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Pediatrics 2006;117:e67-e75

DOI: 10.1542/peds.2005-0267

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://www.pediatrics.org/cgi/content/full/117/1/e67>

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American Academy of Pediatrics

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Lactation Counseling for Mothers of Very Low Birth Weight Infants: Effect on Maternal Anxiety and Infant Intake of Human Milk

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The authors have indicated they have no financial relationships relevant to this article to disclose.

ABSTRACT

OBJECTIVE. Although it is well documented that breastfeeding promotes health and development of very low birth weight (VLBW) infants, lactation initiation among mothers of VLBW infants is low. Mothers are anxious about the health of their children, and medical staff may be reluctant to promote breastfeeding out of concern for increasing that anxiety. Therefore, the purpose of this study was to examine whether mothers of VLBW infants who initially planned to formula feed were different in terms of their level of anxiety and maternal stress compared with mothers who had planned to breastfeed their infants. The aims of this study were to (1) determine whether counseling mothers of VLBW infants who had initially planned to formula feed on the benefits of breast milk would increase their stress and anxiety levels, (2) assess whether mothers who initially had not planned to breastfeed changed their plans after counseling to provide breast milk, and (3) measure the amount of breast milk expressed by mothers who initially planned to formula feed. Their results were compared with those of mothers of VLBW infants who initially planned to breastfeed.

METHODS. Initial plan to breastfeed (initial breastfeed group [IBG]; $n = 115$) or formula feed (initial formula feed group [IFG]; $n = 81$) was determined before counseling. All participants received counseling on infant health benefits, collection and storage of breast milk, and breast pump procurement. Maternal anxiety was measured using the State-Trait Anxiety Inventory (STAI), which was administered to mothers before and after counseling and every 2 weeks until infant discharge. Maternal stress was measured after counseling with the Parental Stressor Scale: NICU. Infant breast milk intake was measured throughout hospitalization. An exit questionnaire that pertained to the perceived benefits and efforts of expressing milk was administered close to the time of infant discharge.

RESULTS. After lactation counseling, 100% of the IBG and 85% of the IFG initiated breast milk expression (used the electric breast pump in the hospital) for a total lactation initiation rate of 94%. After adjustment for the mothers who initiated

www.pediatrics.org/cgi/doi/10.1542/peds.2005-0267

doi:10.1542/peds.2005-0267

Key Words

very low birth weight, lactation, anxiety, counseling, human milk

Abbreviations

VLBW—very low birth weight
IFG—initial formula feed group
IBG—initial breastfeed group
STAI—State-Trait Anxiety Inventory
PSS-NICU—Parental Stress Scale: Neonatal Intensive Care Unit
WIC—Special Supplemental Nutrition Program for Women, Infants and Children

Accepted for publication Jul 5, 2005

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milk expression but did not provide any breast milk, the lactation initiation rate for the entire group was 84%. Non-Hispanic black mothers and Non-Hispanic white mothers initiated milk expression at similarly high rates (95% vs 93%). Also, milk expression initiation was similar for low-income and non-low-income mothers (95% vs 92%). IFG and IBG STAI and Parental Stressor Scale: NICU scores were not significantly different, and there were no significant differences between groups in the change in anxiety after counseling. In addition, the mean difference scores (after counseling – before counseling) for STAI anxiety “state” were not significantly different between groups, even when controlling for “trait” anxiety. State anxiety declined during the first 6 weeks of infant hospitalization in a similar manner for both groups. Maternal trait but not state anxiety scores were inversely correlated with total infant breast milk intake. Breast milk intake (mL/kg per day) was greater in the infants of mothers in the IBG compared with the IFG at each week during the first month and for their entire hospital stay. Infant breast milk intake increased from weeks 1 to 3 in both groups and continued to rise in the fourth week for the IBG. However, breast milk intake declined at week 4 for the IFG. IBG infants received breast milk for 83% of the total fed hospital days (days that feedings were given) compared with 44% of total fed days for the IFG. The proportion of enteral intake that was breast milk was also greater for the IBG compared with IFG during the first 4 weeks and for the total hospitalization. However, the mothers in IFG were able to provide at least 50% of their infants’ enteral intake for the first 3 weeks, 48.8% for the fourth week, and 32.8% of the enteral intake for the entire hospitalization. Infants of low-income women received significantly lower amounts of breast milk than did infants of non-low-income mothers. Race and income accounted for 36% of the variance in breast milk intake. Of the 184 mothers who initiated breast milk expression, 72 (39%) completed the exit questionnaire. Infant health benefits were the most common reasons cited by both groups for expressing milk. The most common reasons that both groups reported for ceasing milk expression were (1) low milk supply, (2) returning to work or school, and (3) inability to pump as often as needed. Almost all of the mothers reported that pumping was worth the effort (IBG 100%, IFG 87%), and 100% said that they were glad that the staff helped them with milk expression.

