

ORIGINAL ARTICLE

Breast milk banking: Current opinion and practice in Australian neonatal intensive care units

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Aim: To find out the knowledge and attitudes of health-care professionals (HCPs) in Australian neonatal intensive care units (NICUs) towards breast milk banking (BMBg) and pasteurised donated breast milk (PDBM).

Methods: Cross-sectional structured survey of HCPs in all 25 NICUs in Australia.

Results: Response rate was 43.4% ($n = 358$ of 825). Participants included nurses and midwives (291, 81.3%) and the remainder were neonatologists and neonatal trainees (67, 18.7%). A variable number of HCPs agreed that PDBM would decrease the risk of necrotising enterocolitis (81%) and allergies (48.9%), 8.4% thought PDBM will carry risk of infections and 78.8% agreed that PDBM is preferable over formula, but only 67.5% thought that establishing breast milk banks (BMBs) are justifiable. Significant differences were found between doctors and nurses/midwives, with 19.4% of doctors compared with 5.8% of nurses/midwives agreed that PDBM carried an increased risk of infection. Although, over 90% of nurses/midwives and 70% of doctors agreed that the donation of breast milk is important, only 71% of nurses/midwives and 52.2% of doctors thought that setting up a BMB was justifiable.

Conclusion: The opinions about BMBg differ widely between HCPs; however, the majority support the practice. HCPs had different knowledge gaps in regard to BMBg. Nurses/midwives positively view the practice of BMBg more strongly compared with neonatologists.

Key words: breast milk; breast milk bank; pasteurised donated breast milk; premature; preterm; very low birthweight.

What is already known on this topic

- 1 Breast milk is associated with immunological, neurodevelopmental, economic and environmental advantages to the infant and beneficial effects on cardiovascular risk factors in later life.
- 2 If the mother's own milk is unavailable or insufficient, a suitable alternative should reasonably be pasteurised donated breast milk.
- 3 There is evidence for increased health risks of using formula, which are expected to be compounded in preterm or VLBW infants with an immature gut.

What this paper adds

- 1 The opinions about breast milk banking differ widely; however, the majority of health-care professionals support the practice of breast milk banking.
- 2 Nurses/midwives view breast milk banks more positively compared with neonatologists.
- 3 There were no differences between the opinions of nurses/midwives with advanced lactation training versus those without one.

Maternal breast milk (BM) is the recommended form of enteral nutrition for term and preterm or very low birthweight (VLBW) infants with much evidence highlighting the benefits.^{1,2} However, when a mother is unable or unwilling to breastfeed her child due to maternal illness, insufficient milk supply or other reasons, an alternative must be sought.^{3,4} In the 1980s,

after human immunodeficiency virus (HIV) was identified in BM, BM banks (BMBs) throughout Australia were closed.⁵ The only alternative since the closures has been formula.

However, there is evidence for increased health risks of using formula, which are expected to be compounded in preterm or VLBW infants with an immature gut.^{3,6,7} Immediate concerns of formula feeding include an increased risk of feeding intolerance and an association with necrotising enterocolitis (NEC) and late-onset sepsis, all of which hinder growth and development.^{3,6,8} Individual studies and systematic reviews have also shown possible association between formula feeding and an increased risk of later life conditions such as atopy,^{2,7} diabetes^{2,7,9,10} and childhood obesity.^{2,7,9–11} Considering the potential consequences of formula feeding, if the mother's own milk is unavailable or insufficient, a suitable alternative should reasonably be pasteurised donated BM (PDBM).^{4,12–15}

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Furthermore, BM has been shown to enhance gastrointestinal growth and maturation, increase gastric emptying and intestinal motility and increase tolerance of a full enteral feeding for preterm and VLBW infants,^{3,14,16} possibly owing to the macronutrients in BM being more easily digested than formula.¹⁷ Various neurodevelopmental advantages have also been associated with BM when compared with infants fed with formula, including superior mental and motor development, visual acuity and intelligence quotient.^{3,16} A major benefit of BM is the delivery of immunoprotective and growth factors⁴ to the immature gut mucosa against NEC,^{12,13,15} late onset sepsis,¹² diarrhoea¹³ and urinary and upper respiratory tract infections,¹³ which are all causes of premature infant morbidity and mortality.^{6,14,16} In addition, a randomised trial and observational studies conducted by Singhal *et al.* have shown that BM consumption provided beneficial effects in later life on such cardiovascular risk factors as high blood pressure,¹⁸ insulin resistance and the low density lipoprotein and high density lipoprotein cholesterol ratio.¹⁹ Some of these beneficial effects persist in infants fed with PDBM, although the evidence for this is limited.^{4,12–14,16,20}

The present survey seeks to find out the knowledge and attitudes of health-care professionals (HCPs) in Australian neonatal intensive care units (NICUs) towards BM banking (BMBg) and PDBM.

