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The Relationship Between Infant Feeding Outcomes and Maternal Emotional Well-being Among Mothers of Late Preterm and Term Infants

A Secondary, Exploratory Analysis

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ABSTRACT

Background: Late preterm birth is associated with lower rates of breastfeeding and earlier breastfeeding cessation than term birth.

Purpose: The objectives of this secondary analysis were to compare the incidence of exclusive breastfeeding after late preterm and term childbirth and to examine the association between infant feeding outcomes and maternal emotional well-being.

Methods: Participants were 105 mother–infant dyads (54 late preterm and 51 term) at a southeastern US medical center. Face-to-face data collection and telephone follow-up occurred during 2009-2012.

Results: Late preterm mothers were less likely to exclusively provide their milk than were term mothers during hospitalization. Feeding at 1 month did not differ between late preterm and term infants. Among late preterm mothers, (1) formula supplementation during hospitalization was associated with greater severity of anxiety than among those exclusively providing formula and (2) exclusive provision of human milk at 1 month was associated with less severe depressive symptoms than among those supplementing or exclusively formula feeding. Among term mothers, feeding outcome was not related to emotional well-being measures at either time point.

Implications for Practice: Mothers of late preterm infants may particularly benefit from anticipatory guidance and early mental health screening, with integrated, multidisciplinary lactation teams to support these interrelated healthcare needs.

Implications for Research: Prospective research is critical to document women's intentions for infant feeding and how experiences with childbirth and the early postpartum period impact achievement of their breastfeeding goals.

Key Words: anxiety, breastfeeding, depressive symptoms, mothers, preterm infants

BACKGROUND AND SIGNIFICANCE

Late preterm newborns (34-37 gestational weeks) account for 6.8% of births in the United States.[1] Late preterm newborns appear similar to term infants after birth,[2] yet late preterm infants are less neurologically and physiologically mature.[3] Although greater attention and tailored management is being implemented for late preterm infants,[4,5] late preterm birth is associated with lower rates of breastfeeding, earlier breastfeeding cessation, and more infant feeding-related morbidities than term birth.[6-11] The discrepancy in breastfeeding outcomes include those who prenatally reported intent to breastfeed.[12] Exclusive breastfeeding for 6 months and continued breastfeeding for 2 years or beyond is recommended for optimal infant nutrition and development.[13-15] Lactation is additionally associated with better short- and long-term maternal health outcomes.[16]

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Women who give birth late preterm have also been found to have greater prenatal and postnatal emotional distress than those who delivered at term.[8] Previous research has linked greater maternal emotional distress to poorer breastfeeding outcomes after late preterm childbirth. Zanardo and colleagues[10] found that high maternal anxiety, depressive symptoms, and distress after late preterm childbirth were associated with less at-breastfeeding at hospital discharge. McDonald and colleagues[8] found that, compared with term infants, late preterm infants were less likely to be breastfed within 24 hours of birth and their mothers were more likely to report the first breastfeeding attempt as unsuccessful. In a sample including late preterm and term mothers, greater postpartum anxiety was associated with reduced breastfeeding duration.[17] The studies by Zanardo and colleagues,[10] McDonald and colleagues,[8] and Paul et al[17] did not include assessment of women's breastfeeding intentions, so less is known about whether maternal emotional well-being is related to achievement of individual breastfeeding goals after late preterm childbirth.

Objectives

The objectives of this secondary analysis were to compare the incidence of exclusive breastfeeding after late preterm and term childbirth and to examine the association between infant feeding outcomes and maternal emotional well-being. Furthermore, we explored the relationships among breastfeeding intentions, maternal comfort with the idea of formula feeding, and infant feeding outcomes in a subsample of the mothers of late preterm and term infants.

The first hypothesis was that, because of the lower rates of breastfeeding in late preterm mother–infant dyads reported in the literature, the incidence of the exclusive provision of human milk during hospitalization and at 1 month postpartum would be lower among the late preterm than among term mother–infant breastfeeding dyads. The second hypothesis was that nonexclusive breastfeeding would be associated with greater maternal emotional distress among both the late preterm and term groups, since previous studies found less at-breastfeeding and a shorter duration of breastfeeding were associated with greater maternal emotional distress.[8,17] Exploratory analyses examined whether maternal breastfeeding intentions or comfort with the idea of formula feeding was related to infant feeding outcomes during hospitalization and at 1 month postpartum.

