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# In-Hospital Formula Use Increases Early Breastfeeding Cessation Among First-Time Mothers Intending to Exclusively Breastfeed

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## Abstract

**Objective**—To evaluate in-hospital formula supplementation among first time mothers who intended to exclusively breastfeed and determined if in-hospital formula supplementation shortens breastfeeding duration after adjusting for breastfeeding intention.

**Study design**—We assessed strength of breastfeeding intentions prenatally in a diverse cohort of expectant primiparae and followed infant feeding practices through day 60. Among mothers planning to exclusively breastfed their healthy term infants for ≥ 1 week, we determined predictors, reasons, and characteristics of in-hospital formula supplementation; and calculated the intention-adjusted relative risk (ARR) of not fully breastfeeding days 30–60 and breastfeeding cessation by day 60 with in-hospital formula supplementation (n=393).

**Results**—210 (53%) infants exclusively breastfed during the maternity stay and 183 (47%) received in-hospital formula supplementation. The most prevalent reasons mothers cited for inhospital formula supplementation were: perceived insufficient milk supply (18%), signs of inadequate intake (16%), and poor latch or breastfeeding (14%). Prevalence of not fully breastfeeding days 30–60 was 67.8% vs 36.7%, ARR 1.8 [95% CI, 1.4–2.3], in-hospital formula supplementation vs exclusively breastfed groups respectively, and breastfeeding cessation by day 60 was 32.8% vs 10.5%, ARR 2.7 [95% CI,1.7–4.5]. Odds of both adverse outcomes increased with more in-hospital formula supplementation feeds (not fully breastfeeding days 30–60, P=.003 and breastfeeding cessation, P=.011).

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**Conclusions**—Among women intending exclusively breastfed, in-hospital formula supplementation was associated with nearly 2-fold greater risk of not fully breastfeeding days 30–60 and nearly 3-fold risk of breastfeeding cessation by day 60, even after adjusting for strength of breastfeeding intentions. Strategies should be sought to avoid unnecessary in-hospital formula supplementation and to support breastfeeding when in-hospital formula supplementation is unavoidable.

## Keywords

Formula; supplementation; hospital; infant; breastfeed; neonate; breastfeeding duration

Improving rates of breastfeeding exclusivity and duration are among national Healthy People 2020 goals,[1] as the myriad risks of non-exclusive or shortened breastfeeding for both mother and infant are generally dose-responsive.[2–4] Recommended maternity practices to support breastfeeding include provision of breastmilk substitutes only when medically indicated,[5, 6] e.g. neonatal hypoglycemia that does not respond to breastfeeding. Accordingly, The Joint Commission, which accredits and certifies health care organizations in the US, now includes exclusive breastmilk feeding among its evidence-based perinatal core measures with the target at 90% of term singletons being exclusively breastfed during the birth hospitalization[7]. Further, Healthy People 2020 newly targets reducing the proportion of breastfed newborns who receive formula supplements within the first 2 days of life to 14.2% from the baseline of 24.2% reported in 2007–09.[1]

The current high rates of in-hospital formula supplementation are of concern as multiple studies document that formula supplements during the maternity stay are associated with shortened durations of both exclusive[8–10] as well as 'any' breastfeeding.[10–13] For example, amongst 1907 mothers who intended to breastfeed for longer than 2 months surveyed in the Infant Feeding Practices Study II, exclusive breastfeeding during the hospital stay was associated with an aOR of 0.47 (0.34–0.64) for breastfeeding cessation before 6 weeks.[12] The study was limited, however, by measuring in-hospital breastfeeding exclusivity by maternal recall at 1 month postpartum.

It is unclear whether early formula supplementation is causally related to shortened breastfeeding duration. None of the aforementioned studies adjusted for strength of breastfeeding intentions, and some did not measure intention at all[8, 13], despite the fact that feeding intention has been demonstrated in previous studies to relate positively to breastfeeding duration.[11, 14–16] In addition to potentially serving as a marker for weaker breastfeeding intentions, early formula provision has been hypothesized to create or exacerbate problems with infant breastfeeding behavior and/or maternal milk supply.[17]

Our objectives were to prospectively evaluate among first-time mothers intending to exclusively breastfeed during the birth hospitalization, the predictors of, reasons for, and characteristics of in-hospital formula supplementation; and whether in-hospital formula supplementation is associated with increased risk of not fully breastfeeding between days 30–60 or breastfeeding cessation by day 60 after adjusting for strength of breastfeeding intentions measured prenatally.

## Methods

Our analysis is based on participants in a longitudinal cohort study examining barriers to early lactation success in a multi-ethnic population of first-time mothers. We have previously described the screening and enrollment.[18, 19] Briefly, we screened all women receiving care between January 2006 and December 2007 at the University of California Davis Medical Center (UCDMC) for eligibility based on prenatal inclusion [participants between 32 and 40 weeks gestation at time of interview, expecting their first live-born infant, carrying a single fetus, speaking either English or Spanish, and living within the catchment area (8-mile radius of UCDMC in Sacramento, CA)] and exclusion [mothers who were referred to UCDMC due to medical condition, those with known absolute contraindication to breastfeeding, or who were <19 years of age and not able to obtain parental consent] criteria. Consenting, enrolled participants were further screened for postpartum follow-up eligibility within 24 hours of giving birth. Postnatally, we excluded participants from follow-up for the following reasons: mother delivered elsewhere, infant born < 37 weeks, mother and baby separated in the immediate postpartum > 24 hours, or mother did not initiate breastfeeding. In addition, for this analysis, we excluded mothers who indicated in the prenatal interview intention to exclusively breastfeed < 1 week. Institutional review board approval from the University of California Davis and written informed consent from each participant were obtained. A protocol to conduct secondary chart review and data analysis was also approved by the Cincinnati Children's Hospital institutional review board.

UCDMC has a breastfeeding policy consistent with the Ten Steps for Successful Breastfeeding.[20] Mothers experiencing lactation difficulties are referred to a nurse lactation consultant. Women may also be referred to an early breastfeeding follow-up clinic after discharge for on-going lactation assistance.

