Effect of Early-Onset Sepsis Evaluations on In-Hospital Breastfeeding Practices Among Asymptomatic Term Neonates

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KEY WORDS
asymptomatic infection, breastfeeding, early-onset sepsis, neonatal screening, system-based practice

ABBREVIATIONS
AAP: American Academy of Pediatrics
aOR: adjusted odds ratio
CDC: Centers for Disease Control and Prevention
CI: confidence interval
EOS: early-onset sepsis
GBS: group B streptococcus

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abstract

OBJECTIVE: To examine the effect of separation for early-onset sepsis (EOS) evaluations due to perinatal risk factors on breastfeeding practices among asymptomatic term newborns.

METHODS: This observational study included 692 nulliparous women with term, singleton uncomplicated pregnancies who intended to breastfeed and whose infants were well appearing at birth. We examined the rate of early breastfeeding initiation (within 2 hours of birth) and formula supplementation (in the first 24 hours) among this mother–infant cohort.

RESULTS: Asymptomatic infants separated for EOS evaluation within 2 hours of birth were more likely to have delayed initiation of breastfeeding (46.5% vs 12.5%; $P < .001$). This association remained significant when adjusted for potential confounders (adjusted odds ratio [aOR]: 5.5 [95% confidence interval (CI): 3.4–8.9]; $P < .001$). Among infants separated for EOS evaluation, mother–infant time together of ≤0.5 hour in the first 2 hours of life significantly delayed initiation (aOR: 8.9 [95% CI: 1.5–53.7]; $P = .02$) compared with infants spending >1.5 hours with their mothers. In bivariate analysis, both separation and initiation were associated with formula supplementation. After adjusting for confounders, only delayed initiation remained significantly associated with supplementation (aOR: 1.9 [95% CI: 1.1–3.5]; $P = .03$).

CONCLUSIONS: Early separation of asymptomatic infants from their mothers for EOS evaluation was significantly associated with delayed initiation of breastfeeding, which in turn was associated with increased formula supplementation in the first day of life. This unintended consequence of EOS evaluations among asymptomatic infants may be minimized by delaying early separation for performance of the evaluation, attempting breastfeeding initiation before separation, and/or applying more efficient criteria for identifying infants requiring evaluation.

Breastfeeding is widely recognized as the optimal method of feeding for infants in the first year of life.[1] The importance of breastfeeding has been recognized by The Joint Commission for accreditation of US hospitals, which now includes the rate of exclusive breastfeeding as a core measure of perinatal care.[2] The American Academy of Pediatrics (AAP) has endorsed the Baby-Friendly Hospital Initiative's Ten Steps to Successful Breastfeeding put forward by the World Health Organization/UNICEF.[1] In their statement on breastfeeding in 2012, the AAP noted that none of the exclusive breastfeeding targets of the Healthy People 2010 initiative had been achieved and that action will be needed to reach the Healthy People 2020 population targets for

breastfeeding, which include 81.9% for any breastfeeding, <15.6% supplementation at 48 hours, and 44.3% exclusive breastfeeding at 3 months.[1,3] In striving to attain these goals, the AAP recognizes the "need to revise disruptive hospital policies" that interfere with early contact between mother and infant.[1]

Evaluation for possible early-onset sepsis (EOS) due to perinatal risk factors is 1 of the most common medical interventions in low-risk term newborns.[4] Published AAP breastfeeding policies for hospital practice recommend not separating mothers and infants unless a significantly elevated risk of sepsis is present.[5] However, based on national guidelines from the Centers for Disease Control and Prevention (CDC) and the AAP, a large proportion of asymptomatic infants with many different perinatal risk factors are considered to have an elevated risk.[6] At numerous hospitals (including our own), EOS evaluations are conducted in a location separate from the delivery suite, resulting in early maternal–infant separation. Although such separation has been considered brief, necessary, and benign, its impact on breastfeeding has not, to our knowledge, been quantified. In the present study, we examined the effect of the separation of mothers and well-appearing infants in the first 2 hours of life for EOS evaluation on initiation of breastfeeding within the first 2 hours of life and on formula supplementation within the first 24 hours of life.