MATERIALS AND METHODS

This exploratory study was conducted from 2009 to 2012 as a secondary analysis of a larger ongoing descriptive comparative study. The purpose of the original study was to compare maternal emotional well-being after late preterm and term childbirth[18] with postnatal unit in-person and 1-month telephone assessments through an institutional review board (IRB)–approved process.

What This Study Adds

- Among mothers of late preterm infants, supplementing human milk feeding with formula during hospitalization was associated with more maternal anxiety during hospitalization than among those exclusively providing formula.
- At 1 month postpartum, exclusive human milk feeding was associated with lower maternal depressive symptom scores in late preterm dyads than among those supplementing human milk feeding with formula or those exclusively formula feeding at 1 month.
- Among mothers of term infants, infant feeding outcomes were not related to measures of emotional well-being during hospitalization or at 1 month postpartum.

Participants

Mothers delivered their infants in a regional referral birthing center of a southeastern US academic medical center with approximately 3300 births per year. All of the infants in this study were born and treated at the same hospital, which was not designated as Baby-Friendly.

Beginning in 2009 for the ongoing larger study, review of postpartum medical records were used to determine potential eligibility (maternal age at least 18 years, custody of child, no history of HIV infection, psychosis, or bipolar disease, English speaking, infant singleton). Non–English-speaking Hispanic mothers were excluded because the measures of maternal emotional well-being used (see the "Measures" section) have not been validated in this population. In addition, the research team did not include a Spanish-speaking data collector because of funding constraints. Infant health was not an inclusion or exclusion criterion. The goal of this secondary analysis was to enroll adequate numbers of breastfeeding dyads to examine hospital breastfeeding exclusivity. Therefore, late preterm and term mothers providing their milk to their newborns, as indicated by their postpartum hospital records (mother's own milk or not), were oversampled from 2010 to 2011. The appropriateness of potential participation was then checked with the nursing staff. Term dyads (infants born >37 gestational weeks) were matched to late preterm dyads (infants born 34-37 gestational weeks) on maternal race/ethnicity because demographic characteristics have been found to contribute to the breastfeeding disparity between term and late preterm dyads.[19]

Mothers (N = 105) from the larger study provided information on their characteristics, completed a questionnaire packet, and described their infant feeding and other perinatal experiences (54 late preterm and 51 term). At 1 month postpartum, 88 mothers

provided questionnaire, feeding, and related data (45 late preterm and 43 term). Questionnaires regarding maternal intentions for breastfeeding duration, breastfeeding exclusivity, and comfort with the idea of formula feeding, described later, were added part way into the larger project (in 2010) by a postdoctoral fellow (K.P.T.) who had just joined the team to provide data for this exploratory study on the relationship of infant feeding outcomes and maternal emotional well-being and to asses maternal plans and practices for infant sleep locations.[20] Therefore, these measures were administered to about half of the participants (N = 53; 26 late preterm and 27 term).

A set of sensitivity analyses was conducted to compare characteristics of the (1) 1-month subsample of 88 and (2) breastfeeding intentions and comfort with formula feeding subsample of 53 with those dyads from the total sample of 105 not included in the subsample. Nonparametric tests were conducted within each group (late preterm or term) to evaluate the similarities of the groups across the different analyses (hospitalization, 1 month, and breastfeeding intentions and formula comfort). Wilcoxon 2-sample tests for continuous measures and Fisher exact tests for categorical measures did not indicate any significant differences ($P > .10$) in those included and those not included.

Measures

Maternal and Infant Characteristics

Demographic information was recorded on a form completed by the mother. The infant's medical records were reviewed after enrollment and following hospital discharge to obtain data on obstetric history and medical course. Infant feeding outcomes—exclusive human milk, human milk supplemented with formula, or exclusive formula—were assessed by maternal report.

Measures of Maternal Emotional Well-being

Four aspects of maternal emotional well-being were each assessed during postpartum hospitalization and at 1 month postpartum: depressive symptoms (Edinburgh Postnatal Depression Scale, EPDS[21]), anxiety (State Anxiety subscale of the State-Trait Anxiety Inventory, STAI-S[22]), posttraumatic stress symptoms (Perinatal PTSD Questionnaire, PPQ[23,24]), and worry about the child's health (Child Health Worry Scale, Worry Scale[25,26]). These variables represent major maternal emotional responses to the birth and hospitalization of preterm infants, and all are related to child development.[27,28] In this sample, the EPDS had Cronbach αs of 0.87 at hospitalization and 0.74 at 1 month. Cronbach αs for the STAI-S were 0.94 at hospitalization and 0.83 at 1 month. PPQ Cronbach αs were 0.76 at hospitalization and 0.73 at 1 month. Worry Scale Cronbach αs were 0.89 at hospitalization and 0.89 at 1 month.

