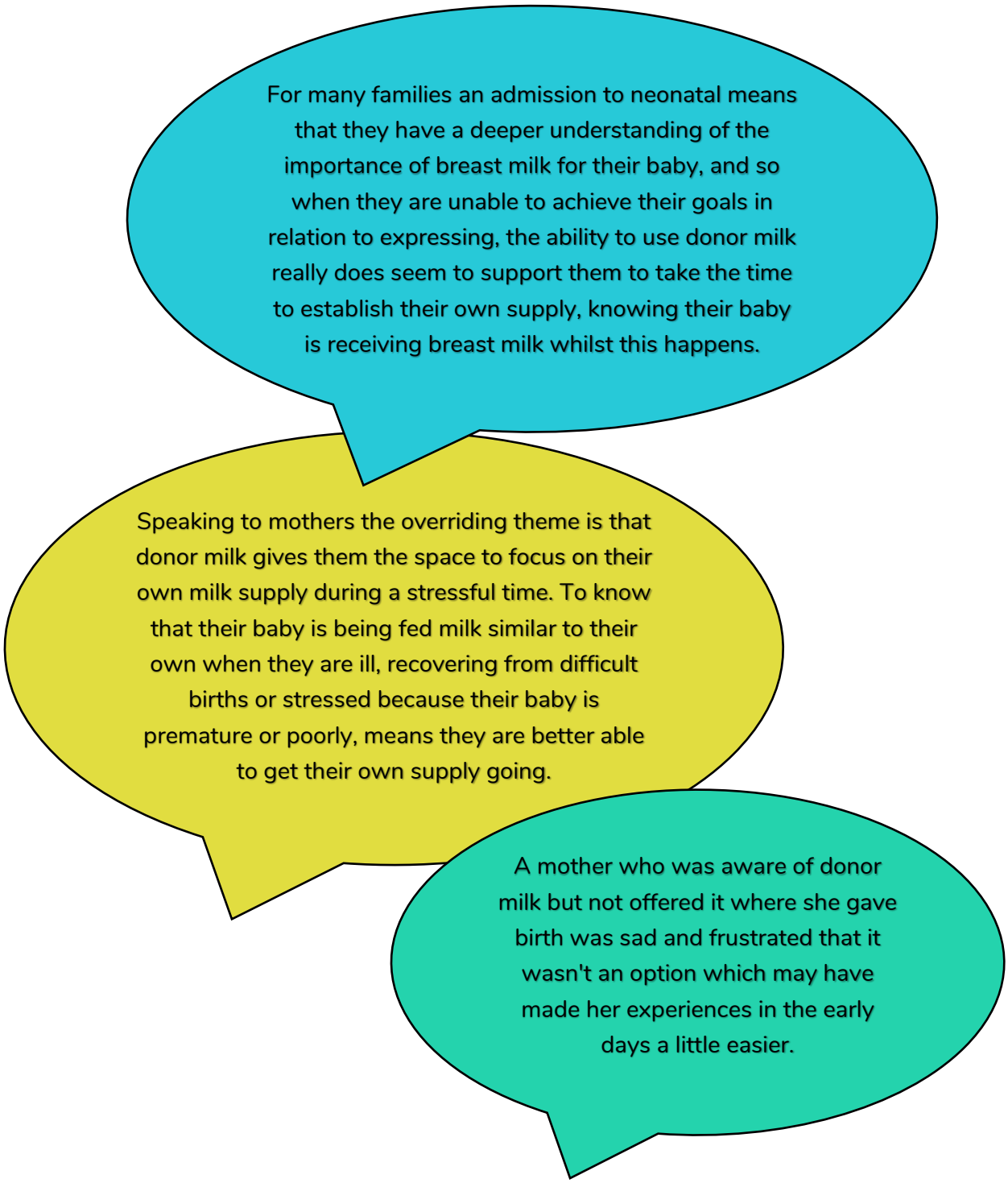


Figure 3. Examples of quotes from healthcare professionals



It is clear that many mothers find the use of DHM a beneficial and supportive intervention[18] however it is important to be mindful that for others it may reinforce a sense of "failure" that they have been unable to produce milk for their baby. For this reason, it is essential that staff are trained to have informed and sensitive discussions around DHM use.

Cultural acceptability of donor human milk

DHM is acceptable to the vast majority of families, however there are some communities for whom its use needs additional consideration. This may include Muslim families, relating to the Islamic concept of milk kinship, whereby recipients of DHM are believed to become related as "milk siblings" to the children of the milk donor.

As part of the original BAPM Framework for Practice (2016) a small working group including representation from BAPM, UKAMB, the Muslim Council of Britain and Muslim scholars met and agreed a resolution to this concept of milk kinship. There was consensus that in the interest of the principle of preserving life it was acceptable to use anonymised DHM (*Appendix 6*). A key component of this resolution was that milk tracking technology should be enhanced to ensure full traceability of milk from donor to recipients, and vice versa.

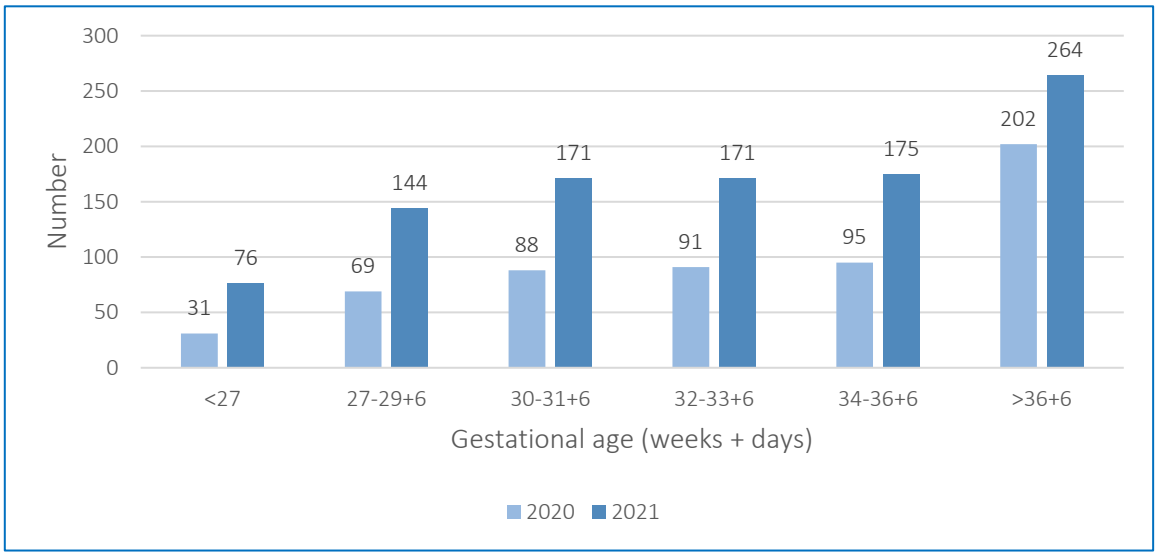
As further research and consideration is given to the implementation of human milk banking services, listening to the thoughts and concerns of each community will be crucial to ensure that appropriate communication tools and staff training pathways are developed. As with all discussions related to infant care, these resources should emphasise parental choice and be delivered by teams that are both well-informed and respectful of beliefs and cultural attitudes towards infant feeding.