METHODS

Study Design

The present study is a secondary, observational analysis of data collected between 2002 and 2005 for a randomized controlled trial examining the maternal and infant consequences of epidural analgesia use during labor in healthy, low-risk women. Study participants were nulliparous women with singleton low-risk pregnancies planning to deliver at Brigham and Women's Hospital or Massachusetts General Hospital. Women were randomized during pregnancy to receive doula support in labor or to usual care. Women in the doula group were encouraged to avoid epidural analgesia.[7] The study was approved by the Partners HealthCare Human Research Committee.

Study Population

There were 820 mother–infant dyads enrolled in the original study. After applying exclusion criteria as delineated in Fig 1, our analysis of breastfeeding initiation included 692 dyads. A total of 101 infants were separated from their mothers in the first 2 hours of life for EOS evaluation due to the presence of perinatal risk factors, and 591 were not separated. These 591 dyads included 23 infants who were evaluated for EOS based on perinatal risk factors but separated after 2 hours of life and 568 infants without perinatal EOS risk. For the analysis of supplementation, we also excluded infants who were labeled as having "nothing by mouth" during the first 24 hours and those who became hypoglycemic (supplementation might have been medically indicated in the latter group). After these exclusions, all infants in the cohort were asymptomatic, and all maternal–infant separations in the first 2 hours of life were for EOS evaluation.

During the study period, neither of the institutions had a written policy for supplementation of breastfeeding infants.

Definitions

Early initiation of breastfeeding was defined as any documented breastfeeding attempt within the first 2 hours of life regardless of the quality of the feeding attempt. The first 2 hours after birth were designated as the time window of interest for several reasons. By definition, newborns with risk factors for EOS have a medical problem at birth that must be addressed. Although neither the CDC nor the AAP specify exactly when EOS evaluation for risk factors should occur, we chose 2 hours after birth as the period within which we believe most clinicians accomplish this task. Given the technical issues of EOS evaluation, we also felt that 2 hours was a more realistic goal for initiation of breastfeeding (rather than the usual standard of 1 hour).

Supplementation was defined as offering formula within the first 24 hours of life for 2 reasons. First, even in the setting of breastfeeding difficulty, there are few situations in which formula supplementation would be medically indicated in the first 24 hours of life for asymptomatic infants. Second, our data were most complete for this time period because many infants in our institutions are discharged between 24 and 48 hours of life.

Data Sources

Demographic data and information on intention to breastfeed were obtained at the time of enrollment by using a prenatal questionnaire. Details regarding the clinical course of the mother and infant, including feeding measures, were abstracted from medical records.

EOS Evaluation Criteria and Methods

During the study period, asymptomatic term infants born at our study centers were evaluated for EOS based on the following risk factors (as aligned with