Subjects were interviewed prenatally regarding demographic characteristics (ethnicity, years of education, health insurance status [public vs private, used as a proxy for income] and age), psychosocial measures related to infant feeding,[21] and infant feeding intentions (IFI). For the latter, we used the previously validated Infant Feeding Intentions (IFI) Scale,[22,23] which provides a quantitative measure of intention to provide breastmilk as the sole source of milk over the first 6 months. Possible score ranges from 0 (no intention to breastfeed at all) to 16 (very much agree with 'When my baby is 6 months old, I will be breastfeeding without using any formula or other milk'). Based on the IFI Scale score, we ranked strength of breastfeeding intention as weak (0–7.5); moderate (8.0–11.5); strong (12–15.5) or very strong (16.0). We also asked the open-ended questions 'How long do you plan to breastfeed before you start giving your baby formula/cow's (or regular) milk?' Within 24 hours of birth (day 0), research assistants obtained information from the medical record and a face-to-face interview with the mother on labor, delivery and birth interventions and outcomes; infant feeding patterns and breastfeeding behaviors; breastfeeding problems; formula use and reasons for supplementation (multiple reasons were accepted); and nipple type and pain.[24] Assistants observed and rated breastfeeding according to the Infant Breastfeeding Assessment Tool[25] if possible. Feeding surveys and observations were repeated on days 3 and 7 at the home, hospital or clinic. In-hospital formula supplementation was recorded if

reported by the mother or documented in the medical record prior to hospital discharge up to 72 hours of age. Daily reasons for in-hospital formula supplementation, as described by the mother in response to open-ended queries, were coded according to salient concepts; multiple codes could be assigned to each response. Related codes were then grouped into main categories. Mothers were queried at 14, 30 and 60 days by telephone regarding: (1) breastfeeding practices, both since the previous interview and within the past 24 hours, including breastfeeding frequency and use of formula or other milks/liquids (and reasons); (2) breastfeeding problems since the last interview; and (3) reasons for breastfeeding cessation, if applicable.

### Analytic sample

In addition to the postnatal exclusion criteria established for the original follow up cohort, for the analysis reported here we also excluded participants who did not intend to ever exclusively breastfed. We operationally defined this exclusion criterion as participants who indicated in response to the prenatal interview question, "How long do you plan to breastfeed before you start giving your baby formula?" an answer of less than 1 week. Thus this analysis is based on first-time mothers who delivered at term, were separated from their infant for fewer than 24 hours after birth, and intended to exclusively breastfed at least through the maternity stay.

### Assignment of in-hospital formula supplementation exposure status

Dyads were categorized into the in-hospital formula supplementation group if the infant received any formula supplementation as reported by the mother or documented in the medical record during the maternity stay. Otherwise the dyad was defined as exclusively breastfeeding during the birth hospitalization.

**Definition of breastfeeding outcome measures**—We operationally defined "not fully breastfeeding between days 30 and 60" [26] as the mother indicating at the day 60 interview use of any formula or other milks during the interval since the day 30 interview (ie, supplementing breastfeeding with formula or feeding only formula between days 30 and 60). Full breastfeeding allows for occasional use of water, tea or juice, but no formula or other breast milk substitutes. We operationally defined "breastfeeding cessation by day 60" as the participant indicating at the day 60 interview no breastfeeds and no feeds of expressed mother's milk in the previous 24 hours.

**Statistical analyses**—We compared the prevalence of in-hospital formula supplementation stratified by maternal characteristics, labor and delivery variables, infant characteristics, and concurrent maternity stay variables. We used the $\chi^2$ statistic to test for significant differences in in-hospital formula supplementation prevalence across strata and logistic regression analysis to determine if these differences persisted after adjustment for IFI rank.

We next used logistic regression analysis to calculate the crude and aOR for each breastfeeding outcome in the in-hospital formula supplementation vs exclusively breastfed in-hospital groups. We included IFI rank, maternal education (some vs no college),

ethnicity, age, health insurance status, and length of maternity stay as confounding variables in our adjusted models. We used Kleinman's method to estimate adjusted relative risk (ARR) and 95% CI from the multiple variable logistic regression models.[27] We further examined the aOR of each breastfeeding outcome by the reason and characteristics of in-hospital formula supplementation with exclusively breastfed in-hospital serving as the referent group. As multiple reasons for in-hospital formula supplementation were accepted, we also compared aOR for breastfeeding outcomes among in-hospital formula supplementation mothers who did vs did not report a specific reason.

Among in-hospital formula supplementation users, we also tested for significant trends by in-hospital formula supplementation characteristics of volume, number of feeds, mode and timing of first use for each breastfeeding outcome using the $\chi^2$ test. We then used multivariate analysis to evaluate independent associations of in-hospital formula supplementation frequency, volume and mode (bottle vs no bottle use) with outcomes, as bottle use was correlated with both frequency and volume of feeds. All analyses were performed using SAS version 9.3 (SAS Institute Inc. Cary, NC).

## Results

Over the 24 months of enrollment, 768 of women screened met prenatal inclusion criteria of whom 69% (532) agreed to participate in the study (detailed previously[18]). Of the 532 women interviewed prenatally, 40 (8%) were lost to follow-up prior to the day 0 postpartum interview and 44 (8%) became ineligible for postnatal follow-up [preterm birth (11), separated > 24 hours at birth (21), and chose not to breastfeed (12)]. Of the 448 participants in the original follow-up cohort, 409 planned to exclusively breastfeed for at least 1 week (91%). Analyses were performed on those with available data on in-hospital formula supplementation use (n=407) and breastfeeding practices to 60 days (n=393). Mean (SD) maternal age was 26.3 (5.9) years (range 16.4 to 41.5); 38% had a high school education or less; 47% had public health insurance (used as a proxy for low-income); and self-identified ethnic distribution was 42% white, non-Hispanic; 26% Hispanic; 14% black, non-Hispanic; 12% Asian and 6% mixed or other (Table I; available at www.jpeds.com). Mean (SD) infant gestational age and birthweight were 39.6 (1.0) weeks and 3377 (433) grams, respectively; and 69% of participants delivered vaginally (Table II; available at www.jpeds.com). Mean and median hospital stays were 2.5 (1.5) and 2.2 days. Overall, 210 (53%) were in the exclusively breastfed in-hospital group and 183 (47%) infants received in-hospital formula supplementation during the birth hospitalization (114, 48, and 21 initiated in-hospital formula supplementation during the first, second, and third 24 hours after birth, respectively.)