Donor human milk use in the UK

Changes in demand for milk

Requests for DHM have been increasing globally as well as in the UK over recent decades[19], with a noticeable surge in demand over the two year period from 2020 to 2021. A 2022 UK online survey (Shenker et al., unpublished data) identified that the drivers for this are multifactorial and include a greater awareness of DHM amongst healthcare professionals and parents, increasing use of DHM to support maternal lactation within hospital and community settings, and clinical trials such as FEED1 (https://www.feed1.ac.uk/home.aspx). Data from Milk Bank Scotland demonstrate the increase in demand in DHM from 2020 to 2021, as well as the widening gestational age range of recipients (Figure 4).

Figure 4. Recipients of donor human milk from Milk Bank Scotland in 2020/21 by gestational age



Current practice

A 2022 online survey of UK neonatal units (108/195 responses, 55.4% of total NNUs; 18 Level 1, 47 Level 2, 41 Level 3) explored current and future expectations of DHM use in the next two years (Shenker et al., unpublished data). This identified considerable variation in current practice which is described in Table 1 below.

Table 1. Indications for donor human milk use within enteral feeding guidelines from 102 neonatal unit responses

Indication for use in enteral feeding guideline	Number (%)
Under a specified gestational age (weeks)	87 (85.3)
Under a specific birth weight (grams)	77 (75.5)
Reversed or persistently absent end diastolic flow	56 (54.9)
Post-medical necrotising enterocolitis	53 (52.0)
Post-surgical necrotising enterocolitis	52 (51.0)
Parental preference	23 (22.5)
Congenital bowel anomaly e.g. gastroschisis	23 (22.5)
Congenital cardiac anomaly	23 (22.5)
Top up (bridging) feeds	22 (21.6)
Haemodynamically unstable / inotropic support	19 (18.6)
Hypoxic ischaemic encephalopathy ± therapeutic hypothermia	17 (16.7)
Haemodynamically significant persistent ductus arteriosus	12 (11.8)
Parental allergies	2 (2.0)
Other	40 (39.2)

A third of respondents (34.9%) felt that their requirement for DHM would increase in the next two years, a further third (31.3%) predicted usage would stay the same, and a minority (3.8%) reported usage would decrease as a result of increased lactation support. A quarter of respondents (25.9%) were unsure. When asked whether the availability of DHM was supportive of lactation and breastfeeding on their neonatal unit, over half (53.9%) responded it was always supportive, a third s (34.3%) felt it was sometimes supportive, 8 units (7.8%) were unsure and 3 units (2.9%) reported it frequently undermined maternal breastfeeding.

Duration of DHM use wasn't specifically explored in this survey, however in a 2022 random sample of 18 feeding guidelines taken from neonatal units and networks across the UK, duration of DHM use varied from a specified number of weeks after birth to a defined CGA beyond which the perceived risk of NEC had reduced.

It is clear that there is existing wide variation in practice which may reflect ongoing uncertainty related to evidence gaps and a need for further research, although it may also be influenced by variability in access to DHM.

Working group recommendations for donor human milk use

These recommendations are informed by a composite of existing evidence (primarily in relation to NEC prevention), international guidance (in particular the WHO recommendations), current UK practice and healthcare professional and parental feedback.

They align with the GIRFT recommendations that DHM should be equitably available for high risk infants in the absence of sufficient MOM, and they are underpinned by the ethos that consistency in practice across neonatal units and networks is fundamental to providing families with a seamless care journey.

1. DHM may be considered in babies born at <32 weeks gestation and/or <1500 grams to establish enteral feeding when MOM is unavailable or insufficient to meet their baby's requirements.

2. Parents must provide informed consent for the use of DHM, and as part of the consent process they should be counselled regarding the differences between both DHM and PTF when compared to MOM, including their benefits, risks and the ongoing uncertainties.

3. DHM use must be supported by adequate lactation support and appropriate staff training.

4. There is insufficient evidence to make specific recommendations about duration of DHM use, fortification of DHM and use of DHM in moderate and late preterm and term babies.

5. Neonatal units and networks must work collaboratively to produce guidelines that ensure DHM use is consistent.

Milk banking infrastructure in the UK

Across the four devolved nations of the UK there are 14 HMB. Scotland and Northern Ireland each have a single, centrally funded HMB which provides a country wide service. The remaining 12 HMB are based in England, with a number of these providing DHM to Wales.

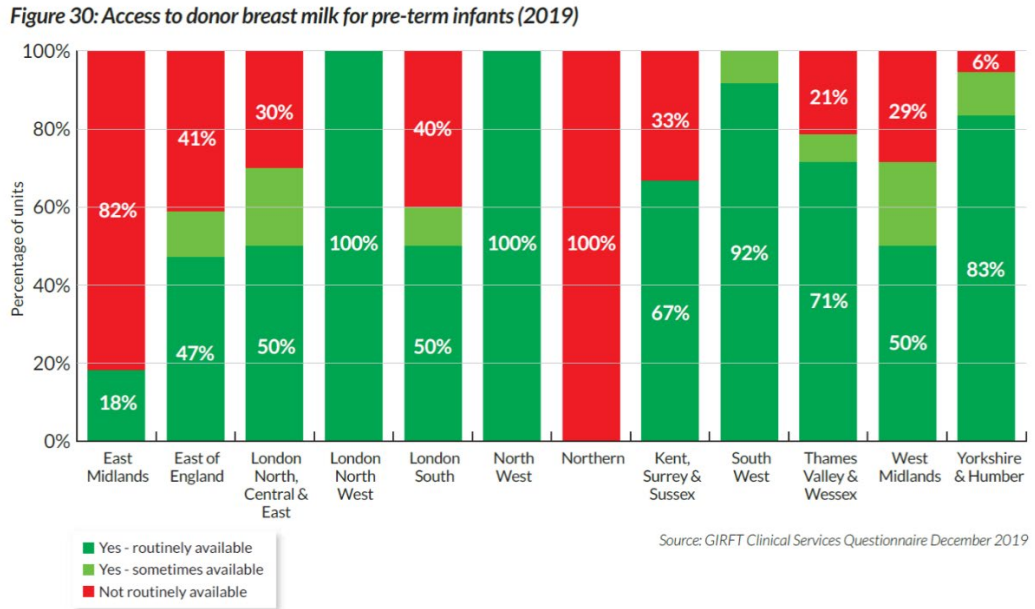
There is considerable variation in terms of facility size, staffing numbers and grades, operational capacity, scale of provision, funding and models of milk distribution between these HMB, reflecting their disparate evolution. There is currently no consensus on the "ideal" model, with each having advantages and disadvantages (see *Appendix 7*), however there is widespread recognition that higher level discussions are required, especially around size and funding to ensure the sustainability of UK milk banking.

