

## Short Communication

## Development of the breast milk expression experience measure

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**Abstract**

Exclusive breastfeeding provides optimal nutrition through 6 months. Recent research has shown that milk expression may affect breastfeeding duration. A woman's experience with milk expression might mediate the effect of milk expression on breastfeeding duration. The objective of this study was to develop a measure to evaluate women's experiences of expressing milk. Based on the available literature, we developed a brief measure of the Breast Milk Expression Experience (BMEE) assessing three dimensions: (1) social support for milk expression; (2) ease of learning how to express milk; and (3) personal experiences of milk expression. All items used 1–5 Likert scales, with higher scores indicating better experiences. We administered the items immediately after expression to 68 mothers who expressed milk post-partum. We evaluated this measure for reliability using Cronbach's alpha. Mothers completing the BMEE were 57% primiparous with 75% vaginal births. The BMEE demonstrated appropriate reliability with a Cronbach's alpha of 0.703 for the summary index and 0.719–0.763 for social support, learning experience and personal experience subscales. The BMEE also indicated good predictive validity; of the six mothers who had a mean score <3 on the 11-item scale post-partum, two (33.3%) were expressing breast milk at 1 month, compared with 37 (80.4%) of the 46 mothers who had a mean score ≥3 on the 11-item scale post-partum ( $P = 0.012$ ). The BMEE is a promising measure of milk expression experience in this population. Use of this measure may allow improved understanding of women's experiences expressing milk.

**Keywords:** breastfeeding, lactation, breast milk expression, breastfeeding duration, breastfeeding knowledge, breastfeeding support.

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**Introduction**

Breastfeeding reduces the incidence of many infectious diseases in infancy, including gastroenteritis, lower respiratory tract infection and enteroviruses (Beaudry *et al.* 1995; Kramer *et al.* 2003; Quigley *et al.* 2007; Sadeharju *et al.* 2007). In addition, formula feeding is known to increase the risk of sudden infant death syndrome, allergic disease, otitis media and

eczema, and reduces maternal risk of breast and ovarian cancer (Kramer *et al.* 2001; Collaborative Group on Hormonal Factors in Breast Cancer 2002; Danforth *et al.* 2007; Ip *et al.* 2007). The many benefits of breastfeeding and risks of formula feeding for mothers and infants have made improving breastfeeding duration a goal of the World Health Organization, the Centers for Disease Control and many other public health agencies (Gartner *et al.* 2005;

Centers for Disease Control 2011; World Health Organization 2011). Although 73% of women in the United States initiated exclusive breastfeeding in 2004–2008, only 42% were still exclusively breastfeeding at 6 months (MMWR Morb Mortal Wkly Rep 2010).

Breast milk expression may be recommended by providers in the early post-partum period due to latch problems, engorgement or other maternal or infant conditions (Riordan 2005; Labiner-Wolfe *et al.* 2008; Lawrence & Lawrence 2011). However, Schwartz *et al.* (2002) found that mothers who expressed breast milk in the first three weeks were more likely to discontinue breastfeeding by 3 months of age, and Chapman *et al.* (2001) found that mothers who pumped in the immediate post-partum period had a trend towards shorter breastfeeding duration than mothers who did not pump. Our group recently conducted a randomized trial comparing breast pumping to hand expression among mothers of poorly feeding newborns, and found that mothers randomly assigned to hand expression in the newborn period were more likely to be breastfeeding at 2 months than mothers randomly assigned to breast pumping in the newborn period (Flaherman *et al.* 2011). Improved understanding of maternal experience of milk expression might allow identification of strategies to improve breastfeeding duration.

Previous research into maternal experience of milk expression has focused on the consumer characteristics of breast pumps. Fewtrell *et al.* (2001) reported a 5-item questionnaire regarding the consumer characteristics of pumps (ease of use, adequacy of suction, comfort, pleasant to use and overall opinion of pump), and Hopkinson & Heird (2009) compared two electric pumps, using an adapted version of the Fewtrell scale. As social support, learning experience and other personal experiences of expressing milk have been shown to be important in improving breastfeed-

ing duration (Blyth *et al.* 2002; Rempel 2004), a more comprehensive measure of milk expression experience could inform strategies to improve breastfeeding duration. An optimal measure would also assess hand expression, which is widely practiced as well. A recent Cochrane collaborative review of methods of milk expression found that ‘no study reported data on maternal satisfaction in a useable way for this review’. (Becker *et al.* 2008).

We report here the development and performance characteristics of the Breast Milk Expression Experience (BMEE), an investigator-developed questionnaire we used to quantify maternal social, personal and learning experiences of breast milk expression.

## Methods

### Development of the BMEE

From a review of the literature on breast milk expression and based on our clinical experience, we identified three conceptual areas relevant to maternal experience: social support, learning experience and personal experience. Social support was defined as mother’s perception of informational, emotional and physical assistance with breast milk expression from close social connections. Learning experience was defined as the mother’s perception of the experience of developing physical actions and tasks necessary for successful breast milk expression. Personal experience was defined as a mother’s subjective experiences regarding the practice of breast milk expression and included attitudes related to successful breast milk expression.