Breastfeeding Intentions

Maternal intentions for infant feeding were not assessed upon admission to labor and delivery at this hospital. Therefore, during postpartum hospitalization, the Infant Feeding Intentions (IFI) scale[29] was used to assess maternal recall of plans for infant feeding. In a previous study, the IFI scale was correlated with breastfeeding duration.[29] Cronbach α for the IFI scale in this study was 0.80.

Comfort With Formula Feeding

Participants were also evaluated on their level of "comfort with the idea of formula feeding" during postpartum hospitalization. Mothers reported a score from 1 to 4, ranging from 1 (very uncomfortable) to 4 (very comfortable).[30]

Procedure

Following IRB approval from Duke University Medical Center, a research team member confirmed potential eligibility and the appropriateness of potential participation with the nursing staff. Mothers who were considered to be well enough to potentially participate in the study by their nurses and who were awake and not engaged with a healthcare professional were approached on the postnatal unit the day after childbirth or later. Directly after a mother provided written informed consent to participate in the study, or at a time during postpartum hospitalization more convenient to the mother, the demographics form and questionnaires were administered. A participant who conveyed significant emotional distress during data collection was referred to a mental health professional. Mothers were paid $10 each time they participated in the questionnaires (during postpartum hospitalization and at 1 month postpartum).

Analyses

Descriptive statistics were used to summarize the characteristics of the mother–infant dyads, as well as infant feeding outcomes and maternal emotional well-being during postpartum hospitalization and at 1 month postpartum. Cross-sectional outcome analyses were conducted during hospitalization and at 1 month. We applied nonparametric methods for this analysis. When statistical significance testing was conducted, the level of significance was set at $P < .05$ (2-tailed tests). Statistical analyses were conducted using SAS 9.3.

Outcome Analyses

First, infant feeding outcomes between the late preterm and term mother–infant dyads were examined using χ^2 tests. EPDS total scores were dichotomized (total score ≤ 12 or > 12)[21] and used as a covariate in the analyses on infant feeding outcomes by late preterm and term participants at hospitalization and 1 month postpartum, using the Cochran–Mantel–Haenszel test.

Next, Wilcoxon 2-sample tests were used to test for differences between late preterm and term maternal emotional well-being outcome total scores at hospitalization and 1 month. A Kruskal–Wallis test was then used to determine whether there were differences among the 3 infant feeding outcome groups, namely, (1) exclusive human milk; (2) human milk supplemented with formula; (3) exclusive formula, on the different measures of maternal emotional well-being. When a significant feeding group difference was demonstrated, *a posteriori* multiple comparisons were conducted using the Wilcoxon 2-sample Test to test for pairwise differences on the maternal well-being measures in the different feeding groups.

A Kruskal–Wallis test was also used to test whether the length of infant hospitalization was associated with the infant feeding outcomes during hospitalization. A Wilcoxon 2-sample test was used to examine whether infant care (rooming-in only or the infant spent any time in an intensive care unit) was associated with maternal anxiety or depressive symptoms during hospitalization. Then, the Cochran–Mantel–Haenszel test was used to examine whether infant care (rooming-in only or any intensive care) was associated with the infant feeding outcomes during hospitalization. Within the term group, the Wilcoxon 2-sample test was also used to test whether the length of infant hospitalization was associated with childbirth mode (cesarean delivery or vaginal delivery). A Fisher exact test was then used to determine whether childbirth mode was associated with nonexclusive breastfeeding among the term dyads during hospitalization.

Finally, Wilcoxon 2-sample tests were used to test for group (late preterm vs term) differences in the total score of the IFI scale and ratings of comfort with the idea of formula feeding among the subsample of late preterm and term participants for whom these data were available. For the IFI scale, the analysis of total scores was conducted among those who indicated any intent to provide their milk (total score of >0) in order to compare plans for breastfeeding duration and exclusivity between the late preterm and term mothers who reported that they intended to breastfeed.