The UK Association for Milk Banking (UKAMB) has an important role to play in any future discussions. It is an independent, charitable organisation which supports information sharing and encourages consistent and collaborative working between HMB, as well as providing/signposting useful resources for milk donors. It is working towards the development of a dashboard to facilitate the movement of DHM from areas where supply is plentiful to areas of need. This aims to enable HMB to work together at times of high demand and to increase flexibility across the human milk banking sector.

Equity of access to DHM underpins the recommendations in this document, however current evidence suggests that this is inconsistent across the UK. This was highlighted by the findings of the GIRFT Clinical Services Questionnaire which explored DHM availability across neonatal networks in England. Figure 5 below is taken directly from the GIRFT report with the authors' approval.

What is unclear from the GIRFT findings is whether DHM is unavailable due to local policy, a perceived lack of availability due to the absence of a local HMB/hub/depot, or an actual shortfall in DHM supply. The consensus from the milk banking community is that variability in access is related to a perception of, rather than an actual shortfall of DHM.

Figure 5. Findings from the Girft Clinical Services Questionnaire regarding DHM availability in England



Working group recommendations to support UK milk banking infrastructure

1. A national dashboard of DHM use should be established to enable HMB to understand current and future demand for milk, and to identify potential gaps in supply.

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3. A national risk register should be agreed. Each HMB should have a local risk register which feeds into the national register.

4. A short life working group should be convened, including key stakeholders to critically review and future proof UK milk bank infrastructure.

Regulation/legislation of donor human milk/human milk banking in the UK and abroad

There is no global consensus on how best to regulate HMB and ensure the safe provision of DHM. Differences exist both between and within countries whilst varying classifications affect accessibility and the costs associated with regulatory compliance. The potential regulatory options include a food, a medical product of human origin (MPHO)/substance of human origin (SoHO), a medicine, a nutrition therapy/functional food or as an undefined class that is unique to human milk. The advantages and disadvantages of each option are available to view in the PATH Resource Toolkit entitled 'Strengthening Human Milk Banking' which is free to download from: https://www.path.org/programs/maternal-newborn-child-health-and-nutrition/strengthening-human-milk-banking-resource-toolkit/

Where DHM is regulated as a food, as in the UK, the important ethical considerations that are described for all MPHO are not addressed. Alternatively, the inclusion in food regulation of the industry safety and quality standard, the Hazard Analysis Critical Control Points (HACCP) https://www.food.gov.uk/business-guidance/hazard-analysis-and-critical-control-point-haccp is an invaluable tool enabling HMB to identify and quantify risk throughout the storage, handling, processing and transportation procedures included in all milk banking operations.

Currently, few European countries have a regulatory framework for the banking and use of DHM despite there being 280 HMB currently operational within 29 countries. A recently published survey of HMB throughout Europe found that the legal classification and regulatory status of DHM were defined in only nine out of the 26 countries that responded[20]. Of these, six defined DHM as a food product (including the UK), two as a MPHO in accordance with blood, tissue and cells regulation and one as a medicinal product. Within these, most do not provide a comprehensive framework covering DHM and the availability of national guidelines varies, as do the contents where available. DHM remains unclassified in the remaining 17 countries that responded to the survey. The available legislative regulations differ widely and do not always include the safety and quality of DHM, protection of donors and recipients, and controls for cost recovery[20]. Uncertainties about regulatory requirements for the operation of HMB has been cited as a barrier to their establishment[21].

In 2019 the updated version of 'Guide to the quality and safety of tissues and cells for human application' published by the European Directive for the Quality of Medicines and Health Care (EDQM) included a chapter on human milk with recommendations for the operation of HMB and the safe handling of DHM. In July, 2022, the European Commission (EC) adopted the proposal for a Regulation on Standards of Quality and Safety for Substances of Human Origin (SoHO) Intended for Human Application. The list of SoHO has been extended to include human milk. It will take several years to evaluate the impact of this on all aspects of the provision and use of DHM.

In the UK, the provisions of the Food Standards Authority (FSA) apply to HMB, although it is unusual for them to undergo FSA inspection. The use of the FSA as the regulatory body allows for the commercialisation of human milk through private companies There is an expectation that adherence to the recommendations laid out in the NICE Clinical Guideline CG93 'Donor milk banks: service operation' https://guidance.nice.org.uk/CG93 will be audited on an annual basis and the results available as part of each Trust's NICE compliance reporting. This does not apply for commercial milk companies who are not required to follow NICE Guidelines.

It is important to highlight that the existing NICE guidance was published in 2010 and a number of areas require updating to reflect evolving evidence and practice. These include the definitions of

HMB, donors and recipients, and recommendations for quality assurance and tracking and tracing requirements. The latter could enhance data capture and contribute to further understanding of DHM use and health economic evaluation.

Standardisation of processes (e.g. donor recruitment, screening, contraindications to donation, support for donors and duration of donation period) across the UK would enable a more consistent approach.

Finally, in the short term, a requirement for HMB to provide access to their compliance data and increased inspections by the FSA would improve transparency and focus attention on debates concerning the optimal regulatory process for UK HMB.

Working group recommendations for the regulation/legislation of donor human milk/human milk banking

1. DHM should be viewed as a substance of human origin (SoHO) as per the forthcoming EU recommendation, and should be legislated accordingly.

2. Within the SoHO legislation DHM should have a specific regulatory basis which recognises its own unique status.

3. All HMB should be enabled to provide annual NICE CG93 compliance data, and be audited within a regulatory framework which is fit for purpose and unambiguous.

4. The existing NICE guideline requires updating at the earliest opportunity.

Commercialisation of human milk

Women and their families have been exchanging milk throughout history, and still do via informal networks for milk sharing, commercially via peer to peer selling or more recently by providing breast milk to commercial for-profit human milk companies. These companies offer financial reimbursement, based on the volumes of milk supplied, to mothers for their time and effort to provide their milk. The inclusion of a financial arrangement for milk supplied means that human milk handled through for-profit milk companies is 'provided' and not 'donated', mothers are known as milk providers, rather than milk donors.

Concerns have been raised globally around the ethics and potentially exploitative practices of paying women to supply human milk for the commercial gain of milk companies. Among the risks of turning a food substance into a tradeable commodity are that mothers may be induced to over produce milk, provide more milk than is optimal for their own baby's health, fail to declare medications, drug, tobacco or alcohol use, or provide milk that is more likely to be diluted to increase payments. In India, the licence to trade has recently been withdrawn from the company that started the first commercial human milk company in Asia.

UK for-profit human milk companies screen milk providers as per NICE guidance (see milk regulation above), however to ensure viability of their products they pool milk from different mothers which renders them not fully compliant with NICE, although they do guarantee full traceability. In addition, the lack of regulation of human milk in the UK allows human milk companies to develop clinical products that do not need to meet any minimum nutritional standards or undergo any product safety testing or efficacy trials before being brought to market, leaving consumers vulnerable. Commercial milk company marketing and advertising campaigns should be subject to close clinical scrutiny as lack of regulation in this area has led to some questionable claims where data are not substantiated.