### In-hospital Formula Use

in-hospital formula supplementation use by maternal characteristic is shown in Table I, and by labor, delivery, and early postpartum experiences; and maternity stay variables in Table II. After adjusting for IFI rank, the prevalence of in-hospital formula supplementation differed significantly by maternal education, income, and ethnicity. In-hospital formula supplementation was also significantly more common among dyads who had known

maternal, obstetric, peripartum or postpartum risk factors for breastfeeding difficulties (e.g. obesity, diabetes, flat or inverted nipples, no prenatal breast enlargement, cesarean delivery, greater intrapartum blood loss, delay in first holding the infant or first breastfeeding, and maternal-infant separation).

In our examination of the maternally reported reasons for in-hospital formula supplementation use, 8 main categories emerged (Table III). Further description and examples of each category are detailed in Table IV (available at www.jpeds.com). The most prevalent category (18% of overall sample) for in-hospital formula supplementation was perceived low milk supply, followed by signs of inadequate intake (16%), poor infant breastfeeding behavior (14%), and maternal-infant separation (10%). Least frequent categories included psychosocial reasons (5%), breastfeeding pain or maternal incapacitation (4% each) and concerns regarding maternal medication (1%).

### Breastfeeding Outcomes

Infants who received in-hospital formula supplementation were more likely to not be fully breastfeeding during days 30–60 than infants exclusively breastfed in-hospital, 67.8% vs 36.7%, P<0.0001, OR =3.6 (2.4, 5.5). Adjusting for IFI rank, demographic characteristics and length of maternity stay yielded an aOR of 3.9 (2.2, 6.5) and an ARR of 1.79 (1.43, 2.27). Infants in the in-hospital formula supplementation group were also more likely to experience breastfeeding cessation by day 60 than infants exclusively breastfed in-hospital, 32.8% vs 10.5%, P<0.0001, yielding an aOR of 4.4 (2.2, 8.7) and an ARR of 2.71 (1.75, 4.53).

The aOR of not fully breastfeeding days 30–60 were significantly higher within every reason for in-hospital formula supplementation (vs no in-hospital formula supplementation) except concern over maternal medication. The aORs (Figure) were greatest in the case of breastfeeding pain, maternal incapacitation, psychosocial reasons, and poor infant breastfeeding behavior. Similarly, the adjusted odds of breastfeeding cessation by day 60 were significantly higher within every reason for in-hospital formula supplementation (vs no inhospital formula supplementation) except concerns over maternal medication, separation of the dyad, and maternal incapacitation. aORs for breastfeeding cessation by day 60 were highest for in-hospital formula supplementation reasons of poor infant breastfeeding behavior, breastfeeding pain, psychosocial reasons, and perceived low milk supply. In-hospital formula supplementation because of poor infant breastfeeding behavior was the only reason that resulted in significantly greater aORs of breastfeeding cessation by day 60 compared with in-hospital formula supplementation being given for any other reason or combination of reasons that did not include poor breastfeeding behavior, P=0.02.

The aORs of not fully breastfeeding days 30–60 increased with increasing volume and number of in-hospital formula supplementation feeds (P=.016 and .002, respectively), and with bottle use (vs no bottle use, P=.011) (Table V). There was significant colinearity between these three variables, however. When all three in-hospital formula supplementation characteristics were included in a multivariate logistic regression model, bottle use (P=.029) and number of inhospital formula supplementation feeds (P=.003) remained independent predictors of not fully breastfeeding days 30–60. The aORs of not fully breastfeeding days

30–60 also increased with syringe feeding (vs no syringe feeding, P=.042) (Table III). Breastfeeding cessation by day 60 was significantly more likely with greater total number of in-hospital formula supplementation feeds (P=.003), but not with greater in-hospital formula supplementation volume (P=.10) or bottle use (P=.068). In multivariate analysis, number of in-hospital formula supplementation feeds remained a significant predictor of breastfeeding cessation by day 60 (P=.011).

There was no statistically significant difference in outcomes by age at first in-hospital formula supplementation, whether the infant received formula prior to the first breastfeed, or whether the mother indicated that in-hospital formula supplementation was recommended by a member of the healthcare team vs her own preference.

## Discussion

In this diverse group of first-time mothers who intended to exclusively breastfed for at least 1 week, in-hospital formula supplementation use was widespread. Even though hospital policy at UCDMC at the time of the study incorporated the Ten Steps[6], nearly half of all infants (47%) received in-hospital formula supplementation, most often because of maternal concern(s) about insufficient milk supply, perceived signs of inadequate infant intake, and/or poor infant breastfeeding behavior. Perceived insufficient milk supply has previously been cited as a prominent reason for in-hospital formula supplementation, in both quantitative[28] and qualitative[29] studies. The latter formative work suggests that greater understanding of the process of breastfeeding and normative newborn behavior may reduce the perception of insufficient milk.[29]

We found that in-hospital formula supplementation use was associated with a 1.8-fold increased risk of not fully breastfeeding between days 30 and 60 and a 2.7-fold increased risk of breastfeeding cessation by day 60, after excluding mothers who planned to introduce formula within the first week postpartum and adjusting for both prenatally-measured strength of intention to provide only breastmilk during the infant's first 6 months and demographic factors associated with lower breastfeeding rates. In-hospital formula supplementation given because of poor breastfeeding behavior was more strongly related to breastfeeding cessation by day 60 than giving formula for other reason(s). This suggests that these dyads are particularly vulnerable to the detrimental effect of early formula use and demonstrates the urgent need to develop and test effective interventions to prevent and help mothers overcome poor infant breastfeeding behavior.

The increased odds of not fully breastfeeding between days 30 and 60 were significant for all early formula use reasons, with the exception of concern over maternal medication use. This suggests that early formula supplementation itself may inherently interfere with establishing full breastfeeding. Physiologically, this has long been suspected, given the supply and demand nature of milk production. This increased risk of not fully breastfeeding between days 30 and 60 for nearly all reasons of in-hospital formula supplementation, including maternal incapacitation and maternal-infant separation, argues against the view that formula use is merely a marker for breastfeeding problems, previously theorized as a primary reason for the associated shortened breastfeeding durations.[9] Moreover, the 'dose-

response' association with in-hospital formula supplementation gives further credence to the hypothesis that formula supplements may be at least in part causally related to the subsequent lack of full breastfeeding and breastfeeding cessation by day 60. Dose-responsivity is one of the cardinal criteria for attributing causality when epidemiologic associations are observed.[30] It seems the sequence for many first-time mothers is that perceived breastfeeding problems are not fully resolved; subsequent early formula and bottle use perpetuate the problem and/or create new problems (via lesser supply from lesser demand or breast refusal), reducing the duration of exclusive and any breastfeeding.[31] We acknowledge, however, the possibility that our risk estimates represent a combination of in-hospital formula supplementation causing adverse outcomes, some residual confounding (eg maternal motivation incompletely adjusted for by our measures), and, in some cases, persistence of the breastfeeding problem(s) or concerns that originally precipitated the use of formula.