Methods

Design and participants

This was a cross-sectional survey of HCPs working in all 25 NICUs in Australia. The survey was conducted from April to July 2010.

The participants of the survey included the following:

- 1 a total of 146 neonatologists and neonatal trainees in Australia who were identified via the Australian and New Zealand Neonatal Network and Royal Australian College of Physicians, who were sent an electronic invitation to online survey.
- 2 a total of 578 neonatal nurses and midwives who were identified via Australian College of Neonatal Nurses Inc (ACNN), who were sent an electronic invitation to the online survey.
- 3 a total of 101 nurses and midwives, who are employed at Canberra Hospital and who were given a hardcopy survey.

To improve the response rate of the survey, a reminder email was sent to those who were invited to the online survey 6 weeks later.

Ethics approval was granted by the ACT Survey Approval Sub-Committee and ACT Health Human Research Ethics Committee (no ETH.11/09.1012) and Australian National University Research Ethics Committee (research protocol number 2010/041).

Survey instrument

The cover letter alerted participants that all instances of 'donated breast milk, PDBM' in the survey questions referred to donated BM pasteurised and stored according to BMB standards. The survey was composed of three sections (Appendix I),

the first of which requested demographic information including age, education, occupation, years and location of practice, ethnicity and religion. The next section contained nine questions dealing with knowledge regarding perceived risks, benefits and disadvantages of PDBM and formula milk and the practice of donating BM. The final section was composed of nine questions that sought to find out whether respondents are in favour of or against PDBM and BMBg. Respondents were also given an opportunity to provide comments and feedback. The majority of questions in the second and third sections, except for one, required respondents to rank the item on a five-point Likert scale where one was designated as strongly disagree and five designated as strongly agree.

Statistical analysis

Statistical analyses were performed using the Predictive Analytics SoftWare (PASW) (PASW for Windows, release 18.0.2, SPSS: an IBM company, Chicago, IL, USA, 2010). Data from Likert scales were reduced to nominal level by combining all 'agree and disagree' responses into two categories of 'agree/accept' and 'do not agree/reject'. Data are presented as number (%), median (interquartile range) or mean (standard deviation). The chi-squared, Fisher exact and *t*-tests were used where appropriate. All analyses were pre-specified. The level of statistical significance for all analyses was set at $P < 0.05$ using two-tailed comparisons.

Results

Response rate and respondent characteristics

A response rate of 43.4% was obtained for the survey ($n = 358$ of 825). Overall, median (interquartile range) of 12 (11–14) respondents did not answer one or more of the questions in the survey. Further details of the respondents' socio-demographic data are listed in Table 1.

The majority of the respondents (85.5%) were working in a tertiary NICU, with 81.3% being nurses or midwives. Females represented 86.6% of the respondents and over 41% of the respondents were over the age of 50 inclusive. The mean (standard deviation) number of years the nurses had worked was significantly higher than the doctors (17.0 (9.9) vs. 11.1 (8.2), respectively; $P < 0.0001$). Over 62% of the respondents had completed a bachelor's degree or a higher level of education.

Perceived risks, benefits and disadvantages of PDBM and formula

Table 2 lists the overall responses of HCPs as well as the responses of doctors and nurses/midwives. Only 8.4% of the HCPs agreed that PDBM would carry an increased risk of infection, which increased to 12.6% when asked specifically about HIV. A significant majority agreed that PDBM would decrease the risk of NEC (81%) and be more nutritious (74.3%) compared with formula. In regard to decreased immunological benefits following pasteurisation, the responses were quite neutral with 38.6% of HCPs agreeing and 33.8% disagreeing. Likewise,

Table 1 The socio-demographic characteristics of the respondents

Characteristic		Frequency (%) (n = 358)
Gender	Female	310 (86.6)
	Male	44 (12.3)
Age group	<29	25 (7)
	30–39	60 (16.8)
	40–49	118 (23.5)
	≥50	149 (41.7)
Education	Certificate/diploma	125 (35.0)
	Bachelor	145 (40.5)
	Masters	62 (17.3)
	Doctorate	17 (4.7)
Ethnicity	Not stated	24 (6.7)
	Aboriginal and Torres Strait Islander	1 (0.3)
	Asian	15 (4.2)
Religion	Caucasian	318 (88.8)
	None	132 (36.9)
	Christian	197 (55.0)
	Atheist	19 (5.3)
Occupation	Other	10 (2.7)
	Doctor	67 (18.7)
	Nurse/midwife	273 (76.3)
Location†	Nurse/midwife with advanced lactation training (lactation consultant)	18 (5.0)
	Ward/clinic	94 (26.2)
	Neonatal intensive care unit	306 (85.5)
	Other	31 (8.6)

†Total does not add to 100% because participants may work in more than one location.

only 48.9% of the HCPs thought that PDBM would decrease the risk of allergies, with 39.4% of the respondents being neutral or unanswered.