RESULTS

In the full sample, late preterm infants had gestational ages at birth of 34⅐ to 36⅐ weeks and the term infants had gestational ages of 37⅐ to 41⅐ weeks. The sample was 50.0% white non-Hispanic, 34.6% black non-Hispanic, and 15.4% English-speaking Hispanic women. Participant demographics by late preterm and term childbirth status are provided in Table 1.

During hospitalization, of the 105 mothers, 36 (34.3%) exclusively breastfed, 47 (44.8%) fed their milk and supplemented with formula, and 22 (21%) exclusively formula fed. There was a significant difference in the proportion of hospital infant feeding outcomes between the late preterm term and term participants (χ^2= 16.79, df = 2, P = .0002), with less exclusive human milk provision among the late preterm dyads (Table 2). The increased likelihood of late preterm mothers using formula during hospitalization remained statistically significant after controlling for the level of maternal depressive symptoms during hospitalization (χ^2= 7.35, df = 1, P = .007).

At 1 month postpartum, of 88 mothers, 24 (27.3%) exclusively breastfed, 31 (35.2%) supplemented with formula, and 33 (37.5%) exclusively formula fed. The 1 month feeding outcomes of the late preterm and term participants did not differ statistically (χ^2= 2.54, df = 2, P = .28), including after controlling for the level of maternal depressive symptoms at 1 month (χ^2= 0.18, df = 1, P = .67; see Table 2). The ways that women fed their infants during hospitalization (exclusive human milk feeding, human milk supplemented with formula, and exclusive formula feeding) were significantly associated with the continuation of these same feeding practices at 1 month postpartum among both the late preterm (χ^2= 20.94, df = 4, P = .0003) and term (χ^2= 17.02, df = 4, P = .0002) mothers.

Among the women who supplemented with formula in the hospital, 34 were reached at 1 month and 8 of these women exclusively provided their milk at 1 month. There was not a statistically significant difference in the move to exclusive human milk provision between the late preterm (5 of 23; 21.7%) and term (3 of 11; 27.3%) mothers (Fisher exact test; P = .99). Two mothers (1 late preterm and 1 term) who exclusively formula fed in the hospital provided their milk in combination with formula at 1 month. Half of the women who exclusively provided their milk in the hospital were doing so at 1 month.

As previously reported with a subsample of the current study's sample,[18] the late preterm mothers reported significantly more anxiety, worry, and depressive symptoms during hospitalization and at 1 month than the term mothers.

Among mothers of late preterm infants, supplementing human milk feeding with formula during hospitalization was associated with more maternal anxiety during hospitalization than those exclusively providing formula (Table 3). The duration of late preterm infant hospitalization was not associated with infant feeding outcomes during hospitalization (χ^2= 1.42, df = 2, P = .49). Furthermore, in this group, infant care outside of the well-baby nursery (rooming-in) was positively associated with maternal anxiety (P = .05), but infant care (rooming-in only or any intensive care) was not associated with either maternal depressive symptoms (P = .81) or infant feeding outcome (P = .80) during hospitalization.

TABLE 1. Characteristics of the Late Preterm and Term Mother–Infant Dyads (N = 105)[a]

	Late Preterm (N = 54), Mean (SD) or % (n)	Term (N = 51), Mean (SD) or % (n)
% White non-Hispanic	50.9 (27/53)	49.0 (25/51)
% Black non-Hispanic	34.0 (18/53)	35.3 (18/51)
% Hispanic and Other	15.1 (8/53)	15.7 (8/51)
% Married[b]	65.4 (34/52)	45.1 (23/51)
% Public assistance	43.1 (22/51)	41.2 (21/51)
% First-time mother	25.9 (14/54)	31.4 (16/51)
Maternal age, y	29.3 (6.3)	28.1 (5.7)
Gestational age,[c] wk	35.8 (0.8)	39.7 (1.0)
% Infant female	50.0 (27/54)	41.2 (21/51)
Apgar score at 1 min	7.4 (2.1)	7.6 (1.9)
Apgar score at 5 min	8.7 (0.8)	8.8 (0.8)
% Cesarean birth	51.9 (28/54)	39.2 (20/51)
Head circumference at birth,[c] cm	32.3 (1.8)	34.1 (1.5)
Length at birth,[c] cm	47.1 (2.8)	50.6 (2.7)
Birth weight,[c] g	2585.1 (470.6)	3351.3 (428.8)
% <2500	48.2 (26/54)	0.0 (0/51)
% 2501-3000	33.3 (18/54)	21.6 (11/51)
% >3000	18.5 (10/54)	78.4 (40/51)
% Had any pregnancy complications	55.6 (30/54)	41.2 (21/51)
% No prenatal care	3.7 (2/54)	5.9 (3/51)
% Diabetes	9.3 (5/54)	0.0 (0/51)
% Hypertension	37.0 (20/54)	26.5 (13/49)
% Antepartum hemorrhage	3.8 (2/53)	3.9 (2/51)
% Chorioamnionitis	5.6 (3/54)	15.7 (8/51)
% Rupture of membranes prior to delivery	67.9 (36/53)	82.0 (41/50)
% Received prenatal steroids[b]	15.7 (8/51)	2.0 (1/51)
% Received prenatal antibiotics[d]	62.3 (33/53)	35.3 (18/51)
% Only in well baby nursery[d]	61.1 (33/54)	88.2 (45/51)
Length of hospital stay,[c] d	7.0 (11.3)	3.1 (3.6)
% Provided human milk at discharge	48.2 (39/51)	51.9 (42/51)