The odds of not fully breastfeeding between days 30 and 60 were significantly greater when in-hospital formula supplementation was provided by bottle compared with provision only by alternative feeding methods. This is similar to the findings of Howard et al[10] who reported that cup-feeding in-hospital formula supplementation was associated with a longer duration of exclusive or full breastfeeding when compared with bottle-feeding in-hospital formula supplementation in infants fed >2 supplemental feedings or born by cesarean delivery. Infants fed with a syringe (vs no syringe feeds) also fared worse, suggesting that passive feeding methods may cause greater harm. We found no significant differences between other non-bottle feeding methods, but this finding should be interpreted with caution as there were relatively few infants supplemented using each alternative feeding method.

The major strengths of this study are the relatively large and diverse sample of nearly 400 first-time mothers, prenatal measurement of IFI, collection of in-hospital formula supplementation data garnered from both the medical record and maternal interviews during the maternity stay, and follow-up on breastfeeding status through day 60. The study is limited in that the reasons for in-hospital formula supplementation as well as information on who recommended it were by maternal report. Some categories, (eg finger-feeding), have relatively small sample sizes and corresponding wide CI, limiting definitive conclusions about non-significant findings in particular.

Our findings corroborate and expand upon those of other studies demonstrating that in-hospital formula supplementation is associated with shortened durations of both exclusive [8–10] as well as 'any'[10–13] breastfeeding. Semenic et al[9] found that in-hospital formula supplementation was independently associated with cessation of exclusive breastfeeding prior to 6 months among first-time Canadian mothers who planned to exclusively breastfed for at least 6 weeks (adjusted Cox hazard ratio [95% CI] 1.4 [1.01, 1.96]); however, breastfeeding intentions were not otherwise quantified. Similarly, in Australia, in-hospital formula supplementation independently and negatively predicted 'any' breastfeeding to 6 months among primiparous women after adjusting for whether or not they intended prenatally and postnatally to breastfeed to 6 months;[11] again, strength of this intention was not otherwise quantified. Our ability to adjust for strength of intention to

exclusively breastfed measured prenatally provides stronger evidence that in-hospital formula supplementation is not simply a marker for less motivation to breastfeed.

We acknowledge conflicting evidence from a recent small study demonstrating that early limited formula use in infants with early moderate weight loss was associated with a higher prevalence of exclusive breastfeeding at 3 months.[32] We believe there may be issues with the appropriateness of the control intervention in the latter study but agree that there is a need to identify infants who truly need short-term formula use and how to best preserve breastfeeding.

In summary, in our study population, in-hospital formula supplementation during the maternity stay was associated with nearly double the risk of not fully breastfeeding between days 30–60 and triple the risk of breastfeeding cessation by day 60 after adjusting for prenatal breastfeeding intentions. Adverse breastfeeding outcomes were evident across a wide range of reasons for in-hospital formula supplementation and dose-dependent, suggesting that formula contributes to the poorer outcomes. It is important to note, however, that our data do not allow us to fully elucidate direct and indirect effects of early formula use. In some cases early formula use could be contributing significantly to the risk of negative breastfeeding outcomes through exacerbation of pre-existing issues with infant feeding or milk supply. Infants receiving in-hospital formula supplementation for the reason of poor breastfeeding behavior were particularly vulnerable.

Our findings support inclusion of exclusive breastfeeding during the maternity stay as an important Joint Commission National Quality Measure for Perinatal Care.[7] Simultaneous strategies to avoid unnecessary in-hospital formula supplementation and to mitigate adverse outcomes associated with unavoidable in-hospital formula supplementation use should be sought. In particular, our results support minimizing the number of in-hospital formula feeds and using feeding methods other than bottle-feeding. We further urge increased emphasis on prevention and early intervention for maternal report of breastfeeding concerns and problems.

## Acknowledgments

## Abbreviations

| | |
|---|---|
| **aOR** | adjusted odds ratio |
| **ARR** | adjusted relative risk |
| **IFI** | infant feeding intentions |
| **UCDMC** | University of California Davis Medical Center |

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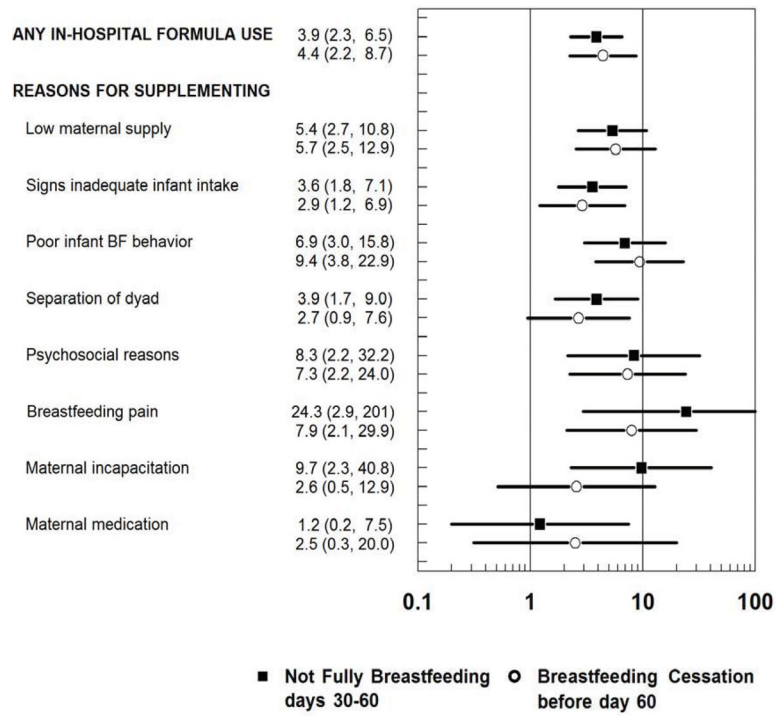
**Figure.**