Attitudes towards BMBg

The majority of the HCPs (78.8%) agreed that PDBM is preferable over formula. When asked specifically for preterm infants, the response was 71.3%, which fell to 40.2% for term infants. Although, 87.1% of the respondents thought that donating BM was important, only 67.5% thought that establishing BMBs was justifiable. Majority considered the practice of BMBg in Australia and New Zealand to be safe and trustworthy (Table 2).

Responses of doctors versus nurses/midwives

Table 2 shows the responses of nurses/midwives and doctors. A greater number of doctors (19.4%) agreed that PDBM carried an increased risk of infection compared with 5.8% of the nurses ($P < 0.001$). When asked specifically about HIV, this increased to 26.9% and 9.3%, respectively ($P < 0.001$). A smaller number of doctors (67%) agreed that PDBM decreased the risk of NEC compared with nurses/midwives (84.2%, $P < 0.01$). Many more nurses/midwives (79.8%) thought PDBM is more nutritious than formula compared with 50.8% of doctors ($P < 0.001$). The doctors (56.7%) agreed more that pasteurisation decreased the immunological benefits of BM than the nurses/midwives (34.4%, $P = 0.001$), and 29.9% of the doctors and 53.3% of the nurses/midwives agreed that PDBM may decrease the risk of allergies ($P < 0.001$).

PDBM is preferable over formula for preterm infants to nurses/midwives (76.2%), whereas only 50.2% of the doctors agreed ($P < 0.001$). For term infants, the number that agreed decreased to 44.7% nurses/midwives and 20% of doctors ($P < 0.001$). Over 90% of the nurses/midwives and 70% of the doctors agreed that the donation of BM is important ($P < 0.001$),

Table 2 Knowledge and attitudes of health-care professionals towards pasteurised donated breast milk

Theme: pasteurised donated breast milk	Overall (n = 358)	Doctors (n = 67)	Nurses/midwives (n = 291)	P-value
Increases risk of infection	8.4	19.4	5.8	<0.01
Increase risk of HIV	12.6	26.9	9.3	<0.01
Decreases risk of NEC	81	67.2	84.2	<0.01
More nutritious	74.3	50.8	79.8	<0.01
Decreases immunological benefits	38.6	56.7	34.4	<0.01
Decreases risk of allergies	48.9	29.9	53.3	<0.01
Preferred over formula	78.8	61.9	82.7	<0.01
For preterm	71.3	50.2	76.2	<0.01
For term	40.2	20.9	44.7	<0.01
Donating BM is important	87.1	71.6	90.7	<0.01
Setting up BMB is justified	67.5	52.2	71	<0.01
BMB are safe and trustworthy	71.5	64.2	73.2	0.186

The % represents those who agreed for the specific theme. Data are presented as %. BM, breast milk; BMB, breast milk bank; HIV, human immunodeficiency virus; NEC, necrotising enterocolitis.

Table 3 Knowledge and attitudes of the nurses/midwives (with/without advanced lactation training) towards pasteurised donated breast milk

Theme: pasteurised donated breast milk	Advanced lactation training			P-value
	Overall (n = 291)	No (n = 273)	Yes (n = 18)	
Increases risk of infection	5.8	6.1	1.9	0.828
Increases risk of HIV	9.3	9.5	5.6	0.894
Decreases risk of NEC	84.2	83.9	88.9	0.818
More nutritious	79.8	78.7	94.5	0.190
Decreases immunological benefits	34.4	33.3	50	0.234
Decreases risk of allergies	53.3	51.7	77.8	0.057
Preferred over formula	82.7	82.7	83.4	0.806
For preterm	76.2	75.6	85.2	0.522
For term	44.7	43.9	55.6	0.470
Donating BM is important	90.7	90.5	94.4	0.894
Setting up BMB is justified	71	70.6	77.8	0.701
BMB are safe and trustworthy	73.2	72.8	88.8	0.223

The % represents those who agreed for the specific theme. Data are presented as %. BM breast milk; BMB, breast milk bank; HIV, human immunodeficiency virus; NEC, necrotising enterocolitis.

whereas only 52.2% of the doctors and 71% of the nurses/midwives thought that setting up a BMB was justifiable ($P = 0.005$).