CONCLUSION. Counseling mothers of VLBW infants increases the incidence of lactation initiation and breast milk feeding without increasing maternal stress and anxiety.

IN THE PAST decade, several studies have documented better health outcomes for very low birth weight (VLBW, ≤ 1500 g birth weight) infants who are fed with

breast milk.¹⁻⁴ Previously, few mothers were encouraged by neonatal intensive care providers to provide breast milk for their premature infants if they had intended to formula feed. Because breastfeeding was not viewed as highly beneficial or necessary, mothers who chose to breastfeed were supported primarily for the emotional benefits that they would supposedly derive from “being able to do something” for their preterm infant.⁵ In recent years, mounting evidence has made it clear that providing breast milk promotes health and development of VLBW infants.² The incidences of sepsis,⁶⁻⁹ necrotizing enterocolitis,^{1,9,10} feeding intolerance,^{7,9} retinopathy of prematurity,³ and developmental delay¹¹⁻¹⁴ are lower in VLBW infants who are fed breast milk. This evidence has led the American Academy of Pediatrics to state that breast milk is the preferred nutrient substrate for both term and preterm infants.¹⁵

This change in emphasis toward providing breast milk has meant that a concerted effort needs to be made to better educate, inform, and motivate mothers to express their milk for their infants. Despite the health benefits of breast milk for VLBW infants, in the United States, lactation initiation among mothers who deliver prematurely is lower than among mothers who deliver at term.¹⁶ Precise incidence rates of lactation initiation among mothers of VLBW infants are unknown because the data on these infants typically have been grouped into the much healthier low birth weight category (all infants <2500 g).¹⁷ It is known that the incidence of breastfeeding among mothers of VLBW infants is negatively correlated with infant gestational age, socioeconomic status of the mother, and prenatal smoking. Higher maternal age and educational attainment, being married and white, and having private insurance are positively associated with breastfeeding preterm infants.^{18,19}

Mothers of hospitalized infants report difficulty with milk expression, which leads to insufficient milk production.^{20,21} Milk production insufficiency is often blamed on stress, as emotional disturbances have been found to interfere with oxytocin release that is responsible for the milk ejection reflex.²² However, this has not been studied adequately in mothers who deliver prematurely. In instances when there is a failure to achieve or maintain lactation, mothers of preterm infants have identified inadequate equipment, inconsistent advice and assistance,^{23,24} and low social support²⁵ as causes. In addition, prolonged hospitalization and infant medical complications are associated with discontinuing milk expression before infant discharge.¹⁸ These findings suggest that lactation initiation and maintenance are especially difficult for mothers of VLBW infants.

There is evidence that counseling mothers of VLBW infants is effective at increasing lactation success.^{20,26,27} One study found that prenatal consultation with a neonatologist, emphasizing the importance of breast milk,

significantly increased the length of breast milk feeding both in hospital and after discharge in preterm infants compared with a matched case-control group of infants whose mothers did not receive the prenatal consultation.²⁶ Pietschnig et al²⁰ measured breastfeeding rates of VLBW infants before and after the introduction of professional support from International Board Certified Lactation Consultants and found that the breastfeeding rate before availability of professional support was 21.5% and increased to 62.5% after the support was instituted. Meier et al^{17,27} demonstrated that providing an electric pump and lactation support to every mother throughout the infant's hospitalization eliminated the differences in lactation initiation and duration that have been reported among low-income and minority women.

Despite the proven health benefits of breast milk and studies showing the effectiveness of evidence-based lactation interventions, the lactation initiation rate of women with VLBW infants remains low. Another factor contributing to this may be the reluctance of medical staff to actively promote milk expression for mothers who state that they plan to formula feed their infants. They are concerned that these mothers will feel guilty or coerced and then may experience even more stress and anxiety if they are unable to establish and maintain milk expression. Therefore, mothers who state that they plan to formula feed may never be counseled on the benefits of breast milk for their VLBW infants.

There is evidence, however, that informing mothers that their milk is important for their VLBW infants does not make them feel guilty or coerced. Miracle et al²⁸ conducted semistructured interviews with 21 mothers of VLBW infants who initially selected formula feeding but changed their decision to express their milk after counseling was received from a nurse, physician, or lactation expert about the health benefits of breast milk. Mothers reported that the decision to formula feed was based on the absence of role models for breastfeeding, concern for pain and other lifestyle inconveniences, and lack of knowledge about the importance of their milk for their infants. All of the mothers provided breast milk for ≥ 30 days and reported benefits to themselves and to their infants. None of the mothers reported that they felt coerced or pressured in any way about their initial or changed feeding decision. These results suggest that lactation counseling is effective at increasing lactation initiation and breast milk feeding of VLBW infants without mothers' feeling coerced.