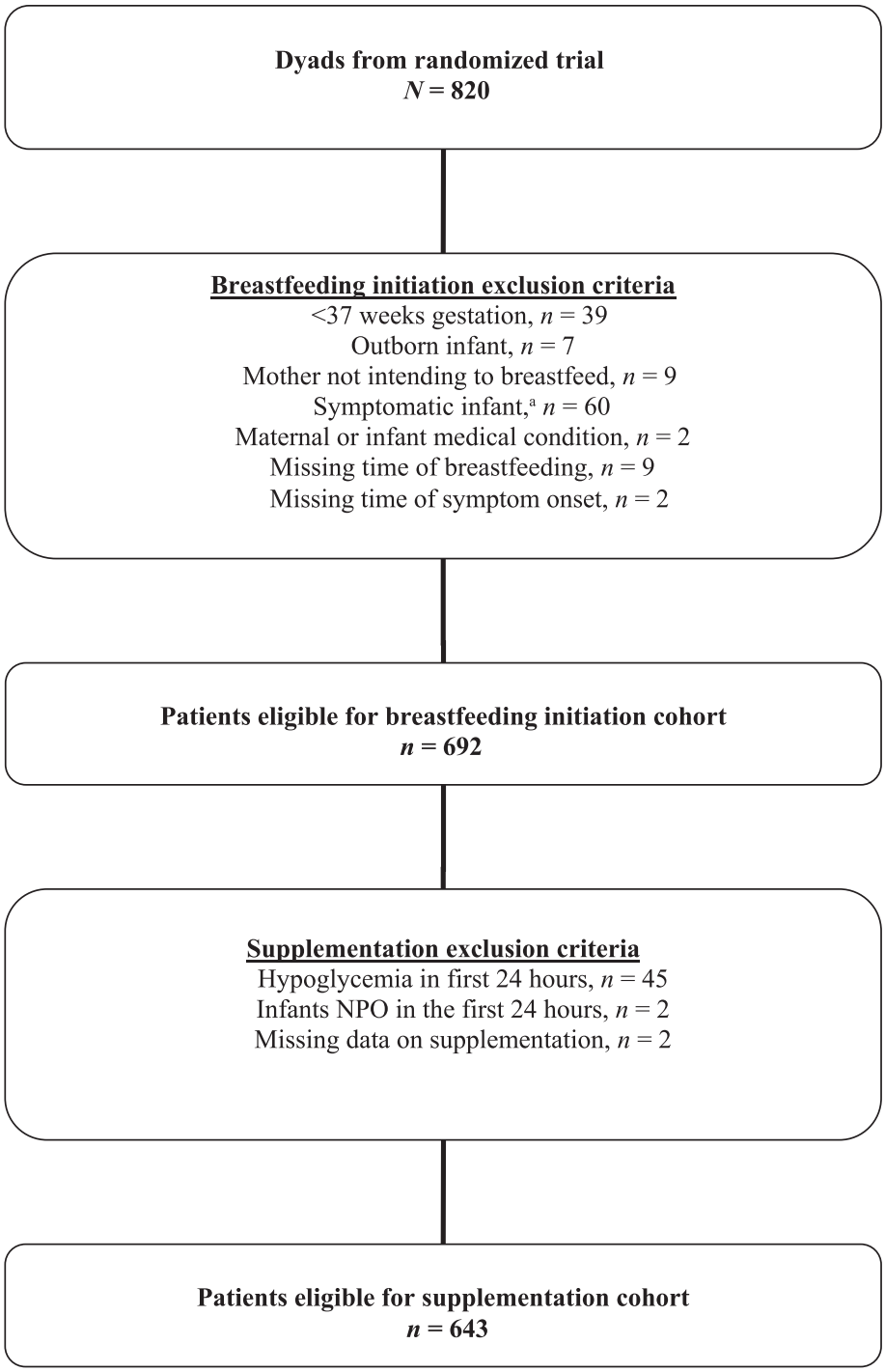

FIGURE 1 Study population distribution. [a]Symptomatic infants were defined as those who were not well appearing and who had symptoms serious enough to warrant separation from their mother in the first 15 minutes of birth. NPO, nothing by mouth.

the CDC perinatal group B streptococcus [GBS] prevention guidelines of 1996 and 2002): inadequate intrapartum antibiotic prophylaxis indicated for maternal GBS colonization; maternal fever (≥100.4°F [≥38°C]); and chorioamnionitis. Duration of rupture of membranes ≥18 hours and/or sustained fetal tachycardia (rate >160 beats/min), when present in combination with another risk factor, were also criteria for evaluation. All infants meeting criteria for sepsis evaluation were transferred to an area separate from the mother's delivery room for this evaluation, which included a physical examination, drawing of complete blood counts and blood cultures, and initiation of antibiotics, if indicated. Indications for empirical neonatal antibiotics were as follows: chorioamnionitis; maternal fever ≥101°F (≥38.33°C); or maternal fever between 100.4°F (38°C) and 100.9°F (38.28°C) in combination with any other risk factor. Asymptomatic infants were transferred back to the mother's room after the EOS evaluation was completed. If neonatal antibiotics were indicated, subsequent doses were administered on the postpartum floors.