Adjusted Odds Ratios for Not Fully Breastfeeding days 30–60 and Breastfeeding Cessation by day 60 for in-hospital formula supplementation Users by Reason for in-hospital formula supplementation

(Referent Group is infants exclusively breastfed during maternity stay)

**Table 1**

In-hospital Formula Use in First-Time Mothers Intending to Exclusively Breastfeed by Maternal Characteristics[*]

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions)[*] | P-value |
|---|---|---|---|---|---|---|
| **Overall** | | 407 (100) | 46.0 | | | |
| **Maternal Characteristics (from prenatal interview)** | | | | | | |
| **Age, y** | | | | | | |
| | < 30 | 290 (71) | 48.6 (42.8, 54.4) | 0.1650 | 48.1 | 0.28 |
| | 30 | 117 (29) | 41.0 (32.0, 50.1) | | 42.2 | |
| **Education** | | | | | | |
| | No college | 156 (38) | 58.3 (50.5, 66.2) | 0.0002 | 57.7 | <0.001 |
| | Some college | 251 (62) | 39.0 (33.0, 45.1) | | 39.5 | |
| **Ethnicity** | | | | | | |
| | Asian | 50 (12) | 60.0 (45.9, 74.1) | 0.0003 | 60.3 | <0.001 |
| | African-American | 57 (14) | 61.4 (48.4, 74.4) | | 59.3 | |
| | Hispanic, English primary language | 59 (14) | 54.2 (41.1, 67.3) | | 53.8 | |
| | Hispanic, Spanish primary language | 47 (12) | 53.2 (38.4, 68.0) | | 54.4 | |
| | White, non-Hispanic | 169 (42) | 32.5 (25.4, 39.7) | | 32.9 | |
| | Identifies with > 1 ethnic group | 25 (6) | 48.0 (27.0, 69.0) | | 48.6 | |
| **Health insurance status** | | | | | | |
| | Private | 216 (53) | 38.4 (31.9, 45.0) | 0.0007 | 38.9 | 0.002 |
| | Public (Medi-Cal) | 188 (47) | 55.3 (48.1, 62.5) | | 54.8 | |
| **Smoked during pregnancy** | | | | | | |
| | No | 375 (94) | 46.4 (41.3, 51.5) | 0.8940 | 46.6 | 0.81 |
| | Yes | 23 (6) | 47.8 (25.7, 69.9) | | 44.1 | |
| **Excessive prenatal depressive symptoms**[§] | | | | | | |
| | No | 334 (82) | 44.6 (39.3, 50.0) | 0.1154 | 44.8 | 0.15 |
| | Yes | 73 (18) | 54.8 (43.1, 66.5) | | 54.0 | |
| **Prenatal breast enlargement** | | | | | | |
| | None | 28 (7) | 71.4 (53.6, 89.3) | 0.0116 | 71.1 | 0.013 |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| | Little | 218 (54) | 47.7 (41.0, 54.4) | | 47.7 | |
| | A lot | 161 (40) | 40.4 (32.7, 48.0) | | 40.5 | |
| **Breastfeeding self-efficacy**$^{\Sigma}$ | | | | | | |
| | Weak | 119 (29) | 48.7 (39.6, 57.9) | 0.7965 | 45.5 | 0.73 |
| | Moderate | 137 (34) | 44.5 (36.1, 53.0) | | 44.5 | |
| | Strong | 151 (37) | 46.4 (38.3, 54.4) | | 49.0 | |
| **Comfort with breastfeeding** | | | | | | |
| | Very/Somewhat Uncomfortable | 41 (10) | 58.5 (42.8, 74.3) | 0.2589 | 55.8 | 0.30 |
| | Somewhat Comfortable | 105 (26) | 43.8 (34.2, 53.5) | | 41.7 | |
| | Very comfortable | 260 (64) | 45.8 (39.7, 51.9) | | 47 | |
| **Comfort with formula feeding** | | | | | | |
| | Very uncomfortable | 72 (18) | 40.3 (28.7, 51.9) | 0.0809 | 43.2 | 0.34 |
| | Somewhat uncomfortable | 136 (33) | 43.4 (34.9, 51.8) | | 44.6 | |
| | Somewhat comfortable | 153 (38) | 47.1 (39.1, 55.1) | | 45.6 | |
| | Very comfortable | 46 (11) | 63.0 (48.6, 77.5) | | 60 | |
| **Planned EBF Duration** | | | | | | |
| | <3 months | 46 (11) | 69.6 (55.8, 83.4) | 0.0038 | 67.7 | 0.043 |
| | 3–5.99 months | 64 (16) | 48.4 (35.9, 61.0) | | 47.0 | |
| | 6 months | 297 (73) | 42.4 (36.8, 48.1) | | 43.1 | |
| **Intentions to provide only breastmilk to 6 months**$^{£}$[21,21] | | | | | | |
| | Weak or Moderate | 83 (20) | 57.8 (47.0, 68.7) | 0.0433 | 53.5 | |
| | Strong | 135 (33) | 46.7 (38.1, 55.2) | | 47.8 | |
| | Very strong | 189 (46) | 41.3 (34.2, 48.4) | | 42.4 | |
| **Maternal BMI, kg/m2**$^{\#}$ | | | | | | |
| | <25.0 | 114 (30) | 39.5 (30.4, 48.6) | 0.0238 | 39.5 | 0.020 |
| | 25.0–29.9 | 146 (38) | 41.1 (33.0, 49.2) | | 40.8 | |
| | 30.0 | 123 (32) | 55.3 (46.4, 64.2) | | 55.5 | |
| **Diabetes (Gestational or otherwise)** | | | | | | |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| | No | 378 (93) | 44.4 (39.4, 49.5) | 0.0055 | 44.5 | 0.006 |
| | Yes | 29 (7) | 72.4 (55.1, 89.7) | | 72.3 | |

*
Sub-group of 'Early Lactation Success' mothers who intended EBF 1 week and had feeding data to 60 days (see text);

∑
BF Self-efficacy Questionnaire Short Form[21] (Weak=<3.0, Moderate=3.0–3.5, Strong=>3.5);

£
Measured with Infant Feeding Intentions (IFI) Scale,[22,23] which provides a quantitative measure of intention to provide breastmilk as the sole source of milk over the first 6 months (see text);