The purpose of this study was to examine whether mothers of VLBW infants who initially planned to formula feed were different in terms of their level of anxiety and maternal stress compared with mothers who had planned to breastfeed their infants. The aims of this study were to (1) determine whether counseling mothers of VLBW infants who had initially planned to formula feed on the benefits of breast milk would increase

their stress and anxiety levels, (2) assess whether these mothers who initially had not planned to breastfeed changed their plans after counseling to provide breast milk, and (3) measure the amount of breast milk expressed by mothers who initially planned to formula feed. Their results were compared with those of mothers of VLBW infants who initially planned to breastfeed.

METHODS

Sample and Setting

Mothers and their VLBW infants who were delivered at Forsyth Medical Center (Winston-Salem, NC) between May 2001 and August 2003 were studied during the infants' NICU stay. Forsyth Medical Center is a referral center for women who are at high risk for obstetric complications and has a level 4 NICU. Mothers who were 18 years or older and able to speak and understand English were recruited when their infant's birth weight was between 700 and 1500 g. Mothers for whom it was determined had engaged in illicit drug use during pregnancy or were positive for HIV were excluded from participation. The institutional review boards at Wake Forest University School of Medicine Baptist Medical Center, Forsyth Medical Center, and the University of North Carolina at Greensboro approved the study protocol.

Research Design

Mothers were approached within 3 days after delivery about the study and asked to participate. When they agreed, written informed consent was obtained. Mothers of twins and triplets were included, and all infants with birth weights ≥ 700 g and ≤ 1500 g were enrolled. The study involved 2 groups: the initial formula feed group (IFG) and the initial breastfeed group (IBG). Group assignment was made on the basis of the mothers' indication at admission that either they planned to formula feed only or had not yet made a decision (assignment to IFG) or they planned to breastfeed or breastfeed and formula feed (assignment to IBG). The IBG was the comparison group. Maternal feeding choice, English-speaking status, medical history, and insurance status were obtained from the labor and delivery admission records. A mother was determined to be of low income when she was eligible for Medicaid.

After enrollment, the State-Trait Anxiety Inventory (STAI)²⁹ was administered as well as a questionnaire to obtain demographic data. The STAI is a self-evaluation inventory that consists of 2 separate 20-item scales: the "state" anxiety scale and the "trait" anxiety scale. The state anxiety scale is designed to assess the level of relatively transient situation-related stress perceived in a particular situation. The trait anxiety scale is designed to measure the relatively stable long-term anxiety proneness in the individual. The trait anxiety scale was admin-

istered once before counseling. The STAI has been subjected extensively to validity and reliability testing.²⁹

After participants completed the state anxiety and trait anxiety portions of the STAI, board-certified lactation consultants counseled study participants using a standardized script on the benefits of breast milk for premature infants, the procedure for collection and storage of milk, transporting the milk to the NICU, maternal diet, medications, and effects of smoking and birth control methods on lactation. Mothers who smoked were counseled about the negative effect of smoking on milk supply and were encouraged to limit smoking as much as possible. Emphasis was placed on provision of breast milk rather than breastfeeding. After counseling, the state anxiety portion of the STAI was administered within 12 to 24 hours of counseling and every 2 weeks until infant discharge. The Parental Stressor Scale: Neonatal Intensive Care Unit (PSS-NICU),³⁰ a self-report questionnaire designed to assess parental perceived stress related to the psychosocial and environmental aspects of the NICU, was also administered after counseling.

Mothers who decided to initiate lactation were given assistance with breast milk expression using a Medela Classic breast pump and a double breast pump kit (Medela, Inc, McHenry, IL). Mothers were assisted with procurement of an electric breast pump with intermittent suction for use after they were discharged, through rental, through purchase, or from the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). The WIC programs supplied Medela Classic, Medela Lactina, or Ameda Egnell SMB electric pumps (Hollister, Inc, Libertyville, IL). Mothers who were not eligible for WIC and who stated that they could not afford an electric pump were provided with a Medela Classic electric pump free of charge. Mothers were followed by the lactation consultant and provided with ongoing support as needed throughout their infant's stay in the hospital.