[a]Wilcoxon 2-sample tests for continuous measures and Fisher exact tests for categorical measures were used to test for differences in the late preterm and term samples at enrollment.
[b]$P < .05$.
[c]$P < .001$.
[d]$P < .01$.

At 1 month postpartum, exclusive human milk feeding was associated with lower maternal depressive symptom scores in late preterm dyads than among those supplementing human milk feeding with formula or those exclusively formula feeding at 1 month (see Table 3). Furthermore, late preterm mothers supplementing with formula at 1 month had fewer maternal depressive symptoms at 1 month than those exclusively providing formula (see Table 3).

Among mothers of term infants, infant feeding outcomes were not related to measures of emotional well-being during hospitalization or at 1 month postpartum (Table 4). For the term participants, the duration of infant hospitalization was associated with formula provision ($\chi^2 = 7.27$, df = 2, $P = .03$) such that dyads that exclusively provided their milk were discharged earlier than either those who supplemented human milk with formula or those who

TABLE 2. Infant Feeding Outcomes During Hospitalization and at 1 Month Postpartum Among the Late Preterm and Term Mother–Infant Dyads[a]

		Hospitalization[b]		1 mo	
		n	% of Group	n	% of Group
Exclusive human milk	Late preterm	9	16.7	9	20.0
	Term	27	52.9	15	34.9
Human milk with formula	Late preterm	33	61.1	18	40.0
	Term	14	27.4	13	30.2
Exclusive formula	Late preterm	12	22.2	18	40.0
	Term	10	19.6	15	34.9

[a]*For hospitalization, $\chi^2 = 16.79$, df = 2, P = .0002. For 1 month, $\chi^2 = 2.54$, df = 2, P = .28.*
[b]*$P < .001$.*

exclusively formula fed. Term infant care outside of the well-baby nursery (rooming-in) was positively associated with maternal anxiety ($P = .05$), but infant care (rooming-in only or any intensive care) was not associated with either maternal depressive symptoms ($P = .43$) or with infant feeding outcome ($P = .17$) during hospitalization. Among the term participants, both longer infant hospitalization ($P = .002$) and nonexclusive breastfeeding during hospitalization ($P = .05$) were positively associated with cesarean section childbirth (7 of 20; 35.0%; exclusive breastfeeding after cesarean delivery and 20 of 31 (64.5%; exclusive breastfeeding after vaginal delivery).

In the subsample with data on infant feeding intentions, mothers of late preterm and term infants did not statistically differ on their breastfeeding intentions reported during hospitalization or in their comfort level with the "idea of formula feeding" (Table 5).

DISCUSSION

This exploratory study assessed the relationship between infant feeding outcomes and maternal emotional well-being among both late preterm and term mother–infant dyads during postpartum hospitalization through the first postpartum month. The mothers of late preterm infants reported less exclusive breastfeeding during hospitalization. In the subsample of participants reporting their feeding intentions, late preterm and term mothers reported similar breastfeeding intentions and comfort with the idea of formula feeding. Results from our study suggested that mothers of late preterm infants were at risk for deviating from their breastfeeding plans and experiencing emotional distress through at least the first postpartum month.