Analysis

Analyses were performed to identify antenatal, intrapartum, and early postpartum factors associated with the study exposure and outcomes. Statistical differences between groups were assessed by using χ^2 tests or Fischer's exact test for categorical variables and *t* tests or the Kruskal-Wallis test for continuous variables. A *P* value <.05 was considered statistically significant. In the main analysis for breastfeeding initiation, multivariate logistic regression was used to assess the association of late initiation with separation for EOS evaluation. The initial model included all variables significantly associated ($P \leq .05$) with either the exposure or the outcomes in bivariate analysis. Nonsignificant variables ($P > .05$) were then eliminated in a step-wise manner. Variables that altered estimates of our exposure by ≥10% were added back into the model and retained as confounders. Of note,

randomization groups were not associated with either the exposure or outcomes for this study. All analyses were performed by using SAS version 9.3 (SAS Institute, Inc, Cary, NC).

RESULTS

Breastfeeding Initiation Among Infants Separated in the First 2 Hours of Life Versus Infants Not Separated

In the study cohort of 692 mother–infant dyads, delayed initiation of breastfeeding was more common among infants separated from their mothers in the first 2 hours of life (47 of 101 [46.5%]) compared with those not separated (74 of 591 [12.5%]; $P < .001$). All infants in our cohort were asymptomatic, and the only reason for early separation was EOS evaluation. Table 1 compares the clinical and demographic characteristics of dyads with and without separation for EOS evaluation in the first 2 hours of life. Table 2 presents the odds of delayed initiation for factors significantly associated with EOS evaluation and/or delayed initiation. In the logistic regression model, EOS evaluation in the first 2 hours of life remained significantly associated with late initiation of breastfeeding along with non-white race, maternal prepregnancy BMI ≥30, and assisted vaginal or cesarean delivery.

Factors Associated With Breastfeeding Initiation Among Infants Separated in the First 2 Hours of Life

In the subgroup of 101 dyads separated for EOS evaluation in the first 2 hours of life, we examined the total amount of time spent with the mother during the first 2 hours of life both before and after return from EOS evaluation. Among the dyads spending ≤0.5 hour together, 71.4% (20 of 28) initiated breastfeeding late compared with 41.2% (21 of 51) of those spending 0.6 to 1.5 hours, and 13.3% (2 of 15) of dyads spending at least 1.5 of 2 hours together ($P < .001$). Infants with delayed initiation in this cohort were more likely to have mothers with intrapartum fever (45 of 47 [95.7%] vs 43 of 54 [79.6%]; $P = .02$) and to receive empirical antibiotic therapy as part of their management for sepsis risk (37 of 47 [78.7%] vs 27 of 54 [50.0%]; $P = .004$). Maternal demographic factors, other intrapartum factors (spontaneous onset of labor, epidural use, length of labor, and mode of delivery) and infant clinical outcomes did not differ among early and late initiators in this cohort (data not shown; available upon request). Controlling for the effect of maternal fever and neonatal antibiotics in a logistic regression model, only mothers and infants who spent ≤0.5 hour together in the first 2 hours of life had significantly delayed initiation compared with the reference group of infants spending >1.5 hours with their mothers (Table 3).

TABLE 1 Characteristics of Mother–Infant Dyads With and Without Separation in the First 2 Hours of Life for EOS Evaluation, $N = 692$