In the UK for-profit human milk companies market pooled pasteurised human milk intended for term infants, and clinical human milk derived products aimed at the preterm nutrition market. This diversification of product has allowed these companies to open up a wider market for human milk derived products with a range of end users. Human milk products developed include:

- Frozen pooled human milk (marketed directly to parents for term infants)
- Frozen and powdered pooled human milk (modified to contain standardised energy and protein content)
- Frozen liquid human milk breast milk fortifier (energy and protein rich); this has the disadvantage of displacing significant amounts of MOM
- Powdered human milk breast milk fortifier (energy, protein, calcium & phosphate rich)

These products are brought to market at a considerable cost; one month's supply of pooled human milk for a term baby costs approximately £500-1000, human milk derived fortifiers are 100 times more expensive than bovine based fortifiers.

Human milk derived fortifiers

Whilst there is clinical evidence supporting the use of DHM in preterm nutrition, the current clinical trials of the effectiveness of human milk derived fortifiers are generally underpowered for functional outcomes and industry funded[22]. Systematic reviews do not show clear benefits of using human milk

derived fortifiers over current practice of using a bovine based fortifier[23-25]. It should also be noted that many human milk derived fortifiers may not provide equivalent nutrient intakes to multi-nutrient fortifiers, and additional vitamin and mineral supplements may be required in order to meet preterm infant nutritional requirements. Due to practicalities of use, lack of evidence of clinical effectiveness and extremely high costs, the use of human milk derived fortifiers cannot be recommended at this time.

With increasing demand for human milk feeding and a desire for equity of provision, it is essential to balance the rights and needs of babies against the rights of milk providers and their babies. Legislation and regulation are needed urgently to protect all those involved in the for-profit human milk industry, from providers to consumers, ensuring the highest standards are maintained throughout the process.

Working group recommendations for the regulation/legislation of commercial for-profit human milk companies and their products

1. Commercial for-profit UK human milk companies should, at a minimum adhere to the same regulatory/legislative standards as not for-profit HMB.

2. Regulation is required to ensure *modified* human milk derived products meet strict safety standards and the optimal nutritional composition for intended use.

3. For-profit human milk companies must provide accredited lactation care/advice for all milk providers.

4. All claims made by for-profit human milk companies regarding their products must be transparent and evidence based.

5. Ongoing research is required to fully evaluate the clinical effectiveness of human milk derived products in preterm nutrition.

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Appendix 1. Working group bios with any conflicts of interest

Judith Simpson (Chair)
Glasgow Neonatologist and Clinical Lead for Milk Bank Scotland. Member of the previous BAPM Working Group on Donor Human Milk and recent member of the BAPM Executive Committee as representative for Working Groups and Publications.

Debbie Barnett
Midwife by background and Coordinator of Milk Bank Scotland. Chair of the UK Association of Milk Banking (UKAMB) and the Milk Bank Technical Advisory Group of the International Council for Commonality in Bio-Banking Automation (ICCBA). Member of the original BAPM Working Group on Donor Human Milk. Lots of Infant Feeding experience which supports the coordinator role.

Kate Buckley
After my second son was born, I trained to be a breastfeeding Peer Supporter and volunteered my time in Support Groups and on the Maternity Ward for four years. In 2013 I started working as a Milk Processor at the Milk Bank at Chester and left in 2015 to have twin girls.

When the girls were born at 36 weeks, they struggled feeding both from me and from a cup or a bottle. They were born by C-section and we had to use donor milk while I worked on my supply. We had donor milk to help bridge the gap for two weeks by which time, the girls were back to birth weight and my supply had caught up.

I returned to processing donor milk at the Milk Bank at Chester in November 2019 and also help support the Memory Milk Gift Initiative. I personalise wooden Memory Pebbles and add the names of babies of our bereaved families to our Memory Milk Tree.

Sara Clarke
Lead Neonatal Network Dietitian, West Midlands Neonatal Network & Chair of Neonatal Dietitians Interest Group (NDiG), Honorary Lecturer in Neonatal Nutrition, Plymouth University, Member of BAPM Optimising early breast milk toolkit and BAPM Maintenance of breast milk toolkit groups.
I have been involved with supporting breast milk feeding throughout my career in acute paediatric dietetics and more recently neonatal care. As an expert clinical neonatal dietitian, I have experience of writing and implementing clinical nutrition guidelines, including use of donor human milk (DHM). I have an interest in and working knowledge of milk banking and have an interest in the activity of commercial milk banking and development of products based on human milk. I am passionate about the use of human milk, especially in the NNU, and bring that passion and enthusiasm with me to the group to impact on the future use of DHM as part of clinical care.

Nicholas Embleton
I'm a Consultant Neonatologist based in Newcastle, UK – a large tertiary level NICU providing regional fetal medicine and surgery. I've had an active research interest in neonatal nutrition for more than 25 years and led the recent ESPGHAN Committee of Nutrition (CoN) position paper (2022) of enteral nutrition for preterm infants. Previous chair for BAPM Working Group on Donor Human Milk (DHM) (2016) and founding member of UK Neonatal Nutrition Network (N3) since 2003. Our NICU recently started using DHM (2020).

Conflicts of interest: research funding paid to employing institution from Prolacta Bioscience, Danone Early Life Nutrition and NeoKare – all trials publicly available, listed on ISRCTN and registered on NIHR portfolio, no individual remuneration or other conflicts; personal honoraria from

Nestle Nutrition Institute donated to charity. A full list of research studies, funding and publications is available https://orcid.org/0000-0003-3750-5566

Sadie Harrison
I am an Advanced Neonatal Nurse Practitioner (ANNP) working on a Local Neonatal Unit in the South West of England. I have worked within the Neonatology specialist field for a number of years. During this time I have developed a particular interest in nutrition and in particular the use of breast milk. I have been involved in the Baby Friendly initiative in my local unit. I am currently the PI for FEED1 in Exeter and this has resulted in increased use of donor breast milk for babies that would not normally meet criteria. I have a keen interest in research and have previously looked at the role of colostrum for mouth care for my dissertation.

Gemma Holder
I am a Consultant Neonatologist within the NICU at Birmingham Women's and Children's Hospital which provides regional tertiary medical, surgical and cardiac care. I am the Neonatal Nutrition lead within the trust and current Clinical Lead for Birmingham Milk Bank. Since April 2022 I have been acting chair for UK Association for Milk Banking.

Karen Read ((RN (Child), BSN (Hons))
I am a registered Children's nurse with 25 years' experience working in neonatal units. I have supported the development of guidance and policy in the use of donor milk and a milk donation system for mothers with the milk bank in Southampton and the Southwest milk bank on its opening. I currently work as the Professional Lead for Neonatal at UNICEF UK Baby Friendly Initiative, supporting neonatal units on their journey to achieving Baby Friendly Initiative accreditation.
I bring my experience of the use of donor milk, development of guidance, and a national overview of the work neonatal units are undertaking in implementing policy that supports donor milk and infant feeding through the Baby Friendly Initiative standards.

Emma Savage
Operational Manager, Milk Bank at Chester, based at Countess of Chester Hospital, supplying donor milk to approximately 45 neonatal units annually. Worked at the milk bank since 2014 in various roles. Personal experience of donating milk after birth of daughter in 2011.