Enteral feedings of mother's own breast milk or of preterm infant formula (Enfamil Premature Formula 24; Mead Johnson Nutritionals, Evansville, IN) when breast milk was not available were administered when the infant was determined to be stable by the attending neonatologist and advanced according to an established protocol. When infants were breastfeeding, the breast milk intake was determined by weighing the infants before and after feeding³¹ with scales (Scale-Tronix Pediatric Scale 4800; Scale-Tronix, White Plains, NY) that were accurate to 5 g. The intake of breast milk and formula was recorded throughout the hospitalization. Medical records of infants who had been transported to our referral hospital for subspecialty care, Brenner Children's Hospital, were also abstracted to obtain complete data regarding enteral intake. Data were averaged weekly for the first 4 weeks, then for the total hospital

stay to determine whether the participating mothers were able to initiate and maintain milk expression and also to determine the proportion of enteral feeding that was breast milk while infant feeding tolerance was established.

An exit questionnaire that pertained to the perceived benefits and efforts of expressing milk was administered close to the time of infant discharge. It was designed to determine maternal support for, perceived benefits of, and difficulties of breast milk expression. The quantitative questions used a 5-point, Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). One example of the rated questions, which represented an indicator of maternal support, was, "My family supported my pumping."

Statistical Analysis

Data were analyzed by using SPSS-PC software (SPSS, Chicago, IL). The differences between group characteristics were analyzed by using Student's *t* test or χ^2 analysis. To determine whether counseling mothers who had initially planned to formula feed increased their stress level, the difference scores (after counseling – before counseling) for STAI anxiety state were compared by group using Student's *t* test. The scores were analyzed further by analysis of covariance, using anxiety trait as a covariate. To determine whether anxiety state changed over time, repeated measures analysis of variance were used to analyze the state of anxiety scores for the first 4 administrations. STAI scores and infant intake of breast milk were correlated with Spearman rank-order correlation analysis. Mean breast milk intake of the infants of the IBG and IFG were compared using Student's *t* test. Intake was analyzed further by analysis of covariance, using as covariates the characteristics that were significantly different between groups. Multivariate analysis was used to determine differences in breast milk intake by race and income of the participants. The significance level was set at $P < .05$.

RESULTS

A total of 196 mothers participated in the study: 115 (59%) in the IBG with 132 infants and 81 (41%) mothers in the IFG with 91 infants. After lactation counseling, 100% of the IBG and 85% of the IFG initiated breast milk expression (used the electric breast pump in the hospital) for a total lactation initiation rate of 94%. Of mothers who initiated milk expression, 3 IBG and 12 IFG members did not continue to express breast milk after their discharge from the hospital, and their infants did not receive any breast milk. One infant died and 3 infants were transferred before receiving breast milk. After adjustment for the mothers who initiated milk expression but did not provide any breast milk, the lactation initiation rate for the entire group was 84%. The data on these mothers and their infants were in-

cluded in the analyses. The IBG mothers tended to be white ($P = .05$), had completed more years of education ($P = .001$), were more likely to be married ($P < .001$), were more likely to have private insurance ($P = .02$), and were more likely to have previously breastfed a child ($P = .02$) compared with the IFG (see Table 1). There were no differences in infant characteristics between groups.

Fifteen percent ($n = 12$) of the IFG did not change their decision after lactation counseling. These mothers were older than the IFG mothers who chose to express breast milk (29.3 ± 1.5 vs 25.6 ± 0.6 years; $P = .03$). Their infants had greater gestational ages at birth (30.1 ± 0.6 vs 28.6 ± 0.2 weeks; $P = .03$) and greater birth weights (1278 ± 62 vs 1093 ± 24 g; $P = .007$).

State-Trait Anxiety

The STAI anxiety state scores at each time point were within the normal range for all women aged 18 to 39 years (36.17 ± 10.96 ; see Table 2). There were no significant differences in trait or state of anxiety between groups. In addition, the mean difference scores (after counseling – before counseling) for STAI anxiety state were not significantly different between groups, even when controlling for trait anxiety (IFG: -2.44 ± 0.9 ; IBG: -2.43 ± 0.1 ; $P = .99$). State anxiety declined over time in a similar manner for both groups (IBG: $n = 72$; IFG: $n = 39$; repeated measures analysis of variance: $P < .001$). This analysis included only the first 4 administrations because including scores beyond week 4 would have greatly decreased the sample size as a result of the large number of hospital discharges during the second

TABLE 1 Characteristics of Study Participants

	IBG ($n = 115$)	IFG ($n = 81$)
Maternal characteristics		
Age, y ^a	26.9 ± 0.5	25.9 ± 0.2
Married, %	66 ^b	36
Ethnicity, n (%)		
Hispanic	2 (2)	0
Non-Hispanic		
White	70 (61)	38 (47)
Black	41 (36)	43 (53)
Asian	2 (2)	0
Low income, n (%) ^c	57 (50) ^b	54 (67)
Cesarean delivery, n (%)	59 (50)	51 (63)
Primigravida, n (%)	36 (31)	30 (37)
Education, y ^{a,d}	13.1 ± 0.2 ^b	12.0 ± 0.2
Previously breastfed, n (%) ^e	26 (26) ^b	9 (12)
Infant characteristics		
	($n = 132$)	($n = 91$)
Birth weight, g ^a	1143 ± 19.3	1117 ± 23.5
Gestational age, wk ^a	28.5 ± 0.2	28.7 ± 0.2
Female, n (%)	70 (53)	49 (54)

^a Values are means \pm SEM.