Characteristic	Evaluated Within 2 Hours ($n = 101$)	Not Evaluated in 2 Hours ($n = 591$)	P
Maternal demographic characteristics			
Non-white race	42 (41.6)	164 (27.8)	.007
Mean age at delivery, y	31.1 ± 4.7	31 ± 4.2	.85
Prepregnancy BMI ≥30[a]	6 (6.1)	21 (3.6)	.26
Education less than college graduate[a]	12 (12)	73 (12.5)	.89
Intrapartum factors			
Spontaneous onset of labor	66 (65.3)	379 (64.1)	.91
Epidural analgesia used	85 (84.2)	362 (61.3)	<.001
Labor ≥18 h	40 (39.6)	132 (22.3)	<.001
Delivery mode			
Vaginal	49 (48.5)	415 (70.2)	<.001
Assisted vaginal	25 (24.8)	56 (9.5)	
Cesarean	27 (26.7)	120 (20.3)	
Infant characteristics			
Gestational age <39 wk	11 (10.9)	118 (20)	.04
Mean birth weight, g	3500 ± 443.4	3443 ± 427.7	.22
Male gender	57 (56.4)	302 (51.1)	.33
Apgar score ≤7 at 5 min	2 (2.0)	2 (0.34)	.1
Infant outcomes			
Early breastfeeding initiation	54 (53.5)	517 (87.5)	<.001
Admitted to NICU during hospital stay	1 (1.0)	4 (0.7)	.28
Weight at discharge, g	3295 ± 423	3226 ± 407	.11
Length of stay, d	2.1 ± 1	2.3 ± 1.3	.15

Data are presented as n (%) or mean ± SD.
[a] Prepregnancy BMI data were missing in 3 subjects separated for EOS evaluation and in 9 subjects not separated. Maternal education data were missing in 1 subject separated for EOS evaluation and in 5 subjects not separated.

Breastfeeding Initiation Among All Infants Evaluated for EOS With and Without Separation in the First 2 Hours of Life

In addition to the 101 infants separated from their mothers in the first 2 hours of life for EOS evaluation, there were 23 asymptomatic infants whose EOS evaluations were not conducted until after 2 hours. Although the infants separated and not separated from their mothers were similar in terms of perinatal risk factors for EOS (Table 4), infants not separated from their mothers were more likely to initiate breastfeeding early (20 of 23 [87.0%] vs 54 of

TABLE 2 Characteristics Significantly Associated With Delayed Breastfeeding Initiation and the Adjusted Odds of the Final Regression Model, $N = 692$

Characteristic	Unadjusted OR (95% CI)	*P* for Bivariate Analysis	aOR (95% CI)	*P* for Final Model
Separation in 2 h of life for EOS evaluation[a]	6.1 (3.8–9.6)	<.001	5.5 (3.4–8.9)	<.001
Race: non-white	2.0 (1.3–2.9)	.001	1.6 (1.1–2.6)	.03
Maternal prepregnancy BMI ≥30[b]	4.0 (1.8–8.8)	<.001	3.5 (1.5–8.4)	.004
Mode of delivery				
Vaginal	Ref	Ref	Ref	Ref
Assisted vaginal	2.7 (1.5–4.7)	<.001	1.9 (1.0–35)	.05
Cesarean	2.9 (1.8–4.5)	<.001	2.5 (1.5–4.0)	<.001
Length of labor ≥18 h	2.4 (1.6–3.6)	<.001	—	—
Spontaneous onset of labor	0.6 (0.4–0.9)	.008	—	—
Gestational age <39 wk[c]	1.2 (0.71–2.0)	.51	—	—
Epidural used[c]	1.4 (0.9–2.1)	.15	—	—

—, variables not included in the final model.
[a] All cases separated in the first 2 hours were due to risk factor–based EOS evaluation.
[b] Prepregnancy BMI data were missing in 12 subjects of the early initiation group.
[c] These variables were included due to their association with the main predictor (ie, separation).

101 [53.5%]; $P = .004$). This proportion was similar to those never undergoing EOS evaluation for perinatal risk factors (517 of 568 [91.0%]).

Supplementation Rates Among Infants Separated in the First 2 Hours of Life Versus Infants Not Separated

There were 643 dyads included in this analysis (Fig 1). Formula supplementation was significantly associated with both separation for EOS evaluation (18 of 93 [19.4%] separated vs 57 of 550 [10.4%] not separated; $P = .02$) and late initiation (23 of 111 [20.7%] late initiation vs 52 of 532 [9.8%] early initiation; $P = .003$). To understand this association, the cohorts were stratified according to time of initiation, and the relationship between supplementation and separation was then examined. After stratifying according to initiation, separation for EOS evaluation was not significantly associated with supplementation (Table 5).