Natalie Shenker
UKRI Future Leaders Fellow at Imperial College London, working on a programme of research exploring the public health impacts of human milk banking. Co-founder of the Human Milk Foundation, a charity that supports research, education and access to donor milk. At the centre of this work, the Hearts Milk Bank was established in 2017 to provide assured access to donor milk and facilitate research in the sector, as highlighted by the BAPM 2016 Framework. Hearts now provides donor milk to over 50 NHS hospitals as well as a programme of community support for families where mothers face challenges breastfeeding. My research focuses on the optimal implementation of milk bank services to support maternal breastfeeding and mental health, alongside infant outcomes, while underpinning the principles of equity and inclusion.

Gillian Weaver
International human milk banking specialist and consultant.
Co-founder; Hearts Milk Bank, Harpenden. Co-founder and President; Human Milk Foundation, UK. Former manager (27 years); Queen Charlotte's and Chelsea Hospital Milk Bank (Imperial College Healthcare NHS Trust, West London). Member of Guideline Development Group for NICE Clinical Guideline 93; Donor Milk Banks; Service Operation (2010) and member of the previous BAPM Working group on Donor Human Milk. Co-founder and former Chair; UK Association for Milk Banking

(UKAMB), co-founder and former President; European Milk Bank Association (EMBA), initiator; virtual network Global Alliance of Milk Banks and Associations (GAMBA). Occasional advisor to WHO, Ministries of Health (India, Vietnam, Kenya, UK). Consultant: PATH (Strengthening Human Milk Banking and Resource Toolkit for Establishing and Integrating Human Milk Bank Programs), Alive and Thrive (Development of National and International Guidelines, South East Asia).

Zoe Howard
I am a Neonatal GRID trainee from Wales with a keen interest in neonatal nutrition. I have worked in several tertiary NICUs including a regional surgical centre and have experienced very varied use of donor human milk.

I was the trainee lead for nutrition in the University Hospital of Wales between 2019-2021, I am a member of the Neonatal Nutrition Network and have completed the Early Nutrition Specialist e-learning programme giving me additional knowledge of the nutritional needs of the newborn baby. I am passionate about supporting breastfeeding for all babies and appreciate the valuable role donor milk plays in this.

Appendix 2. Differences between mother's own milk and donor human milk

In the past four decades, a substantial body of research has been produced examining the effect of Holder pasteurisation on the nutritional and bioactive characteristics of human milk. DHM has been through multiple processes prior to being fed. After expression, milk is frozen, transported, heat-treated (pasteurised), refrozen and transported again, involving up to five container changes and two freeze-thaw cycles. These stages each affect the biochemical composition and content of DHM compared to fresh or frozen MOM. Holder pasteurisation does not substantially affect the macronutrient composition of donor milk, although transferring milk from container to container results in a measurable loss of the lipid fraction of the milk. A summary of pasteurisation effects on human milk is presented in Table 2.

Despite heat-induced alterations to the bioactive components of breastmilk, pasteurised milk maintains a degree of bacteriostatic and immune-stimulating properties. Although diminished, the partially preserved biological activity likely contributes to the improved outcomes observed in preterm infants fed DHM compared to IF. Both bile salt stimulated and lipoprotein lipase are inactivated through Holder pasteurisation, an important finding given the dependence of the preterm infant on these enzymes for fat absorption. Obliteration of all cellular activity (T-cells, B-cells, macrophages, neutrophils) occurs, along with a reduction in antibody (IgA reduced by 0-48%), lactoferrin (reduced by 57-80%), lysozyme (reduced by 0-60%) and obliteration of the microbiota. However, human milk oligosaccharides, essential in gut microbiome development, immune training and infant development, are preserved intact.

In counselling parents, the key differences between DHM and MOM need to be emphasised, highlighting that optimal outcomes are based on maternal milk and DHM is a bridge to achieving that.

Optimising donor support, donor nutrition, and milk banking processes have led to improvements in the nutritional quality of DHM. For example, early nutritional studies used drip milk, rather than full expressions, which led to assumptions that DHM may not have adequate nutritional quality.

However, with greater milk banking capacity and improvements in milk analysis, batches of milk with above average protein and calorie content could be selected for preterm use. Maintaining consistent temperatures during pasteurisation preserves biological activity, and cost-effective innovations such as pasteurising in water-baths yields a more homogenous temperature within a batch and reduction in the loss of bioactive components[26]. Precise adjustments to water-bath pasteurisers to further optimise temperature conditions also contribute to the preservation of bioactivity. Not all milk banks have access to newer technologies, adequate staffing or training provision to optimise DHM quality. DHM is classified as in Group 1 of the NOVA classification of food[27-29], identifying it as minimally processed. In comparison IF is a NOVA-4 classified food, an ultra-processed food. Research data is accelerating that highlight the link between early and prolonged exposure to NOVA-4 category foods and long-term risks of adverse health.

Table 2. Effect of Holder pasteurisation on breast milk components

Component	Maintained (>50%)	Reduced (10-50%)	Abolished (<10%)
Macronutrients	Carbohydrate Protein and amino acids Total fat		
Micronutrients	Calcium Copper Magnesium Phosphorus Potassium Sodium Zinc Iron		
Vitamins	Vitamin A Folate Vitamin B6 Vitamin C	Vitamin E	
Immune components	TGF-α IGF-1, IGF-2 IGF-BP2,3 IFN-ϒ IL-1β, IL-2, IL-4, IL-5, IL-8, IL-10, IL-12p70, IL-13, IL-17 Gangliosides	CD14 (soluble) IgA, sIgA IgG IL-2 Lactoferrin Lactoferrin-iron binding capacity Lysozyme	IgM T-cells B-cells Macrophages Neutrophils
Metabolic components	Adiponectin Amylase Insulin Epidermal growth factor Heparin-binding growth factor TGF-α, TGF-β MCP-1	Erythropoietin Hepatocyte growth factor	Bile salt-dependent lipase Lipoprotein lipase Alkaline phosphatase

Adapted from Ewaschuk et al, 2011[30, 31], and Peila et al, 2016[32]

Appendix 3. Example of information that should be shared with parents about donor human milk

Donor human milk, or donor milk as it is often called, is breastmilk donated to human milk banks by mothers who have a surplus. The donors of the milk are screened to ensure their milk is suitable including by having blood tests. Their milk is also tested for bacteria before being heat treated. Just like with blood donations, the breastmilk is freely donated and its use is tracked and recorded.

In the UK, in common with most countries, donor human milk is available for some babies whose mothers don't have enough of their own breastmilk. Other supplementary feeds include infant formula which is usually made from cow's milk and which may be adapted for different babies' needs for example preterm formula for babies born early.