^b Significantly different, $P < .05$.

^c Medicaid eligible, no private insurance.

^d Excluded were 11 mothers in the IBG and 6 mothers in IFG who did not answer this question.

^e Excluded were 14 mothers in the IBG and 6 mothers in the IFG who did not answer this question.

TABLE 2 Mean \pm SEM Scores of PSS: NICU and STAI Scale

	IBG	IFG
PSS: NICU	2.2 ± 0.06 ($n = 110$)	2.1 ± 0.08 ($n = 77$)
Anxiety trait	37.4 ± 0.8 ($n = 114$)	38.9 ± 1.1 ($n = 77$)
Anxiety state (before counseling) ^a	44.5 ± 1.2 ($n = 113$)	43.1 ± 1.5 ($n = 77$)
Anxiety state (after counseling) ^a	41.9 ± 1.2 ($n = 110$)	40.8 ± 1.5 ($n = 65$)
Anxiety state (2 wk postpartum) ^a	37.4 ± 1.2 ($n = 95$)	36.9 ± 1.4 ($n = 68$)
Anxiety state (4 wk postpartum) ^a	36.2 ± 1.2 ($n = 73$)	33.2 ± 1.8 ($n = 41$)

Sample sizes different because questionnaires were not returned to researchers or infants were discharged.

^a Significantly different over time for both groups, repeated measures analysis of variance: $P < .001$.

month of life. Maternal trait but not state anxiety scores were inversely correlated with total infant breast milk intake ($r = -0.13$; $P = .01$).

PSS-NICU

The PSS-NICU scores were within the observed range for parents of newborns who required intensive care (2.6 ± 0.75) and were correlated with the STAI state scores after counseling, which was administered at the same time ($r = 0.38$; $P < .001$). There were no significant differences between IBG and IFG mean PSS-NICU scores (Table 2).

Breast Milk Composition of Enteral Intake

Twenty-five percent of all infants received $\geq 98\%$ of their enteral intake as breast milk. Among all infants, 57% of total enteral intake was breast milk and mean total dose of breast milk over the entire hospital stay was 61 mL/kg per day. When comparing breast milk intake of IBG with IFG, the IFG infants whose mothers did not initiate milk expression (ie, did not attempt to use a breast pump) were excluded from the analysis. When the mother attempted milk expression in the first 3 days of delivery but never expressed milk after discharge from the hospital ($n = 19$) or the infant died ($n = 1$) or was transferred ($n = 3$) before receiving breast milk, the infant was included in analyses on breast milk intake.

Breast milk intake (mL/kg per day) was greater in the IBG compared with the IFG ($P < .001$) at each week during the first month and for their entire hospital stay (Table 3). Infant breast milk intake increased from weeks 1 to 3 in both groups and continued to rise in the fourth

TABLE 3 Mean \pm SEM Breast Milk Intake

Hospital Time Interval	IBG, mL/kg per day (SEM)	IFG ^b , mL/kg per day (SEM) ^a
Week 1	18.6 ± 2.1 ($n = 128$) ^b	9.3 ± 2.0 ($n = 74$)
Week 2	69.5 ± 4.5 ($n = 121$) ^b	45.5 ± 5.9 ($n = 73$)
Week 3	96.2 ± 5.2 ($n = 116$) ^b	55.2 ± 7.3 ($n = 63$)
Week 4	106.8 ± 5.2 ($n = 109$) ^b	51.2 ± 8.0 ($n = 61$)
Total hospitalization	78.1 ± 3.6 ($n = 130$) ^b	36.9 ± 4.8 ($n = 76$)

Infants who received no enteral feedings for the entire week were excluded.

^a Includes only infants whose mothers initiated milk expression.

^b Significantly different from IFG: $P < 0.05$.

week for the IBG. Breast milk intake declined at week 4 for the IFG. The proportion of enteral intake that was breast milk was also greater for the IBG compared with IFG ($P < .001$) during the first 4 weeks and for the total hospitalization (Fig 1). However, the mothers in the IFG were able to provide at least 50% of their infants' enteral intake for the first 3 weeks, 48.8% for the fourth week, and 32.8% of the enteral intake for the entire hospitalization. IBG infants received breast milk for 83% of the total fed hospital days (days that feedings were given) compared with 44% ($P < .001$) of total fed days for the IFG. There was no difference in length of stay between the IBG and IFG (52.7 ± 29.6 [IBG] vs 47.7 ± 25 [IFG] days; $P = .2$). When controlling for differences between groups on income, maternal education, marital status, and previous breastfeeding experience, the difference in breast milk intake between groups was still significant. Thus, it seems that the initial decision to breastfeed was the strongest factor in determining the amount of breast milk that infants received.