Other factors associated with formula supplementation included non-white race, maternal education below graduate level, age at delivery, use of epidural analgesia, use of oxytocin to augment labor, and mode of delivery (data not shown; available upon request). These variables were included along with initiation as our main predictor in a logistic regression model. In the final model, late initiation remained significantly associated with supplementation (adjusted odds ratio [aOR]: 1.9 [95% confidence interval (CI): 1.1–3.5]; $P = .03$), along with maternal education less than graduate level (aOR: 3.6 [95% CI: 2.0–6.6]; $P < .001$), non-white race (aOR: 2.8 [95% CI: 1.7–4.8]; $P < .001$), and use of epidural analgesia (aOR: 2.6 [95% CI: 1.4–5.1]; $P = .04$). Cesarean delivery

TABLE 3 Characteristics Associated With Delayed Breastfeeding Initiation in the Cohort Separated for EOS Evaluation Within 2 Hours of Life, $N = 101$

Characteristic	Unadjusted Odds Ratio (95% CI)	*P* for Bivariate Analysis	aOR (95% CI)	*P* for Final Model
Perinatal risk factors				
Maternal temperature				
Maximum temperature >101°F (>38.33°C)	8.5 (1.7–42.6)	.009	2.8 (0.4–19.9)	.31
Maximum temperature 100.4°F–100.9°F (38.0°C–38.28°C)	3.4 (0.7–17.4)	.15	1.7 (0.3–10.4)	.56
No maternal fever	Ref	Ref	Ref	Ref
Inadequate GBS prophylaxis	0.1 (0.01–0.7)	.02	—	—
Rupture of membranes ≥18 h	1.2 (0.5–3.0)	.68	—	—
Chorioamnionitis	2.3 (0.9–5.7)	.08	—	—
Maternal intrapartum antibiotics[a]	0.9 (0.3–2.5)	.76	—	—
Infant characteristics				
Gestational age <39 wk	1.1 (0.3–3.7)	.94	—	—
Birth weight, per 1000 g	1.2 (0.9–1.5)	.11	—	—
Male gender	1.5 (0.7–3.3)	.32	—	—
Apgar score ≤7 at 5 min	1.2 (0.1–19.0)	.92	—	—
Neonatal antibiotic administration at EOS evaluation	3.7 (1.5–8.9)	.004	1.7 (0.5–5.9)	.45
Hours spent with mother in the 2 h after birth[b]				
≤0.5	14.2 (2.7–73.9)	.002	8.9 (1.5–53.7)	.02
0.6–1.5	4.6 (0.9–22.3)	.06	4.0 (0.8–20.3)	.09
>1.5	Ref	Ref	Ref	Ref

[a] Excludes antibiotics used for surgical prophylaxis in cesarean delivery.
[b] Final model, $N = 94$ (3 infants in the early initiation group and 4 infants in the late initiation group had data missing for time spent with mother).

TABLE 4 Comparison of Perinatal Risk Factors Leading to EOS Evaluation Among the Mother–Infant Pairs Undergoing EOS Evaluation Within and After 2 Hours of Life, $N = 124$

Characteristic	Evaluated Within 2 Hours ($n = 101$)	Evaluated After 2 Hours ($n = 23$)	*P*
Perinatal risk factors			
Maternal temperature			
No fever	13 (12.9)	3 (13)	.97
100.4°F–100.9°F (38.0°C –38.28°C)	37 (36.6)	9 (39.1)	
≥101°F (≥38.33°C)	51 (50.5)	11 (47.3)	
Inadequate GBS prophylaxis	12 (11.9)	4 (17.4)	.50
Rupture of membranes ≥18 h	26 (25.7)	5 (21.7)	.8
Chorioamnionitis	26 (25.7)	9 (39.1)	.21
Maternal intrapartum antibiotics[a]	85 (84.2)	17 (73.9)	.24
Administered 4 h before delivery	41 (48.2)	7 (41.2)	
Infant outcome[b]			
Breastfeeding initiation in 2 h	54 (53.5)	20 (87.0)	.004

Unless otherwise indicated, data are presented as *n* (%).
[a] Excludes antibiotics used for surgical prophylaxis in cesarean delivery.
[b] No blood culture–positive cases were present in either group.