Donor milk is mainly offered on a temporary basis as a supplement to a mother's own milk whilst she is building up her supply. It is mostly needed when babies have been born early or are very small. The mother's colostrum (first milk) and the milk she produces after a few days are the most suitable first feeds for babies, especially those that are tiny and sick but if there isn't enough, donor milk is usually the preferred supplement in the early days and weeks when being cared for on a neonatal unit. All new mothers of babies on the neonatal unit will be helped to collect their colostrum by being taught how to express it both by hand and using a breast pump. This should happen within a few hours, preferably within 1 hour of the baby being born. Expressing frequently, even if there is very little colostrum being collected at first, helps to ensure more will be available within a day or two. In the meantime, the tiniest of drops are precious and will be fed to the baby as it helps a baby's digestive system, it contains very high amounts of protective substances to protect against infections and it is very nutritious.

The use of donor milk doesn't replace a mother's own milk, except in rare circumstances such as if she is undergoing treatments or taking medicines that make her milk unsuitable or unsafe (such as chemotherapy) or in the case of some maternal infections or conditions.

Donor milk doesn't match a mother's own milk because it has been heat treated and may be from a mother with an older baby. In addition, a mother's own milk contains special antibodies made in response to any infections she or her baby are exposed to. However, donor milk will provide easily digested nutrition as well as very many anti-infective and other active components that help to keep babies healthy and protect them from gut related conditions which can be very serious for tiny infants.

All of the antibodies and other special human milk components are not present in formula. However, formula does contain higher amounts of some nutrients that are needed for growth and development and for which premature babies often have a greater need. For this reason, the use of donor milk for more than a few days may require the addition of extra nutrients added in the form of a fortifier. A mother's own milk is better able to support growth but it may also need fortifier adding depending on how the baby is growing. Sometimes a specialised formula is also chosen.

Local, national and global recommendations support the provision of donor milk, especially for premature babies during their early days and sometimes weeks on a neonatal unit. The next choice is usually preterm formula if the baby was born early. However, parents or those with parental responsibility, will be asked to provide their consent for the use of donor milk or formula.

If you have any questions or need further information to help you decide please ask the doctors or nurses caring for your baby. You can also ask to speak with the staff at the milk bank if you have questions about the milk banking process.

Appendix 4. Summary of evidence of the impact of donor human milk on preterm outcomes

DHM effect on	Author, date & country of origin	Study design / participants	Comparison	Reported outcomes
Growth	Milk trial 2022[4] USA	RCT 483 ELBW infants	PTF vs FDHM as a supplement to MOM	Favours PTF for weight gain
	Costa 2018[33] Italy	RCT 70 infants <33 weeks	PTF vs DHM as a supplement to MOM for the first 14 days	No difference in weight, length or head growth at 15 days or 36 weeks CGA
	O'Connor 2016[6] Canada	RCT 363 VLBW infants	PTF vs FDHM as a supplement to MOM	No significant difference
	Cristofalo 2013[34] USA/Austria	RCT 53 infants 500-1250 grams	PTF vs (H)FDHM as sole diet	Favours PTF for head growth
	Schanler 2005[35] USA	RCT 173 infants <30 weeks	PTF vs (H)FDHM as a supplement to MOM	Favours PTF for weight gain, no difference for length or head growth
	Lucas 1984[36] UK	RCT 159 infants <1850 grams	PTF vs DHM as sole diet	Favours PTF for all growth parameters
	Tyson 1983[37] USA	RCT 81 VLBW infants	PTF vs DHM as sole diet day from day 10	Favours PTF
	Gross 1983[38] USA	RCT 67 infants 27-33 weeks	IF vs DHM as sole diet	Favours IF for weight gain and head growth
	Schultz 1980[39] Hungry	RCT 20 infants	IF vs DHM as sole diet	No significant difference
	Davies 1977[40] Wales	RCT 68 infants 28-36 weeks	IF vs DHM as sole diet	No difference
	Raiha 1976[41] Finland	RCT 106 preterm infants <2100 grams	IF vs DHM as sole diet	No difference in weight
ND outcome	Milk trial 2022[5] USA	RCT 483 ELBW infants	PTF vs FDHM as a supplement to MOM	No statistical difference
	O'Connor 2016[6]	RCT	PTF vs FDHM as a supplement to MOM	No statistical difference

	Canada	363 VLBW infants		
Time to full feeds	Costa 2018[33] Italy	RCT 70 infants <33 weeks	PTF vs DHM as a supplement to MOM for first 14 days	No difference
	Cristofalo 2013[34] USA/Austria	RCT 53 infants 500-1250 grams	PTF vs (H)FDHM as sole diet	No significant difference
Necrotising enterocolitis	Milk trial 2022[5] USA	RCT 483 ELBW infants	PTF vs FDHM as a supplement to MOM	Favours DHM
	O'Connor 2016[6] Canada	RCT 363 VLBW infants	PTF vs FDHM as a supplement to MOM	Favours DHM
	Cristofalo 2013[34] USA/Austria	RCT 53 infants 500-1250 grams	PTF vs (H)FDHM as sole diet	No difference
	Schanler 2005[35] USA	RCT 173 infants <30 weeks	PTF vs (H)FDHM as a supplement to MOM	No difference
	Lucas 1984[36] UK	RCT 159 infants <1850 grams	PTF vs DHM as sole diet	No significant difference
	Tyson 1983[37] USA	RCT 81 VLBW infants	PTF vs DHM as sole diet from day 10	No difference
Invasive infection	Costa 2018[33] Italy	RCT 70 infants <33 weeks	PTF vs DHM as a supplement to MOM for first 14 days	No significant difference
Mortality	Milk trial 2022[5] USA	RCT 483 ELBW infants	PTF vs FDHM as a supplement to MOM	No significant difference
	Costa 2018[33] Italy	RCT 70 infants <33 weeks	PTF vs DHM as a supplement to MOM for first 14 days	No significant difference
	Corpeleijin 2016[42] Netherlands	RCT 373 VLBW infants	PTF vs (H)FDHM as a supplement to MOM for first 10 days	No significant difference in composite outcome: invasive infection, NEC or all-cause mortality (< 60 days old)
	O'Connor 2016[6] Canada	RCT 363 VLBW infants	PTF vs FDHM as a supplement to MOM	No significant difference
	Cristofalo 2013[34]	RCT	PTF vs (H)FDHM as sole diet	No significant difference

	USA/Austria	53 infants 500-1250 grams		
	Schanler 2005[35] USA	RCT 173 infants <30 weeks	PTF vs (H)FDHM as a supplement to MOM	No difference
	Lucas 1984[36] UK	RCT 159 infants <1850 grams	PTF vs DHM as sole diet	No significant difference

RCT=randomised controlled trial, PTF=preterm formula, DHM=donor human milk, MOM=mother's own milk, CGA=corrected gestational age, VLBW=very low birth weight, FDHM=fortified DHM, (H)FDHM=human milk derived fortified DHM, IF=infant formula, NEC=necrotising enterocolitis

Appendix 5. Examples of potential donor human milk research questions in PICO format