To determine whether ethnicity and income had a role in maternal provision of breast milk, infants were grouped according to income status (Medicaid eligible equals low income) and race. Ninety-five percent of the non-Hispanic black mothers initiated milk expression, and 93% of the non-Hispanic white mothers initiated milk expression. Also, 95% of the low-income mothers initiated milk expression, and 92% of the non-low-income mothers initiated milk expression. However, non-Hispanic white infants received significantly more breast milk (expressed as a percentage of enteral intake) than did non-Hispanic black infants during the first and third weeks of life ($P < .05$; see Table 4). There were no differences during weeks 2 or 4. There was a trend toward a lower breast milk intake for non-Hispanic black infants for the total hospital length of stay ($P = .06$). Infants of low-income women received significantly lower amounts of breast milk at each time point except the second week of life. There was a significant interaction between income and race and breast milk intake at weeks 2 and 3 ($P < .05$). Race and income accounted for 36% of the variance in breast milk intake.

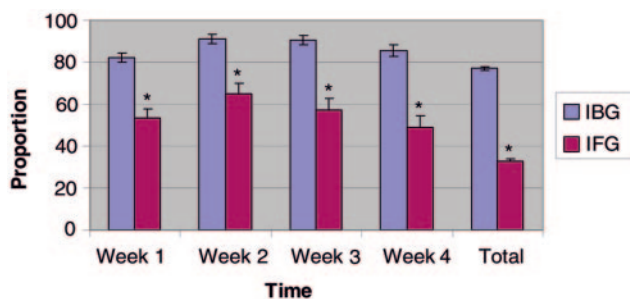


FIGURE 1
Proportion of enteral feeding that was breast milk during the first 4 weeks and during the total hospitalization. IFG includes only infants whose mothers initiated milk expression after counseling. * Significantly different: $P < .05$.

Of the 184 mothers who initiated breast milk expression, 72 (39%) completed the exit questionnaire. Many mothers did not complete the questionnaire because their infants were either discharged to home or transferred to another hospital for subspecialty care before it could be administered. The demographic characteristics of the mothers who completed the questionnaire were similar to the characteristics of the mothers who did not complete the questionnaire except that the IFG mothers who completed the questionnaire were younger than the IFG mothers who did not complete the questionnaire (24 ± 0.8 vs 27 ± 0.8 years; $P = .004$). The majority of mothers from both groups reported that their infants grew well on breast milk and that milk expression, although difficult to do often enough, was easier than they thought it was going to be (Table 5). Both groups also reported that they were proud of themselves for pumping their milk and that their milk helped their infants go home sooner. They indicated that their family and partner were supportive and proud of what they were doing. Most mothers reported that pumping was easier and more comfortable than they thought it would be and that they did not dislike pumping. Almost all of the mothers reported that pumping was worth the effort and that they were glad that the staff helped them with pumping. Infant health benefits were the most common reasons cited by both groups for expressing milk. More women in the IFG compared with those in the IBG ceased milk expression before their infants' discharge (67% [IFG] vs 22% [IBG]; $P < .001$). The most common reasons that both groups reported for ceasing milk expression were (1) low milk supply, (2) returning to work or school, and (3) inability to pump as often as needed (Table 6).

DISCUSSION

Our results demonstrated that lactation counseling for mothers who delivered a VLBW infant did not increase anxiety, regardless of the mothers' original feeding plan: breastfeeding or formula feeding. Mothers who had originally planned to formula feed before preterm delivery had lower STAI anxiety state scores after lactation counseling, and their scores were similar to those of mothers of VLBW infants who planned to breastfeed. Decline in anxiety state scores continued throughout hospitalization and occurred regardless of the mothers' initial feeding plan before delivery. The decline in anxiety scores observed in this study may reflect the normal adjustment that mothers have to preterm delivery. However, the decline in scores is reassuring and suggests that lactation counseling did not heighten anxiety during this stressful situation.