§
Defined as positive screen ( 16) on Center for Epidemiologic Studies – Depression Screen;

#
BMI=Body mass index - measured at 7 days postpartum;

**Table 2**

In-hospital Formula Use in First-Time Mothers Intending to Exclusively Breastfeed by Infant, Labor and Delivery and Postpartum Characteristics[*]

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| **Overall** | | 407 (100) | 46.0 | | | |
| **2. Labor and Delivery Experience** | | | | | | |
| **Delivery mode** | | | | | | |
| | Vaginal | 280 (69) | 36.1 (30.4, 41.7) | <.0001 | 36.0 | <.0001 |
| | Cesarean | 125 (31) | 69.6 (61.4, 77.8) | | 69.6 | |
| **Pitocin use** | | | | | | |
| | None | 172 (42) | 48.3 (40.7, 55.8) | 0.0262 | 47.7 | 0.040 |
| | Used to induce labor | 96 (24) | 51.0 (40.9, 61.2) | | 50.5 | |
| | Used to augment labor | 120 (30) | 36.7 (27.9, 45.4) | | 37.8 | |
| | Both | 17 (4) | 70.6 (46.4, 94.7) | | 71.5 | |
| **Labor pain management**[&] | | | | | | |
| | None | 35 (13) | 28.6 (12.8, 44.3) | 0.7703 | 28.4 | 0.70 |
| | Epidural | 213 (76) | 37.1 (30.5, 43.6) | | 37.3 | |
| | IV analgesia | 17 (6) | 41.2 (15.1, 67.3) | | 41.8 | |
| | Epidural and IV | 14 (5) | 35.7 (7.0, 64.4) | | 31.7 | |
| **Duration of labor, from chart**[&] | | | | | | |
| | <6 h | 14 (5) | 28.6 (1.5, 55.6) | 0.5275 | 26.8 | 0.48 |
| | 6–13.99 h | 105 (37) | 33.3 (24.2, 42.5) | | 33.6 | |
| | 14 h, | 164 (58) | 39.0 (31.5, 46.6) | | 39.0 | |
| **Stage II labor**[&] | | | | | | |
| | 1 h | 141 (52) | 43.3 (35.0, 51.5) | 0.0217 | 42.2 | 0.051 |
| | > 1 h | 131 (48) | 29.8 (21.8, 37.7) | | 30.9 | |
| **Worst pain experienced during childbirth**[32] | | | | | | |
| | None, mild or moderate (score, 0–3) | 55 (14) | 58.2 (44.7, 71.6) | 0.1254 | 57.5 | 0.14 |
| | Severe, but not worst ever (score, 4) | 79 (19) | 40.5 (29.4, 51.6) | | 40.4 | |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| | Worst pain ever (score, 5) | 273 (67) | 45.8 (39.8, 51.7) | | 46.0 | |
| **Intrapartum fluid balance, mL/h$^{¥}$** | | | | | | |
| | < 100 | 93 (36) | 57.0 (46.7, 67.2) | 0.0514 | 57.7 | 0.035 |
| | 100–200 | 87 (33) | 42.5 (31.9, 53.1) | | 42.5 | |
| | > 200 | 80 (31) | 40.0 (29.0, 51.0) | | 39.3 | |
| **Blood loss during delivery, mL** | | | | | | |
| | 500 | 226 (68) | 34.5 (28.3, 40.8) | <.0001 | 34.7 | <.0001 |
| | > 500 | 108 (32) | 62.0 (52.7, 71.3) | | 61.8 | |
| **Amniotic fluid appearance** | | | | | | |
| | Clear | 300 (80) | 43.0 (37.4, 48.6) | 0.6984 | 43.1 | 0.74 |
| | Colored | 77 (20) | 45.5 (34.1, 56.8) | | 45.2 | |
| **3. Infant Characteristics at Birth** | | | | | | |
| **Sex** | | | | | | |
| | Female | 210 (52) | 43.3 (36.6, 50.1) | 0.1952 | 43.1 | 0.17 |
| | Male | 197 (48) | 49.7 (42.7, 56.8) | | 49.9 | |
| **Birth weight, grams** | | | | | | |
| | <3000 g | 74 (18) | 58.1 (46.6, 69.6) | 0.0300 | 56.5 | 0.046 |
| | 3000–3300 g | 108 (27) | 39.8 (30.4, 49.2) | | 40.6 | |
| | 3300–3600 g | 106 (26) | 39.6 (30.2, 49.1) | | 39.3 | |
| | > 3600 | 119 (29) | 39.6 (30.2, 49.1) | | 51.8 | |
| **Gestational Age, weeks** | | | | | | |
| | 37.0–39.9 weeks | 235 (58) | 48.9 (42.5, 55.4) | 0.2036 | 49.0 | 0.19 |
| | 40.0–42.3 weeks | 167 (42) | 42.5 (34.9, 50.1) | | 42.4 | |
| **1 minute Apgar score** | | | | | | |
| | < 7 | 91 (23) | 46.2 (35.7, 56.6) | 0.8745 | 46.5 | 0.82 |
| | 7 | 303 (77) | 45.2 (39.6, 50.9) | | 45.1 | |
| **5 minute Apgar score** | | | | | | |
| | < 9 | 61 (16) | 60.7 (48.0, 73.3) | 0.0097 | 60.8 | 0.008 |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| | 9 | 332 (84) | 42.5 (37.1, 47.8) | | 42.4 | |
| **Oxygen support** | | | | | | |
| | None | 264 (68) | 43.2 (37.2, 49.2) | 0.0477 | 43.4 | 0.054 |
| | Free-flow 02 | 103 (26) | 49.5 (39.7, 59.3) | | 48.9 | |
| | Mask or more | 23 (6) | 69.6 (49.2, 89.9) | | 69.6 | |
| **4. Initial Postpartum Period** | | | | | | |
| **Mother and baby experienced skin-to-skin contact** | | | | | | |
| | Yes | 139 (34) | 43.2 (34.8, 51.5) | 0.3239 | 43.8 | 0.42 |
| | No | 267 (66) | 48.3 (42.3, 54.3) | | 48.0 | |
| **First held baby** | | | | | | |
| | Immediately | 149 (37) | 34.2 (26.5, 41.9) | <.0001 | 34.0 | <.0001 |
| | After procedures, <1 h | 146 (36) | 38.4 (30.4, 46.3) | | 39.0 | |
| | 1–2 h | 55 (14) | 54.5 (41.0, 68.1) | | 54.7 | |
| | >2 h | 57 (14) | 91.2 (83.7, 98.8) | | 90.9 | |
| **Time to first breastfeed** | | | | | | |