### Item development

From the literature on these content areas, 17 items were generated by two of the authors (VF and BG),

### Key messages

- Women’s experiences of milk expression may impact breastfeeding duration.
- Social, personal and learning experiences may contribute to women’s experiences of milk expression.
- The Breast Milk Expression Experience (BMEE) is a reliable measure of women’s experiences expressing breast milk and shows good predictive validity.

who incorporated items that represented all aspects of each content area using a Likert-scale format with five choices per item (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree). Items were written to accommodate both women who were pumping to express breast milk and women who were hand expressing breast milk and were verbally administered by the investigator to each mother with the wording appropriate for her method of expression. To determine content validity, these 17 items were reviewed by an interdisciplinary panel of four content experts. To determine face validity, these 17 items were then tested in six post-partum women. One item was dropped, and minor wording changes were made as a result of this preliminary assessment.

### Test sample

A study doctor or nurse then administered these 16 items verbally shortly after breast milk expression to 68 mothers enrolled in a randomized controlled trial comparing breast pumping to manual milk expression (Flaherman *et al.* 2011). Mothers were recruited at the University of California San Francisco Medical Center, Kaiser Permanente South Sacramento and Stanford University Medical Center and had healthy term infants 12–36 h old who would not latch or would not suck well when latched. Excluded were mothers who were less than 18 years old or did not speak English, had a history of breast surgery other than cyst removal and mothers whose infants were <37 weeks gestation, <2000 g birthweight or required Level II or Level III care. Mothers who reported a history of low milk supply were excluded from the randomized trial because the purpose was to assess the effect of method of expression on milk volume, and differences in volume of expressed milk would be more difficult to detect if the sample included mothers with a history of low milk supply. Informed consent was obtained from all subjects. This study was approved by the University of California, San Francisco Committee on Human Research, the Kaiser Permanente Institutional Review Board and the Stanford University Institutional Review Board.

### Testing hypothesized scales and internal consistency reliability

Internal consistency reliability of the 16-item BMEE was assessed using Cronbach's alpha coefficient. We used the corrected item-total correlation coefficient and the alpha estimate when the item was dropped from the scale to assess item performance. Poorly performing items were defined as items that had an item-total correlation of less than 0.30. Items associated with negative experiences were reverse coded for the overall scale as well as for the subscales.

### Predictive validity

Using chi-square analysis, we used a dichotomous predictor of having a mean score  $\geq 3$  (mean response 3 = 'neither agree nor disagree') on the total scale to assess predictive validity of the BMEE for breast milk expression at 1 month. As items were coded so that positive scores were associated with positive experiences, mothers with a mean score <3 had a negative experience in the aspects of breast milk expression being assessed.

## Results

Of 68 mothers enrolled in the trial, 35 were assigned to the hand expression group, and 33 were assigned to the bilateral electric breast pump group. All 68 (100%) completed the entire personal experience subscale, 67 (98.5%) completed the entire learning experience subscale and 66 (97.1%) completed the entire social support subscale. Of these 68 mothers, 40 (58.8%) were primiparous and 28 (41.2%) had older children; 51 (75%) had vaginal births and 17 (25%) had Caesarean births. Additional description of the cohort can be found in Table 1.

### Reliability

Of the original 16 items, five items were dropped because their item-total correlation was less than 0.3. These five items were: '(Pumping/Hand expression) is embarrassing'; 'I don't want anyone to see me (pumping/hand expressing)'; 'I want to be alone to

**Table 1.** Cohort characteristics

Cohort characteristics ( <i>N</i> = 68)	
Primiparous*	40 (58.8%)
Vaginal delivery*	51 (75%)
Male infant*	29 (42.6%)
Gestational age (weeks) <sup>†</sup>	39.3 ± 1.2
Birth weight (g) <sup>†</sup>	3405 ± 524
Maternal age (years) <sup>†</sup>	30.2 ± 6.4
Infant age (hours) <sup>†</sup>	20.9 ± 7.3

\**n* (%). <sup>†</sup>mean (standard deviation).

(pump/hand express)'; 'The instructions for (using the pump/hand expressing) are clear'; '(Pumping/Hand expression) is painful'. The remaining 11 items had a Cronbach's alpha coefficient of 0.703. (Table 2) The 5-item personal experience subscale had an alpha of 0.719, the 4-item learning experience subscale had an alpha of 0.763 and the 2-item social support subscale had an alpha of 0.736. None of these alpha coefficients increased by more than 0.10 if any of the retained items were deleted. Throughout the analysis, items describing negative experiences were reverse-coded for analysis. Thus, a high score on the three scales indicated positive support and experiences.

### Predictive validity

At 1-month follow up, 39 (75%) of 52 breastfeeding mothers were still expressing breast milk. Forty-six of the 52 (88.5%) mothers who were breastfeeding at 1 month had an 11-item scale mean value  $\geq 3$  ('neither agree nor disagree') on the BMEE at the time of enrolment, and these mothers were more likely to be expressing breast milk at 1 month than the six (11.5%) mothers who had a mean value  $< 3$  on the BMEE at enrolment. Of these six mothers who had a mean score  $< 3$  on the 11-item scale, two (33.3%) were expressing breast milk at 1 month, compared with 37 (80.4%) of the 46 mothers who had a mean score  $\geq 3$  ( $P = 0.012$ ).