Maternal anxiety trait scores were inversely correlated with infant breast milk intake, suggesting that mothers who are prone to be more anxious have more difficulty maintaining lactation. This finding is consistent

TABLE 4 Percentage of Enteral Feedings as Breast Milk

	Non-Hispanic Black			Non-Hispanic White		
	LI (n = 71)	NLI (n = 23)	Total (n = 94)	LI (n = 45)	NLI (n = 68)	Total (n = 113)
Total hospital stay (n = 207)	45.9	62.8 ^a	50.0	59.2	72.6 ^a	67.3
Week 1 (n = 196) ^c	60.1	69.7	62.3	77.7	78.1	77.9 ^b
Week 2 (n = 185) ^{c,d}	68.4	94.7 ^a	74.0	85.3	87.0	82.4
Week 3 (n = 174) ^{c,d}	63.9	90.7 ^a	70.1	85.8	84.5	84.5 ^b
Week 4 (n = 161) ^c	54.6	87.4 ^a	63.0	72.1	84.4 ^a	79.0

Two Hispanic infants, 2 Asian infants, and 12 infants whose mothers did not initiate milk expression were excluded from this analysis. LI indicates low income (Medicaid eligible, no private insurance); NLI, non-low income (private insurance).

^a Significantly different from LI: $P < .05$.

^b Significantly different from non-Hispanic black mothers: $P < .05$.

^c Excluded infants who were given nothing by mouth for the entire week.

^d Race: LI interaction at weeks 2 and 3.

TABLE 5 Pumping Experience by Group: Results of Exit Questionnaire

Statement	Agree/Strongly Agree, % ^a	
	IBG	IFG
	(n = 42)	(n = 30)
My baby grew well on my milk	98	92
Pumping was easier than I thought it was going to be	80	73
I am proud of myself for providing milk for my baby	100	100
My family supported my pumping	95	96
My partner supported my pumping	100	93
My family was proud of me for providing breast milk	93	100
It was hard to pump as often as I was supposed to	81	71
Pumping was uncomfortable	36	27
I disliked pumping	19	25
My modesty made it hard to pump	2	13
My milk helped my baby come home from the hospital sooner	88	73
Pumping was worth the effort	100	87
I am glad that the staff helped me with pumping	100	100

^a "Not applicable" responses were not included in the percentage.

TABLE 6 Reasons for Ceasing Pumping Before Infants' Hospital Discharge

Statement	Agree/Strongly Agree, % ^a	
	IBG	IFG
	(n = 16)	(n = 24)
Breast pump did not work well	6	21
My milk supply became very low	67	71
I had to go back to work/school	55	54
I became tired of pumping	29	40
I could not pump as often as needed	53	60
It was too difficult to pump and take care of my other children	36	50
I wanted to start taking birth control pills	46	42
My partner wanted me to stop pumping	0	10
I developed mastitis or other breast infection	25	0
My baby did not breastfeed well, so I stopped pumping	23	29

^a "Not applicable" responses were not included in the percentage.

with findings by Nissen et al,³¹ who reported that anxiety trait scores were inversely related to levels of oxytocin and prolactin in mothers of term infants who were delivered by cesarean section compared with mothers who delivered vaginally. Our results are also consistent with the findings of Miracle et al,²⁸ who interviewed mothers who planned to formula feed but changed their decision to express milk for their VLBW infants.²⁸ They found that mothers appreciated being informed of the benefits of their milk for their infants, and the encouragement to initiate milk expression did not make them feel guilty or coerced.

In our study, of mothers who initially stated that they did not plan to breastfeed, 85% initiated milk expression for their VLBW infants. This finding demonstrates that counseling can be effective in increasing lactation initiation. In fact, the rate of 94% of all mothers initiating lactation is the highest reported for this population. Even after adjustment for the mothers who initiated milk

expression but did not provide any breast milk, the lactation rate for the entire group was 84%, still higher than any other previously reported rate. Previously reported lactation initiation rates for preterm and low birth weight (<2500 g) infants ranged from 48%¹⁸ to 73%.¹⁷ Being married, having a higher education level, having private health insurance, and previous breastfeeding experience all were positively associated with intent to breastfeed. These data are consistent with the findings of Smith et al,³² who also examined whether these factors were associated with the decision to initiate milk expression for VLBW infants.

The mothers who did not attempt to establish lactation after counseling had delivered later in gestation and their infants were larger compared with the mothers who intended to formula feed but initiated lactation. This is consistent with the results of Meier et al¹⁷ and Furman et al,¹⁸ who also found that mothers who expressed milk had smaller, more premature infants compared with mothers who did not express milk during their infant's hospital stay.

Infant intake of breast milk (61 mL/kg per day) was

similar to the mean breast milk intake of 50 mL/kg per day that was reported by Schanler et al.⁴ The total proportion of breast milk fed (57%) in our study was similar to the 61% reported by Meier et al.¹⁷ In that study, the Rush Mother's Milk Club provided a comprehensive program of lactation support that included lactation counseling soon after delivery, assistance with obtaining an electric breast pump at hospital discharge, lactation assistance throughout the hospitalization, lactation research projects, and breastfeeding peer support. The support provided by our counseling intervention included all of these components except breastfeeding peer support. Counseling and support were provided by a registered dietitian who is also a lactation consultant, with assistance from lactation consultants from the newborn nursery.