Nonexclusive breastfeeding for the late preterm dyads was associated with greater maternal anxiety during hospitalization and with more severe maternal depressive symptoms at 1 month postpartum. Our findings do not demonstrate cause–effect but are consistent with the previous study findings of greater maternal anxiety among late preterm mothers[8,31] and that higher maternal anxiety is associated with poorer breastfeeding outcomes.[32] Depressive symptoms are known to be common in postpartum women[33] and to negatively affect breastfeeding.[34] Mothers of late preterm infants may particularly benefit from anticipatory guidance and early mental health screening, with integrated, multidisciplinary lactation support teams as recently described by Bunik and colleagues,[35] who used a Trifecta Breastfeeding Approach that involves a pediatrician, a lactation consultant, and a clinical psychologist providing comprehensive evaluation and contextualized support for mother–infant dyads. The Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) position statement on breastfeeding[36] recommends that late preterm dyads receive additional monitoring and support from nurses so that families can realize their breastfeeding goals. AWHONN recommendations[37] to prevent or ameliorate inadequate feeding among late preterm mothers and their infants include promotion of kangaroo care, observation of feeding sessions, education on infant behavioral cues for feeding, and validation of women's knowledge about effective breastfeeding. Multidisciplinary guidelines for facilitating late preterm breastfeeding and maternal mental health screening are also detailed by the National Perinatal Association[5] and the Academy of Breastfeeding Medicine.[38]

Mothers who deliver late preterm infants may become distressed because of breastfeeding challenges, their emotional distress may hinder early breastfeeding, or, most likely, their infant feeding practices and emotional well-being are reciprocal processes. In our study, late preterm mothers who were exclusively breastfeeding were less distressed than those providing formula in addition to their milk or those who were exclusively formula feeding.

TABLE 3. Emotional Distress by Infant Feeding Practices Among Mothers of Late Preterm Infants[a]

	Feeding	n	Mean (SD)	Median	25th, 75th Percentile
Hospitalization (N = 53)					
EPDS total score	Exclusive human milk	9	3.8 (3.4)	3.0	2.0, 3.0
	Human milk with formula	32	6.7 (5.1)	6.0	2.5, 10.0
	Exclusive formula	12	4.7 (3.4)	3.0	2.0, 7.5
State Anxiety subscale score STAI[b]	Exclusive human milk	9	31.2 (10.8)	26.0	21.0, 36.0
	Human milk with formula	32	38.2 (11.9)	37.5	29.5, 45.5
	Exclusive formula	12	29.2 (7.1)	28.0	23.0, 36.0
Perinatal PTSD total score	Exclusive human milk	9	1.3 (1.5)	1.0	0.0, 2.0
	Human milk with formula	32	2.2 (1.9)	2.0	0.5, 3.0
	Exclusive formula	11	1.5 (1.8)	1.0	0.0, 2.0
Worry Scale total score	Exclusive human milk	9	14.8 (4.7)	15.0	11.0, 17.0
	Human milk with formula	32	18.0 (5.8)	17.5	14.0, 21.0
	Exclusive formula	11	14.3 (7.1)	13.0	8.0, 18.0
1 mo (N = 41)					
EPDS total score[c]	Exclusive human milk	8	0.8 (0.9)	0.5	0.0, 1.5
	Human milk with formula	17	2.9 (2.6)	3.0	0.0, 4.0
	Exclusive formula	15	6.2 (4.2)	7.0	3.0, 9.0
State Anxiety subscale score STAI	Exclusive human milk	8	27.3 (5.8)	26.5	22.0, 33.5
	Human milk with formula	18	29.7 (7.4)	29.5	23.0, 34.0
	Exclusive formula	14	30.9 (7.6)	28.0	25.0, 34.0
Perinatal PTSD total score	Exclusive human milk	8	0.9 (1.0)	0.5	0.0, 2.0
	Human milk with formula	17	1.6 (1.7)	1.0	0.0, 2.0
	Exclusive formula	15	2.6 (3.0)	2.0	1.0, 3.0
Worry Scale total score	Exclusive human milk	8	10.8 (3.0)	10.5	8.0, 12.5
	Human milk with formula	18	14.5 (6.4)	13.0	11.0, 16.0
	Exclusive formula	15	14.8 (6.0)	14.0	11.0, 17.0

Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; Perinatal PTSD, Perinatal PTSD Questionnaire; PTSD, posttraumatic stress disorder; STAI, State-Trait Anxiety Inventory; Worry Scale = Child Health Worry Scale.
[a]A Kruskal–Wallis test was used to determine whether there were differences among the 3 infant feeding outcome groups on the different measures of maternal emotional well-being. When a significant feeding group difference was demonstrated, a posteriori multiple comparisons were conducted using the Wilcoxon 2-sample test to test for pairwise differences on the maternal well-being measures in the different feeding groups.
[b]$P < .05$.
[c]$P \leq .001$.