| | <1 h | 143 (35) | 31.5 (23.8, 39.2) | <.0001 | 32.0 | <.0001 |
| | 1–2 h | 173 (43) | 39.9 (32.5, 47.3) | | 39.7 | |
| | 2.01–4 h | 42 (10) | 69.0 (54.5, 83.6) | | 69.8 | |
| | >4 h | 49 (12) | 93.9 (86.9, 101) | | 93.5 | |
| **5. Concurrent Maternity Stay Variables** | | | | | | |
| **Separation of dyad€** | | | | | | |
| | No | 289 (71) | 35.3 (29.8, 40.8) | <.0001 | 35.3 | <.0001 |
| | Yes | 116 (29) | 74.1 (66.0, 82.2) | | 74.1 | |
| **Breastfeeding frequency, 0–24 h** | | | | | | |
| | < 8 times | 93 (23) | 73.1 (63.9, 82.3) | <.0001 | 72.7 | <.0001 |
| | 8 or 9 times | 135 (34) | 44.4 (36.0, 52.9) | | 44.3 | |
| | 10, 11 or 12 times | 128 (32) | 34.4 (26.0, 42.7) | | 35.2 | |
| | 13 to 18 times | 46 (11) | 26.1 (12.9, 39.3) | | 25.6 | |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| **Breastfeeding frequency, 24–48 h** | | | | | | |
| | < 8 times | 158 (41) | 50.0 (42.1, 57.9) | 0.4905 | 49.4 | 0.61 |
| | 8 or 9 times | 91 (24) | 40.7 (30.4, 50.9) | | 41.3 | |
| | 10, 11 or 12 times | 113 (29) | 46.0 (36.7, 55.3) | | 46.1 | |
| | 13 to 18 times | 25 (6) | 40.0 (19.4, 60.6) | | 40.9 | |
| **Breastfed "well" frequency,[¥¥] 0–24 h** | | | | | | |
| | 0 or 1 time | 57 (14) | 87.7 (78.9, 96.5) | <.0001 | 87.4 | <.0001 |
| | 2–5 times | 153 (38) | 52.3 (44.3, 60.3) | | 52.1 | |
| | 6 or more times | 196 (48) | 29.6 (23.1, 36.0) | | 29.9 | |
| **Breastfed "well" frequency,[¥¥] 24–48 h** | | | | | | |
| | 0 or 1 time | 47 (12) | 74.5 (61.5, 87.4) | <.0001 | 73.7 | <.0001 |
| | 2–5 times | 124 (31) | 51.6 (42.7, 60.5) | | 51.9 | |
| | 6 or more times | 233 (58) | 38.6 (32.3, 44.9) | | 38.7 | |
| **Expressed or pumped Breastmilk during 1st 3 days** | | | | | | |
| | No | 150 (38) | 30.7 (23.2, 38.1) | <.0001 | 30.8 | <.0001 |
| | Yes | 246 (62) | 55.7 (49.4, 61.9) | | 55.6 | |
| **Baby received expressed breastmilk 0–24 h** | | | | | | |
| | No | 388 (95) | 45.4 (40.4, 50.3) | 0.0570 | 45.4 | 0.055 |
| | Yes | 19 (5) | 68.4 (45.4, 91.4) | | 68.5 | |
| **Baby received expressed breastmilk 24–48 h** | | | | | | |
| | No | 361 (89) | 43.8 (38.6, 48.9) | 0.0008 | 43.7 | 0.0005 |
| | Yes | 43 (11) | 72.1 (58.1, 86.1) | | 72.6 | |
| **Sub-optimal breastfeeding behavior[££], day 0 interview[∞]** | | | | | | |
| | No | 67 (30) | 31.3 (19.9, 42.7) | 0.0343 | 32.2 | 0.051 |
| | Yes | 154 (70) | 46.8 (38.8, 54.7) | | 46.3 | |
| **Sub-optimal breastfeeding behavior[££], day 3 interview[∞]** | | | | | | |
| | No | 157 (67) | 35.0 (27.5, 42.6) | 0.0002 | 34.8 | 0.0001 |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| | Yes | 79 (33) | 60.8 (49.8, 71.8) | | 61.3 | |
| **Nipple pain, peak since birth, day 0 interview**[∞] | | | | | | |
| | Mild (score, 0–2) | 262 (65) | 51.9 (45.8, 58.0) | 0.0021 | 51.8 | 0.004 |
| | Moderate (score,3) | 66 (16) | 27.3 (16.2, 38.3) | | 28.5 | |
| | Severe (score, 4–5) | 78 (19) | 44.9 (33.6, 56.2) | | 44.1 | |
| **Nipple pain, peak since previous interview, day 3**[∞] | | | | | | |
| | Mild (score, 0–1) | 101 (26) | 55.4 (45.6, 65.3) | 0.0649 | 55.7 | 0.058 |
| | Moderate (score, 2–3) | 86 (22) | 47.7 (36.9, 58.4) | | 47.4 | |
| | Severe (score, 4–5) | 208 (53) | 41.3 (34.6, 48.1) | | 41.3 | |
| **Nipple shield use, since birth, day 3 interview**[∞] | | | | | | |
| | No | 308 (78) | 42.9 (37.3, 48.4) | 0.0100 | 42.7 | 0.007 |
| | Yes | 89 (22) | 58.4 (48.0, 68.9) | | 59.1 | |
| **Pacifier use 0–24 h**[∞] | | | | | | |
| | No | 316 (78) | 41.1 (35.7, 46.6) | 0.0001 | 41.4 | <0.001 |
| | Yes | 90 (22) | 64.4 (54.4, 74.5) | | 63.5 | |
| **Pacifier used in previous 24 h, day 3 interview**[∞] | | | | | | |
| | No | 224 (57) | 39.3 (32.8, 45.7) | 0.0008 | 39.6 | 0.002 |
| | Yes | 170 (43) | 56.5 (48.9, 64.0) | | 56.0 | |
| **Peak edema level in 1st 48 h** | | | | | | |
| | None | 173 (43) | 37.6 (30.3, 44.9) | 0.0057 | 37.1 | 0.003 |
| | Edema with no or mild pitting | 174 (43) | 51.7 (44.2, 59.2) | | 52.0 | |
| | Edema with moderate or severe pitting | 55 (14) | 58.2 (44.7, 71.6) | | 58.8 | |
| **Nipple Type, day 0 interview**[∞] | | | | | | |
| | Both everted | 310 (77) | 41.9 (36.4, 47.5) | 0.0016 | 41.9 | |
| | Flat or inverted | 94 (23) | 60.6 (50.6, 70.7) | | 60.8 | |
| **Nipple Type, day 3 interview**[∞] | | | | | | |
| | Both everted | 305 (77) | 42.6 (37.0, 48.2) | 0.0052 | 42.6 | 0.005 |