### Discussion

Our results show that the BMEE is a reliable measure for estimating women's experiences with milk expres-

sion and can be used both for mothers who are breast pumping and for those who are hand expressing, expressing milk from the breast by hand without the use of any equipment. In our study, the BMEE demonstrated good internal consistency and good predictive validity. We believe our results are important because a reliable measure of maternal milk expression experience will allow future research to examine whether maternal experiences of milk expression modify the effects of early milk expression on eventual breastfeeding duration (Chapman *et al.* 2001; Schwartz *et al.* 2002; Flaherman *et al.* 2011).

If maternal experience does modify the effect of early milk expression on eventual breastfeeding duration, use of the BMEE may also allow development of approaches to improve maternal experience of early milk expression. For example, recent data suggest that prevalence of breast pumping during early infancy is high (Labiner-Wolfe *et al.* 2008; Uriell *et al.* 2009; Geraghty & Rasmussen 2010), and the BMEE could be used to compare the experiences of mothers who pump with experiences of mothers who hand express and ascertain whether these practices are beneficial for mothers and infants. Studying maternal experience of expressing milk might also reveal modifiable factors impacting breastfeeding decisions, such as privacy, timing and method of expression. These factors might vary for different racial, ethnic and cultural populations of breastfeeding mothers, and might be different for primiparous or post-Caesarean mothers.

In addition, further development of the BMEE might allow use of this measure in the clinical setting to identify potentially modifiable factors related to breast milk expression for an individual mother. For example, some mothers might have low scores in the personal experience subscale and benefit from increased privacy or comfort while expressing, while others might have low scores on the learning experience subscale and benefit from receiving additional provider teaching. Use of the BMEE could optimize maternal experience of breast milk expression and promote optimal breastfeeding outcomes for mothers who need or want to express breast milk.

Our study has some important limitations. First, our study assessed the BMEE among inpatient post-

**Table 2.** Characteristics of the Breast Milk Expression Experience measure and subscales

Scale	# of items	Cronbach's alpha	Range of scale scores	Mean scale scores $\pm$ SD
Social support*	2	0.7357	1–5	3.95 (0.93)
Personal experience <sup>†</sup>	5	0.7192	1–3.6	2.67 (0.66)
Learning experience <sup>‡</sup>	4	0.7633	1.5–5	3.80 (0.74)
Summary score	11	0.7032	1.55–4.45	3.41 (0.52)

\*Social support: (1) Family members support (pumping/hand expression); (2) My partner supports (pumping/hand expression).

<sup>†</sup>Personal experience: (3) I feel peaceful when (pumping/hand expressing); (4) I look forward to (pumping/hand expressing); (5) I enjoy (pumping/hand expressing); (6) (Pumping/hand expressing) is something I could do easily while doing other things; (7) (Pumping/hand expression) feels awkward.

<sup>‡</sup>Learning experience: (8) (Pumping/hand expressing) is easy to (use/do); (9) I had no problems figuring out how to (use the pump/hand express colostrum/milk); (10) I could easily teach (the pump to someone/someone how to hand express colostrum/milk); (11) I could easily show someone how to (use the pump/hand express).

partum mothers. Therefore, our findings may not apply to mothers expressing breast milk in later infancy. Second, our study assessed the BMEE only for healthy term infants who were not breastfeeding well. Our results may not be applicable to mothers who are expressing breast milk for other reasons, such as prematurity or maternal–infant separation. Third, our study did not have the statistical power to report on construct validity. However, we demonstrated good predictive validity, as mothers with positive scores on the BMEE were more likely to be expressing breast milk at 1 month. Fourth, our results reflect the use of the BMEE in an English-speaking population in Northern California, where both breast pumps and hand expression are available. Investigators contemplating the use of this tool in other locations, particularly in the developing world, should consider their population carefully and determine whether any adaptations should be made.

## Conclusion

The 11-item BMEE is a reliable measure of maternal experience of expressing breast milk and shows good predictive validity. This measure could be used in future research to assess mothers' experiences of breast milk expression and the impact of these experiences on future expression practices and breastfeeding duration. In addition, further development of the BMEE might allow clinical use of the measure to determine optimal approaches to breast milk expres-

sion for individual mothers. Use of the BMEE will allow assessment of maternal experience of breast milk expression for mothers choosing or needing to express breast milk.

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## Conflicts of interest

The authors declare that they have no conflicts of interest.

## Contributions

VJF conceived and designed this study, conducted data analysis and drafted the manuscript. BG participated in the study design, data analysis and editing of final manuscript. CS participated in the study design, data analysis and editing of final manuscript. ALS participated in the study design, data analysis and editing of final manuscript. JA participated in the study design, data analysis and editing of final manuscript. KAL supervised the study design, data analysis and drafting of the final manuscript.



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