This finding is consistent with the work of Ystrom,[39] who found that among term and preterm mothers, supplementing human milk feeding with formula was correlated with greater maternal anxiety and depressive symptoms at 6 months postpartum. Late preterm mothers may therefore benefit from providers who are experienced in tailoring lactation support to enable exclusive human milk provision. Management guidelines such as put forward by Meier et al[4] may be a useful resource for this population. Although early supplementation of breastfed infants is currently common in the United States,[40] formula supplementation may coincide with maternal emotional distress. Poor breastfeeding outcomes among late preterm dyads may reflect a lack of appropriate support for parental negotiation of the physiological, metabolic, and developmental obstacles associated with late preterm childbirth.[41,42]

The infant feeding outcomes of the term group did not correlate with the measures of maternal

TABLE 4. Emotional Distress by Infant Feeding Practices Among Mothers of Term Infants

	Feeding	n	Mean (SD)	Median	25th, 75th Percentile
Hospitalization (N = 51)					
EPDS total score	Exclusive human milk	27	4.5 (5.4)	2.0	1.0, 6.0
	Human milk with formula	13	4.5 (6.0)	1.0	0.0, 9.0
	Exclusive formula	10	1.7 (2.5)	1.0	0.0, 2.0
State Anxiety subscale score STAI	Exclusive human milk	27	30.1 (12.8)	27.0	21.0, 34.0
	Human milk with formula	14	32.4 (10.6)	30.0	24.0, 40.0
	Exclusive formula	10	28.2 (6.2)	26.7	23.0, 34.0
Perinatal PTSD total score	Exclusive human milk	27	1.1 (1.9)	0.0	0.0, 2.0
	Human milk with formula	13	3.2 (3.7)	1.0	1.0, 6.0
	Exclusive formula	10	1.6 (1.8)	1.0	0.0, 3.0
Worry Scale total score	Exclusive human milk	27	13.9 (6.7)	12.0	9.0, 17.0
	Human milk with formula	13	15.0 (7.9)	12.0	8.0, 19.0
	Exclusive formula	10	16.0 (7.5)	13.5	11.0, 25.0
1 mo (N = 39)					
EPDS total score	Exclusive human milk	11	2.3 (1.8)	2.0	1.0, 3.0
	Human milk with formula	13	1.8 (2.2)	1.0	0.0, 3.0
	Exclusive formula	14	1.0 (2.1)	0.0	0.0, 1.0
State Anxiety subscale score STAI	Exclusive human milk	12	25.1 (3.5)	24.5	22.5, 27.0
	Human milk with formula	13	25.0 (3.2)	24.0	24.0, 26.3
	Exclusive formula	14	25.7 (3.4)	25.5	25.5, 29.0
Perinatal PTSD total score	Exclusive human milk	12	1.9 (1.4)	2.0	1.0, 2.5
	Human milk with formula	13	1.7 (2.1)	1.0	0.0, 3.0
	Exclusive formula	14	1.1 (2.4)	0.0	0.0, 1.0
Worry Scale total score	Exclusive human milk	12	11.1 (3.3)	10.0	9.0, 14.0
	Human milk with formula	13	9.6 (3.0)	9.0	7.0, 11.0
	Exclusive formula	14	11.6 (7.7)	9.0	7.0, 12.0

Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; Perinatal PTSD, Perinatal PTSD Questionnaire; PTSD, posttraumatic stress disorder; STAI, State-Trait Anxiety Inventory; Worry Scale, Child Health Worry Scale.

[a]A Kruskal–Wallis test was used to determine whether there were differences among the 3 infant feeding outcome groups on the different measures of maternal emotional well-being.

emotional well-being. However, the low rates of exclusive breastfeeding we observed warrant further investigation. In particular, in the term group, nonexclusive breastfeeding during hospitalization was associated with both cesarean section childbirth and a longer duration of infant hospitalization. Breastfeeding obstacles after cesarean delivery include maternal mobility limitations, positioning difficulties, and frustration at the need for assistance.[43] In addition to Baby-Friendly accreditation[44] and tailored breastfeeding support for the population of dyads that experience operative childbirth, improved maternal access to infants while rooming-in with bassinets that attach to the maternal bed frame has been identified as a way to potentially facilitate breastfeeding and maternal satisfaction after cesarean delivery.[45]