Responses of nurses/midwives with advanced lactation training versus without

There were no significant differences between the opinions of nurses/midwives with advanced lactation training versus those without one (Table 3).

Discussion

Our survey shows that the practice of BM donation, especially for preterm infants, is supported to varying degrees by HCPs. We found that the trend is that nurses feel more strongly for the benefits of PDBM compared with doctors. These findings are not surprising. A study by Hellings in 2004 revealed that paediatric nurse practitioners and nurse-midwives seemed to have a better understanding of the benefits of breastfeeding than their paediatrician colleagues.²¹ Furthermore, earlier research found that paediatricians have significant educational needs in the area of breastfeeding management.^{22,23}

The significantly higher number of years worked in their current position of nurses/midwives compared with doctors and also additional comments made by the respondents suggest that some nurses/midwives have had previous experiences with BMBs prior to their closure in the 1980s or in other parts of the world and have viewed them positively. Furthermore, the sample of nurses/midwives contained only three males, while over 61% of the doctors in the survey were males. A gender difference in opinions of BMBs may have played a prominent role in the difference between doctors and nurses. Other studies showed some evidence that female HCPs might have increased confidence and knowledge about breastfeeding and lactation topics.^{24–27}

Several respondents were concerned about not being up-to-date with the latest research in regard to the effects of pasteurisation on donated BM. These concerns correspond with a study performed in Turkey, which found nurses had a certain knowledge deficit regarding newborn feeding practices.²⁸ Many HCPs are inadequately trained in the area of breastfeeding and BM and rely on personal experiences.²⁹ Furthermore, our study showed an overall median (interquartile range) of 12 (11–14) respondents who did not answer one or more of the questions in the survey. This may reflect a lack of knowledge about BMBs as commented by the respondents. This issue of inadequate knowledge and training in this area needs to be rectified when considering the establishment of BMBs. Insufficient information about PDBM or inadequacy of guidance and encouragement by HCPs could form a barrier for parents to consider PDBM.

To increase the level of safety of the donated BM, pasteurisation is the accepted practice to minimise risks of transmitting infectious pathogens.⁴ Heat treatment of BM can effectively inactivate HIV³⁰ and significantly reduce other disease-causing bacteria in the PDBM⁵ that may have come from the skin or breast pumps.³¹ There are, however, concerns expressed regarding the effects pasteurisation may have on donated BM. Pasteurisation may alter the nutritional and immunological composition of the milk, significantly reducing the protein, lysozyme and IgA concentrations^{8,31}; however, there are also many immunoglobulins, enzymes, hormones and growth factors that remain unchanged or only slightly decreased.⁴ With the increased nutrient requirement of preterm infants,^{14,17} PDBM will need to be fortified to provide sufficient nutrition for these infants.¹⁷

In comparison with raw unpasteurised BM, infants fed with PDBM have increased rates of infection and slightly slower growth rates.^{3,31} However, the rates of NEC and infections in PDBM-fed infants are still found to be lower than that of infants given preterm formula.^{5,12} This has been shown by observational studies that also reveal an increased feed intolerance

compared with preterm infants fed with BM.^{6,8,32} Furthermore, systematic reviews and clinical trials have demonstrated a statistically significantly higher incidence of NEC in formula-fed infants (relative risk 2.5 (95% confidence interval, CI 1.2–5.1), number needed to harm 33 (95% CI 17–100)) when compared with PDBM.³³

Another main concern when considering establishing a BMB is the considerable set-up and maintenance costs. The process of screening donors, pasteurising, storing and shipping of PDBM all carry a significant cost.³ However, these costs are easily offset by the eventual decreased burden of the aforementioned conditions.^{34,35} Although fortification of PDBM to meet the increased nutritional requirements of preterm infants^{4,36} will add to the cost,¹⁷ this does not add extra burden as fortification of maternal BM is now standard practice in NICUs. Furthermore, infants with faster gastrointestinal maturation and decreased incidence of complications associated with formula feeding will likely require a shorter hospital stay⁵ and, thus, further reducing costs.⁴

We acknowledge that our relatively low response rate may have had an effect on these results. However, our study still found a clear tendency to positively support BMBg. The Likert scale used in our survey is also known to have an acquiescence and naysaying bias – the inclination to agree (acquiescence) or disagree (naysaying) with a statement when there is doubt.³⁷ However, we have tried to minimise this bias by using an equal number of questions that both support and disagree with BMBg. Social desirability bias is answering in a way acceptable to what is socially expected rather than responding naturally³⁸ and may have had an effect on the survey also. However, this bias is minimised by the anonymity of the respondent.