(aOR: 1.8 [95% CI: 1.0–3.3]; $P = .07$) and assisted vaginal delivery (aOR: 1.5 [95% CI: 0.7–3.1]; $P = .3$) were retained in the model as confounders.

DISCUSSION

The present study found that early mother–infant separation for EOS evaluation in otherwise asymptomatic, well-appearing term newborns was associated with significant interference with breastfeeding initiation, which subsequently increased the risk for early formula supplementation. This association remained strong after adjusting for confounders. Although infants undergoing such separation constituted 14.6% of the study cohort, they comprised 38.8% of the late initiators. The role of early breastfeeding initiation and avoidance of supplementation on long-term successful breastfeeding has been established.[8] Therefore, we believe that modifying separation for EOS evaluation in this low-risk cohort could substantially improve the rate of breastfeeding.

Practices known to improve breastfeeding rates include skin-to-skin contact, early initiation, no supplementation, and rooming in, all of which require early and consistent proximity of the mother to her newborn.[8–12] The effect of these early interventions has been shown in the analyses of both the 1993/1994 IFPS (Infant Feeding Practices Study) I and the 2005–2007 IFPS II, which concluded that initiation of breastfeeding within 1 hour of birth and avoidance of supplementation were practices most consistently associated with breastfeeding beyond 6 weeks.[8,10] Our results are consistent with previous studies suggesting that mother–infant separation soon after birth delays initiation.[8,9,13,14]

In conducting this study, we were concerned that the factors associated with EOS risk may negatively affect breastfeeding, particularly if such factors (eg, maternal fever) reflect poor maternal condition after delivery. However, the analyses suggest that it was the separation and not the EOS risk factors themselves that resulted in delayed initiation of breastfeeding. Among infants separated in the first 2 hours of life ($n = 101$), the amount of time mother and infant spent together during this period was directly related to early breastfeeding initiation and was the only significant predictor in a regression model (Table 3). Furthermore, infants with EOS risk factors who were not separated for evaluation until after 2 hours of life ($n = 23$) had a risk factor profile similar to infants separated in the first 2 hours but a significantly higher rate of early initiation, similar to infants without any EOS risk factors (Table 4).

The incidence of EOS has declined over the last decade in the United States. Cases that do occur, however, can result in significant morbidity and mortality, leading to continued recommendations for risk factor–based screening at birth. We have previously reported that, following a local algorithm based on the CDC's 2002 recommendations

TABLE 5 Influence of Early Initiation on Formula Supplementation Among Well-Appearing Infants With and Without Separation for EOS Evaluation, $N = 643$

Supplementation Within 24 Hours	Breastfeeding Initiation Within 2 Hours ($n = 532$)		*P*	Breastfeeding Initiation After 2 Hours ($n = 111$)		*P*
	Separation ($n = 49$ [9.2%])	No Separation ($n = 483$ [90.8%])		Separation ($n = 44$ [39.6%])	No Separation ($n = 67$ [60.4%])	
No	43 (87.8)	437 (90.5)	.61	32 (72.7)	56 (83.5)	.23
Yes	6 (12.3)	46 (9.5)		12 (27.3)	11 (16.4)	