The exit questionnaires revealed that mothers who had not planned to breastfeed had similar levels of satisfaction with their milk expression experience compared with mothers who planned to breastfeed. They also reported similar difficulties: difficulty pumping frequently enough to maintain milk supply throughout the hospitalization and having to return to work outside the home. Almost all of the mothers who completed the questionnaire stated that pumping was worth the effort. However, despite the similarities in characteristics between the mothers who completed the exit questionnaire and those who did not, our results may not be representative of the whole group because of the low response rate of 39%.

Our results were consistent with the data of Kavanaugh et al,⁵ who interviewed mothers of VLBW infants who had not planned to breastfeed but changed their decision and expressed milk during their infants' hospitalization. From these interviews, Kavanaugh et al found 2 basic themes representing why mothers changed their decision to express milk (1) because of the potential health benefits of their milk for their infant and (2) being able to provide milk made pumping worth the effort. All of our mothers who completed the questionnaire reported that they were glad that the staff helped them with pumping. Most NICUs provide written information in some form to mothers about the benefits of breast milk. Mothers then are assisted with milk expression by the nursing staff or lactation consultants who are taking care of the mothers but not necessarily familiar with the medical condition of the VLBW infants. This study used individual counseling sessions with lactation consultants who had many years of experience working with mothers and their VLBW infants and who could inform the mothers about specific benefits for their premature infant. This information sharing was immediately followed by milk expression assistance when the mothers were receptive. Mothers were also told that there would be no pressure to continue milk expression if after attempting they did not want to continue. This

method was especially effective at changing mothers' feeding decision for the period of infant hospitalization as evidenced by the 85% initiation rate among mothers who initially planned to formula feed.

The effectiveness of this method is consistent with data on the effects of provider encouragement on breastfeeding initiation in mothers of term infants. A nationally representative sample of mothers was asked to recall whether they were encouraged to breastfeed by their physicians or nurses.³³ Women who were encouraged to breastfeed were >4 times as likely to initiate breastfeeding as women who did not receive encouragement. In groups of women who are traditionally less likely to breastfeed, provider encouragement increased breastfeeding initiation by 3-fold among low-income, young, and less educated women. Also, breastfeeding initiation increased nearly 5-fold among black women and nearly 11-fold among single women. Raisler et al³⁴ found similar results from focus group interviews with low-income mothers who reported that the personal contact with a health care provider was more effective than written information or videos.

In this study, initiation of milk expression among non-Hispanic black and low-income mothers was high, with >90% of these mothers initiating milk expression. This is the first study to report initiation rates this high among these groups. However, despite high initiation, there was a significant difference in the amount of breast milk that the infants received during the first month of life, and for infants of low-income women, there was a significantly lower intake of breast milk during the entire hospitalization. Lactation counseling for all mothers eliminated the disparities in lactation initiation that traditionally are seen with race and income. The assistance that mothers received with obtaining an electric breast pump at the time of discharge was essential to supporting the low-income mothers' efforts to provide breast milk. However, eliminating the financial barrier of pump rental did not eliminate differences in breast milk intake. These findings are similar to those of Meier et al,¹⁷ who also found that lactation counseling and evidence-based interventions, when provided to all mothers of VLBW infants, resulted in a similar lactation initiation rate for mothers who were of low income and non-low income. Dose of breast milk provided by non-low-income mothers was also not independently associated with ethnicity or income, but these investigators also found an interaction between ethnicity and income.

For ethical reasons, there was not a control group who received no lactational counseling. This was a limitation of the study. All of the mothers received the intervention, so we do not know how many mothers would have initiated milk expression without lactation counseling. However, it is unlikely that by chance the initiation rate and the amount of breast milk that the infants received in this study would have been as high as

it was without the initial counseling, assistance with obtaining an electric pump, and continued follow-up and support provided by the lactation consultants.

The findings in this study demonstrate that lactation counseling can be done without increasing anxiety in mothers who intend to formula feed. It is also evident that the majority of mothers who intend to formula feed will initiate milk expression and provide breast milk for the health of their VLBW infants when given appropriate assistance. This adds to the growing body of evidence that mothers are receptive and able to provide breast milk for their VLBW infants.

ACKNOWLEDGMENTS

This study was supported by the International Lactation Consultant's Association, University of North Carolina at Greensboro, and Wake Forest University School of Medicine.

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Pediatrics 2006;117:e67-e75

DOI: 10.1542/peds.2005-0267

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