Question	Rationale
P. In preterm infants <32 weeks or <1500 grams I. Does the use of DHM to make up any shortfall in MOM C. Compared to formula O. Result in a lower incidence of NEC?	The current Cochrane meta-analysis[1] shows that when DHM is used as a supplement to make up any shortfall in MOM the reduction in NEC is of borderline significance. No RCT has ever been powered to conclusively answer this question, and many of the RCT present methodological challenges. However, whilst being 'ethical' there is opposition to this design from both PPI and many clinicians, and an RCT powered on NEC would likely require around n=5000 recruits and may no longer be considered feasible in the UK. Note that >50% of UK babies developing NEC do so after having only ever received MOM. A study only focusing on the highest risk infants e.g. <28 weeks might only need n=1500 infants.
P. In preterm infants <32 weeks or <1500 grams I. Does the continued use of DHM after full feeds are achieved C. Compared to starting formula O. Result in a higher rate of breastfeeding at 36 weeks CGA or discharge?	Observational data suggest that availability of DHM creates a more positive culture towards breastmilk in general but no adequately powered trials exist. A large RCT using this study design (n=1000-3000) would also provide supportive data around whether there is any reduction in NEC. If there was no benefit on continued breastfeeding duration, and there was no evidence that NEC was reduced, then use of DHM could be restricted to the highest risk infants in the first 2-3 weeks. Current practice across the UK varies in terms of duration of use of DHM as a supplement with some switching to formula if the mother stops providing MOM, whereas others continue for longer. Continued use of DHM where there is little/no MOM might cost around £100-300/week per baby. Secondary outcomes might involve qualitative interviews with parents.
P. In preterm infants <32 weeks or <1500 grams I. Does the use of human milk derived BMF fortifiers C. Compared to bovine milk derived BMF O. Result in a lower incidence of NEC?	A single under-powered RCT[17], a small trial in infants not receiving any MOM[35] and some observational studies suggest that an exclusive human milk diet (EHMD) may result in a lower incidence of NEC[43]. At least two commercial human milk fortifier products are available in the UK (Prolacta and NeoKare), but both are likely to be associated with significant additional costs in the order of £1,000-3,000 per baby. However, the in-hospital marginal costs of NEC are around £50,000 (cost of surgery, prolonged stay, additional TPN etc.) and the lifetime costs of NEC can be considerable e.g. if baby developed cerebral palsy. The cost per baby of BMF for an EHMD is similar to a single day of intensive care on the NICU, therefore the high cost could be justified if one less case of NEC occurred for every 20-30 babies receiving an EHMD. An adequately powered trial would require >2000 infants.
P. In preterm infants <32 weeks or <1500 grams receiving DHM to make up any shortfall in MOM I. Does the routine use of a BMF C. Compared to only using a BMF if growth is faltering O. Result in better 2 year outcomes?	Many UK neonatal units do not routinely use BMF, either because of concerns of an increased risk of NEC, or because they believe it is not required. Studies do not show a higher rate of NEC in babies receiving BMF, but many clinicians believe there is a risk, and many parents are concerned. Where BMF is not used, clinicians would still be required to provide additional electrolytes, minerals and vitamins to meet estimated requirements. However, data also show that slower growth (that may be due to inadequate nutrient intakes) is associated with worse brain outcomes. It is possible there may be a 'trade-off' between short-term outcomes (such as NEC) and longer-term brain outcomes, so a well-designed trial would need to assess infant development (e.g. BSID or PARCA-R) at 2 years of age. A study would need around n=2000 infants.
P. In late and moderately preterm infants	Most postnatal wards in the UK do not routinely use DHM if there is insufficient MOM, although some do. Indications for using

(LMPT) infants (32-36 weeks) and/or those with birth weights 1500-2500 grams where the mother intends to provide MOM I. Does the use of DHM to make up shortfall in supply of MOM C. Compared to formula O. Result in a higher rate of breastfeeding at discharge (O^1) or better developmental outcome at 2 years (O^2)?	DHM/formula may include a high risk of, or the occurrence of hypoglycaemia, and/or where infants require early supplemental feeds but lactation is not established. Longitudinal studies (**LAMBS) show that lack of breastmilk exposure on discharge is the strongest determinant of adverse neuro-cognitive outcomes in LMPT infants at 2 years of age. Rates of breastfeeding at discharge in LMPT are lower than for term or very preterm infants. An RCT might require n=1000-2000 infants, but LMPT are around 4-5 times as prevalent as very preterm infants.
P. In otherwise healthy term infants (>36 weeks) where the mother intends to breastfeed but is struggling to establish lactation or breastfeed I. Does the routine availability of DHM for the first 72 hours C. Compared to no DHM availability O. Result in a higher rate of breastfeeding at 6 and 12 weeks?	Most postnatal wards do not use DHM for otherwise 'well' infants but around 20-30% of mother's who intended to breastfeed discontinue in the first few days for a variety of reasons. Short-term use of DHM may provide the mother with reassurance, and a sufficient amount of DHM could be provided for the mother to take home.
What is the optimal number, size and geographical location of HMB in England and Wales?	There are currently 14 HMB located in England of varying size. Most are co-located in maternity units, but some are independent. Whilst most support more than one neonatal unit, many are unable to provide 24/7 availability to supply or collect/pasteurize. However smaller HMB may benefit from more established connections with local donors and the community. Larger units would benefit from economies of scale, more cost-effective and can better cope with rapid changes in supply and demand. Existing systems could provide hubs in neonatal networks where no HMB exists that could provide a focal point for collection of donations and storage of DHM for supply to individual units within that network.
What alternative methods for 'pasteurisation' of DHM exist, and what is the strength of the data to show (a) newer techniques might better preserve the bionutrient properties and (b) are equally safe/effective?	Holder pasteurisation is the gold standard technique, but High-Temperature-Short-Time pasteurisation, High Pressure Processing and Ultraviolet-C irradiation might better preserve bionutrient properties.

DHM = donor human milk, MOM = mother's own milk, NEC = necrotising enterocolitis, RCT = randomised controlled trial, CGA = corrected gestational age, BMF = breast milk fortifier, HMB = human milk ba

Appendix 6. Resolution on the use of donor human milk for Muslim infants

Draft statement (October 2015)

Background

The introduction of anonymised donor human milk (DHM) to countries with Muslim populations has been challenged by the Islamic concept of milk kinship. Here the sharing of milk, historically in the form of a wet nurse, creates kinship ties and thus marriage prohibitions between the family of the donor and the recipient. Surveys in the United Kingdom have shown that these beliefs may affect the acceptability of DHM to Muslim parents, and impact on the clinical use of DHM in neonatal units in areas with predominantly Muslim populations. Given the benefits of DHM, especially in the prevention of necrotising enterocolitis in preterm infants, we believed it was necessary to find a resolution to this situation. In order to facilitate this, representatives from the Muslim Council of Britain (MCB), the United Kingdom Association for Milk Banking (UKAMB), and the British Association of Perinatal Medicine (BAPM) met at a Round Table Discussion on the 26th April 2015 in London.

Aims

To work together in an atmosphere of mutual respect and understanding to give vulnerable infants the best possible start in life, regardless of their religion or ethnicity.