for perinatal GBS prevention at our institution, we evaluated 14.7% of well-appearing late preterm and term infants and empirically treated 55.4% of those infants.[15] Although AAP hospital practice guidelines recommend immediate skin-to-skin contact for asymptomatic infants with their mothers, they recognize the need for pediatric assessment among infants "born in the context of markedly elevated infection risk."[5] In practice, concern that delayed EOS evaluation may lead to progressive newborn infection, along with the logistics of evaluating neonates and initiating treatment, contribute to the early separation of the infant from the mother at many birth hospitals. Recent research has demonstrated that a multivariate model to quantify the risk of EOS based on intrapartum risk factors can be combined with the infant's clinical condition to identify infants at highest risk of infection.[16,17] Clinical care algorithms that use such an approach may significantly reduce the number of infants evaluated and empirically treated with antibiotics. This approach, we believe, may improve breastfeeding outcomes by reducing the need for medically indicated separation. Mother–infant separation is required in many care settings to obtain laboratory studies of newborns at risk for EOS. Cantoni et al[18] recently demonstrated that frequent, standardized physical examinations may be substituted for laboratory studies to screen infants for GBS-specific EOS. Such an approach could be integrated into the evaluation of infants who require EOS evaluation to minimize mother–infant separation in the first hours of life. Other possible approaches to improving breastfeeding outcomes among the infants who still require evaluation include: conducting the EOS evaluation in the mother's delivery room; allowing the first breastfeeding to occur before separation; and/or permitting maternal–infant contact during the time required for antibiotic infusion, with the latter having been shown to prolong separation.[4] We found a strong relationship between delayed initiation and duration of mother–infant separation. Quality improvement efforts directed at improving the efficiency of indicated evaluations should be pursued to reduce the duration of mother–infant separation. Additional practices to support breastfeeding among mother–infant dyads when separation is unavoidable have been published by the AAP and the Academy of Breastfeeding Medicine.[5,19]

Consistent with previous studies,[20–24] we found independent significant associations of race, maternal education, high prepregnancy maternal BMI, assisted mode of deliveries, and epidural analgesia use with delayed initiation and/or early supplementation in our cohort. Our findings reinforce the need for intensive early breastfeeding support directed toward these vulnerable populations at higher risk for failure.

The present study had several limitations. It was conducted in 2 tertiary care centers with strict compliance with local CDC-based EOS guidelines. Our results may not be generalizable therefore to hospitals with dissimilar EOS care protocols, different perinatal care structures, or those with established World Health Organization Baby-Friendly Hospital Initiative practices. Our institutions did not have a strict supplementation policy at the time of this study, and our outcomes may be different from care settings with more robust breastfeeding policies. The study was conducted before the 2010 revision of the CDC guidelines for perinatal GBS prevention, and although the associations we identified should remain, the frequency of evaluations may be lower under the new guidelines.[4] The present study also did not include follow-up data to explore the long-term effect on breastfeeding outcomes. However, multiple large cohort studies have demonstrated the importance of early initiation and avoidance of early supplementation to breastfeeding success.[8,10] We instead focused on a very low risk cohort to highlight the group in which modification of EOS evaluation practices might be most beneficial with the least potential for harm. Our results are therefore best generalized to this group of mother–infant dyads.

CONCLUSIONS

We found that mother–infant separation within 2 hours of birth for conducting EOS evaluation among asymptomatic term infants was associated with delayed breastfeeding initiation and increased early formula supplementation, with the potential for long-term consequences. We recommend that perinatal centers consider the impact of sepsis evaluations on breastfeeding when formulating neonatal care guidelines.

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Dr Mukhopadhyay analyzed and interpreted the data, and revised and rewrote the initial manuscript. Dr Lieberman was the overall principal investigator for the study; she conceptualized the study question, designed the study, designed the data collection instruments, reviewed the analysis and conclusions, and reviewed and revised the manuscript. Dr Riley was the site principal investigator at Massachusetts General Hospital for the randomized trial; she interpreted the results and reviewed and revised the manuscript. Dr Puopolo reviewed the data analysis, interpreted the results, reviewed the conclusions, and reviewed and revised the manuscript. Dr Johnson was responsible for designing the pediatric elements of the original study; she conceptualized the hypothesis for the current manuscript, contributed to study design and design of the data collection instruments, collected and analyzed the data, and drafted the initial manuscript. All authors approved the final manuscript as submitted.

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