Although generally positive, the opinions about BMBg differ widely. Before considering establishing a BMB and being able to educate parents, sufficient and standardised education is required for HCPs who will be responsible for educating and encouraging mothers to breastfeed or use PDBM as the next alternative. Further research and collaboration with HCPs are needed to achieve a consistent approach towards BMBg in NICUs and ensure the anticipated cost benefits eventuate.

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Melbourne; Monash Medical Centre, Melbourne; Royal Children's Hospital, Melbourne; Royal Women's Hospital, Melbourne; Royal Hobart Hospital, Hobart; Flinders Medical Centre, Adelaide; Women's and Children's Hospital, Adelaide; King Edward Memorial Hospital for Women, Perth; Princess Margaret Hospital for Children, Perth; Neonatology Clinical Care Unit, Perth.

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Appendix I

Survey of knowledge and attitudes of health care professionals towards pasteurised donated breast milk (PDBM) and breast milk banking (BMBg)

Section 1:

1. Are you? Female ☐ Male ☐

2. Age:
3. Completed Highest Level of Education:
 - ☐ Diploma
 - ☐ Bachelor Degree (Including Honours)
 - ☐ Master's Degree
 - ☐ PhD
 - ☐ Other – Please specify:
4. Occupation/Position (tick all that apply):
 - ☐ Midwife (including midwife students)
 - ☐ Nurse (including nursing students)
 - ☐ Lactation Consultant
 - ☐ Staff Specialist – Neonatologist
 - ☐ Staff Specialist – Paediatrician
 - ☐ Trainee – Neonatology
 - ☐ Trainee – Paediatrics
 - ☐ Other – Please specify:
5. Years working in above mentioned position:
6. Place of work:
 - ☐ Canberra Hospital
 - ☐ Other Australian Hospital
 - ☐ New Zealand
7. I work in: (select all that apply)
 - ☐ Antenatal Ward
 - ☐ Antenatal Clinic
 - ☐ Postnatal Ward
 - ☐ Postnatal Clinic
 - ☐ Special Care Nursery
 - ☐ Neonatal Intensive Care Unit (NICU)
 - ☐ Other – Please specify:

It is helpful to gather information regarding your ethnicity and religion to find if these influences might affect one's view's regarding breast feeding. If you feel uncomfortable answering these questions, please skip the following two questions and move on to the following page.

8. What is your ethnicity?

9. What is your religion?

Section 2:

Please note that all instances of 'donated breast milk, PDBM' in this survey refer to donated breast milk pasteurised and stored according to Breast Milk Bank Standards.

1. I am aware there are breast milk bank services in Australia and New Zealand.
 - ☐ Yes ☐ No
2. Donated breast milk will increase the risk of infection and sepsis for infants.
 - ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
 - ☐ Strongly Agree
3. There is an increased risk of necrotising enterocolitis in infants given formula milk over donated breast milk.
 - ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
 - ☐ Strongly Agree
4. Infants can contract disease such as HIV from donated breast milk.
 - ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
 - ☐ Strongly Agree
5. Breast milk is more nutritious for infants than formula milk.
 - ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
 - ☐ Strongly Agree

6. Donated pasteurised breast milk does not provide the same immunological benefits when compared to non-pasteurised breast milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
7. Donated breast milk will increase the risk of infants having allergies.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
8. Breast milk donation in Australia and New Zealand is trustworthy and safe.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
9. Infants risk contracting cytomegalovirus (CMV) from donated breast milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree

Section 3:

Please note that all instances of 'donated breast milk, PDBM' in this survey refer to donated breast milk pasteurised and stored according to Breast Milk Bank Standards.

1. Donated breast milk is the best option for premature infants and formula milk should only be considered in extreme circumstances.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
2. There is too little evidence supporting donated breast milk over formula milk to justify establishing a breast milk bank.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
3. It is important for premature infants to be given donated breast milk and only supplemented with formula milk if nutrition is insufficient.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree

4. The costs of setting up and maintaining a breast milk bank outweigh the benefits.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
5. Donating breast milk is important to help others who do not have enough breast milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
6. Infants are better off with formula milk as it is more nutritious than donor breast milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
7. I would encourage all mothers to consider donated breast milk prior to formula milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
8. I would encourage mothers of term infants to consider donated pasteurised breast milk prior to formula milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree
9. I would encourage mothers of preterm infants to consider donated pasteurised breast milk prior to formula milk.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree
☐ Strongly Agree

Please provide any further comments that will be helpful to further this research:

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Thank you once again for your participation in this survey.