Summary of round table discussion

The National Institute for Health and Care Excellence (NICE) issued guidelines for the use of DHM throughout the United Kingdom in 2010. These state that every aliquot of DHM given must be traceable from donor to recipient. Participants at the round table discussion agreed that this means that, in the future should there be doubt about whether a potential bride or groom had received DHM from a particular donor it will be possible to address this. The process would involve reviewing the recipient's medical records, in conjunction with records from the relevant human milk bank, to rule out whether they had received milk from the same lactating mother. In the future, electronic barcode tracking is likely to be introduced. This will make the process more straightforward, and also extend the current 30 year limit for the retention of medical records as mandated by NICE.

Resolution

Concerns about milk kinship should not lead to DHM being with-held from vulnerable infants, as there are safeguards in place that guarantee the traceability of milk from donor to recipient.

Actions agreed upon

1. To reinforce, via the inclusion of a statement in the soon to be published BAPM Framework for the use of DHM in the United Kingdom, the need for a robust system to ensure the traceability of donated milk. This would ideally be via an electronic bar code system.
2. To recommend at the next review of the NICE guidelines on DHM that records for the use of DHM be kept for longer than the current standard of 30 years.

3. To produce a parent information leaflet explaining the rationale for the use of DHM, and steps that can be taken by families who are concerned about the implications of establishment of possible milk kinship.
4. To disseminate throughout the United Kingdom, via local religious communities and clinicians in neonatal units in areas with significant Muslim populations, this resolution.

Signatories

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Appendix 7. Advantages/disadvantages of differing models of human milk bank

Table 2. Advantages/disadvantages of differing models of human milk bank based on how they are funded and resourced

1. NHS based HMB – providing DHM to a single hospital/NHS Trust Small scale. HMB funded by the NHS Trust in which it is located, and resourced to provide DHM to the funding organisation. Any surplus DHM may be made available to other hospitals/Trusts (with or without accompanying charges). .	
Advantages	Disadvantages
• No requirement for external ordering of milk • Minimal transportation of pasteurised DHM required • NHS location facilitates access to NHS ordering and supplies • Integrated easily with on-site breastfeeding support services • Feeling of local 'ownership' and maintenance of tradition	• Financially dependent on one NHS Trust • Dependence usually also on local hospital charities e.g., for equipment • Financial insecurity may limit longer term service development and increase service vulnerability • Small pool of staff may risk service sustainability and limit opportunity for staff training/development • Small scale operation less able to respond to fluctuating demand • Inefficient use of equipment and other resources • Inability to benefit from economies of scale
2. NHS based HMB – providing DHM to multiple hospitals/NHS Trusts Medium scale. HMB funded in part by local hospital/NHS Trust	
Advantages	Disadvantages
• HMB funded in part by provision of DHM to other hospitals/Trusts on a cost recovery (per litre) basis • Financially self-sustaining when demand meets predicted levels • Recipient hospitals/NHS Trusts only pay for DHM ordered • Service semi flexible at times of increased demand due to increased income/ revenue • NHS location/affiliation may facilitate access to NHS ordering of supplies (reduced costs) • As operational size increases, corresponding staffing levels protect service from staff illness, absence etc	• Financially vulnerable if demand for DHM falls • Potential for inequity of access to DHM in the event of demand outstripping supply • Funding inconsistency may limit longer term service development • Recipient hospitals vulnerable to lack of supply in the event of the milk bank's failure to identify, respond to and mitigate risks to operational sustainability • Potential inflexibility within procurement

3. NHS based Nationally/Regionally funded HMB Central HMB funded by contributions/top slicing from neonatal unit budgets based on DHM use or from health boards based on birth rates	
Advantages	Disadvantages
• Stable and sustainable funding model • Equity of access within a geographically defined area • Staff training, longer term planning and service development enabled and underpinned by financial security	• Less flexibility to increase infrastructure if there's a surge in demand • Potential to innovate may be constrained by need to respond to national/regional governance
4. Independently operating (non NHS based but NHS provider) non-profit HMB (multiple site provision) Registered as a Charitable Incorporated Organisation or a Social Enterprise	
Advantages	Disadvantages
• Not reliant on local or wider NHS core funding • Financially self-sustaining for neonatal unit provision • Built-in accountancy oversight to facilitate cost modelling and efficiency savings • Economies of scale facilitate opportunities for growth • Ability to fundraise and apply for research funding; use this funding to foster innovation, scale-up and support non-commissioned provision of DHM • Transparency of safety standards as a result of annual FSA inspections	• Operates out with constraints of NHS governance and procedures, however provision of NICECG93 compliance data annually e.g., via website enhances transparency and oversight • No guaranteed funding and exposed to additional costs (e.g., rent, insurance) not covered by NHS (highlights need for comprehensive financial oversight)

Table 3. Advantages/disadvantages of differing models of human milk bank (HMB) based on how DHM is distributed

1. HMB providing single site distribution	
Advantages	Disadvantages
• DHM all stored on site – ease of access	• Small size may limit DHM availability if demand surges /donations drop off • Operational size may limit opportunities for staff time to develop expertise in processing DHM, risk assessment, quality assurance and traceability

2. HMB providing multiple sites distribution Distribution of DHM from a central HMB to recipient neonatal units where milk is then stored until use	
Advantages	Disadvantages
• Economies of scale may allow for more sustainable service provision depending on the scale of operations • Staff within central HMB develop greater expertise in processing DHM, risk assessment, quality assurance and traceability due to increased activity and responsibilities	• Potential for long journeys to collect and deliver DHM impacting on the quality of the DHM • Environmentally less sustainable • Staff in recipient neonatal units take responsibility for DHM storage, quality assurance, monitoring stock adequacy and completion of tracking/traceability – requirement for additional and ongoing training to ensure safe use of DHM • Operational failure / temporary closure at the central HMB may compromise DHM availability and equity of access
3. Central HMB with depots/hubs closer to recipient neonatal units	
Advantages	Disadvantages
• Economies of scale allow for sustainable service provision • Staff within central HMB develop expertise in processing DHM, risk assessment, quality assurance and traceability • Storage of DHM across sites mitigates risk of loss of DHM if there is an operational failure in the central HMB • Shorter journey to recipient neonatal units – faster response times may be facilitated • Improves environmental sustainability, enabling shorter journey times • Hubs facilitate local donor recruitment (depots are usually solely for DHM that is ready to issue)	• Staff in depots/hubs take responsibility for DHM storage, quality assurance, monitoring stock adequacy and completion of tracking/traceability - coordination and monitoring of the hubs adds to work load of central milk bank staff • Requirement for additional and ongoing training for all hub staff and users to ensure safe and sustainable use of DHM

BAPM

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This document was produced by the British Association of Perinatal Medicine (BAPM).

BAPM a membership organisation that is here to support all those involved in perinatal care to optimise their skills and knowledge, deliver and share high-quality safe and innovative practice, undertake research, and speak out for babies and their families.

We are a professional association of neonatologists, paediatricians, obstetricians, nurses, midwives, trainees, network managers and other health professionals dedicated to shaping the delivery and improving the standard of perinatal care in the UK.

Our vision is for every baby and their family to receive the highest standard of perinatal care. Join us today.

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