Only half of the women who exclusively breastfed on the postnatal unit exclusively provided their milk at 1 month. In the United States, most mothers stop breastfeeding earlier than they desire.[46] The breastfeeding rates we observed were less than the Healthy People 2020 goal of at least 46.2% of infants being exclusively breastfed at 3 months postpartum.[47] Additional prospective research is critical to document women's intentions for infant feeding and how experiences with childbirth and the early postpartum period impact achievement

TABLE 5. Breastfeeding Intentions and Comfort with Formula Feeding Among Mothers of Late Preterm and Term Infants[a]

	Group	n	Mean (SD)	Median	25th, 75th Percentile
Infant Feeding Intentions scale total score (N = 53)	Late preterm	26	13.0 (3.7)	15.0	10.5, 16.0
	Term	27	12.1 (3.7)	12.5	10.0, 16.0
Comfort with the idea of formula feeding (N = 50)	Late preterm	22	3.1 (1.0)	3.0	3.0, 4.0
	Term	28	2.7 (1.1)	3.0	2.0, 3.5

[a]*Wilcoxon 2-sample tests were used to test for group (late preterm vs term) differences in the total score of the Infant Feeding Intentions scale and ratings of comfort with the idea of formula feeding.*

of their breastfeeding plans. In future studies, larger sample sizes would permit within-group testing of factors associated with infant feeding outcomes among mothers of late preterm and term infants.

Limitations

Although our sample was diverse and infant health was not an inclusion or exclusion criterion, the relationship of infants' degree of illness and maternal emotional distress was not assessed. The sample was limited by the exclusion of families with multiples and of non–English-speaking Hispanic mothers. Maternal history of recreational drug abuse or use of any pharmacological agents that are contraindicated in breastfeeding was also not assessed. Generalizability is further limited by lack of aggregate data from the population of late preterm and term dyads in this community, which would have enabled a comparison between those who enrolled and those who did not participate. In addition, other geographic areas may coincide with different levels of maternal emotional distress following childbirth and/or infant feeding intentions. Furthermore, prenatal maternal emotional distress was not assessed, which McDonald and colleagues[8] found to be greater among mothers who went on to deliver late preterm infants rather than term infants. Finally, maternal recall of infant feeding intentions while on the postnatal unit may have been biased from experiences that occurred between birth and study participation.

A strength of the study was that maternal race and ethnicity were matched between the late preterm and term mothers since preterm birth is more common in African American women[48] and US breastfeeding outcomes vary systematically by maternal ethnicity.[49] Furthermore, in the subsample, mothers of late preterm and term infants did not differ in their breastfeeding plans or comfort with the idea of formula feeding. These findings suggest that the less exclusive breastfeeding and greater maternal distress among mothers of late preterm infants are not an artifact of the demographic characteristics of the sample. However, breastfeeding intention and formula comfort data were limited to half of the

Summary of Recommendations for Practice and Research

What we know:	• Late preterm birth is associated with poorer breastfeeding outcomes than term birth. • Exclusive and continued breastfeeding is recommended for optimal infant nutrition and development. • Women who give birth late preterm have greater prenatal and postnatal emotional distress than those who delivered at term.
What needs to be studied:	• Discontinuation of exclusive and any breastfeeding during transition home and in the early weeks. • More comprehensive documentation of maternal breastfeeding plans, prenatal maternal emotional well-being, and how these interrelated aspects of women's health can be most effectively supported over time.
What we can do today:	• Provide late preterm mothers with tailored breastfeeding support. • Assess the emotional well-being of all mothers during the prenatal and early postpartum periods. • Integrate mental health and lactation support on the postpartum unit and in the community.

participants in this study. Although the characteristics of the subsample did not differ statistically from the remainder of the sample, future research would benefit from more comprehensive documentation of maternal breastfeeding plans. Future research would benefit from the additional postpartum data collection points of 6 months and beyond to determine how maternal emotional well-being and breastfeeding goals can be most effectively supported over time.

CONCLUSIONS

Mothers of late preterm infants are at risk for suboptimal infant feeding outcomes and maternal emotional distress. Mothers of term infants may experience unplanned formula supplementation after cesarean section childbirth and during longer postpartum hospital stays. More comprehensive breastfeeding support for the mothers of both late preterm and term infants is warranted.

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