| Variable | Categories | No. in category (%) | In-hospital formula use % (95% CI) | P-value | In-hospital formula use % (adjusted for feeding intentions) | P-value |
|---|---|---|---|---|---|---|
| | Flat or inverted | 89 (23) | 59.6 (49.2, 69.9) | | 59.7 | |

*
Sub-group of 'Early Lactation Success' mothers who intended EBF 1 week and had feeding data to 60 days (see text);

£
Measured with Infant Feeding Intentions (IFI) Scale,[22,23] which provides a quantitative measure of intention to provide breastmilk as the sole source of milk over the first 6 months (see text);

&
Vaginal births;

¥
[Total volume in during active labor in hospital (IV+po) – out]/number of hours;

€
Mother responded 'yes' to query 'Did your baby ever stay in the nursery'

¥¥
Maternal assessment of feeding; well defined as 'wide jaw motions and swallows'

££
Sub-optimal infant breastfeeding behavior was defined as an IBFAT score 1 [Infant Breastfeeding Assessment Tool][25]

∞
Mean (SD) age at the day 0 interview was 18.7 (9.4) hours and at the day 3 interview it was 3.8 (1.5) days.

**Table 3**

Main Categories and Prevalence of Maternally Reported Reasons for In-hospital Formula Supplementation[a]

| Main category | Prevalence (%) of main category[b, c] | | | |
|---|---|---|---|---|
| | 0–24 h | 24–48 h | 48–72 h | Overall 0–72 h |
| Low maternal supply | 7.4 | 13.7 | 16.4 | **18.1** |
| Signs of inadequate infant intake, e.g. excess weight loss, hypoglycemia | 6.3 | 10.1 | 21.7 | **16.3** |
| Poor infant breastfeeding behavior | 6.6 | 8.8 | 14.6 | **13.7** |
| Separation of dyad | 6.6 | 2.3 | 4.0 | **9.4** |
| Psychosocial reasons | 2.8 | 3.6 | 3.5 | **5.3** |
| Breastfeeding pain | 0.5 | 3.1 | 4.4 | **4.1** |
| Maternal incapacitation | 2.8 | 1.0 | 1.3 | **3.6** |
| Maternal medication | 0.8 | 0.8 | 1.3 | **1.5** |

[a]Mothers (N=393) were asked at the Day 3 interview to provide reasons for formula supplementation (if any) for each 24-hour interval since birth. Reasons for formula supplementation were missing for 4 mothers whose babies received H-formula, resulting in N=389 mothers with complete H-formula reason data;

[b]Number of mothers reporting a reason under specified category at each time interval/number of mothers in the hospital at each time interval: N=112/393, 0–24 h; N=142/388, 24–48 h; N=117/226, 48–72 h; N=179/393, overall 0–72 h;

[c]Mothers could give multiple reasons in their open-ended response, and some reasons were coded under more than one main category.

**Table 4**

Description and Examples of Main Categories of Maternally Reported Reasons for In-hospital Formula Supplementation[a]

| Main category | Description of main category | Examples of maternally reported reasons, grouped under each main category[b] |
|---|---|---|
| **Low maternal supply** | Not enough breast milk being produced to meet the infant's perceived need | • Perceived physical evidence of insufficient milk supply<br><br>• Milk not in yet ("milk not in-worried baby not getting enough")<br><br>• Breasts seem/feel empty ("felt I didn't have enough milk- breasts felt empty")<br><br>• Pumping extracts little breast milk ("Baby is not getting breast milk-I don't have any. I pump but nothing comes out")<br><br>• Baby's response to breastfeeding<br><br>• Baby fussy after breastfeeding but satisfied after formula ("she's hungry and crying, not satisfied after breastfeeding")<br><br>• Baby frequently seems hungry ("my baby is never satisfied-he's acting like he's starving to death") |
| **Signs of inadequate infant intake** | A clinical sign that the mother or a health care provider perceived as indicative of a need to supplement | • Hypoglycemia ("to stabilize blood sugar")<br><br>• Excess weight loss in infant ("baby losing too much weight")<br><br>• Jaundice<br><br>• Not enough bowel movements or voids ("no wet diapers in the first 24 hours") |
| **Poor infant breastfeeding behavior** | Reasons related to the infant's ability to feed effectively at the breast | • Difficulty latching ("baby getting frustrated, can't latch")<br><br>• Baby too sleepy to breastfeed well ("baby falls asleep at breast")<br><br>• Baby refusing to latch/prefers bottle ("baby now is used to the bottle") |
| **Separation of dyad** | Any instance where the mother included in her response that supplementation occurred when she and the baby were separated | • Baby in NICU/re-hospitalized ("Baby in NICU, initially the nurse fed her")<br><br>• Mother in special care unit ("recovering from emergency C-section and seizures")<br><br>• Nurse gave formula while caring for baby ("nurses gave the baby formula to calm him down, without our consent") |
| **Psychosocial reasons** | Includes any response where the mother reported supplementing with formula for psychosocial reasons, particularly related to attitudes toward, knowledge about, or confidence in breast- feeding | Socio-emotional discomfort with breastfeeding<br><br>• The idea or connotations of breastfeeding ("at first, I didn't want to breastfeed: I thought it was disgusting")<br><br>• Embarrassment to breastfeed/preference for privacy ("my parents were around-I didn't feel comfortable breastfeeding around them")<br><br>• Unsure how to breastfeed properly<br><br>• More confident in ability to formula feed ("decided to give more formula because I'm more comfortable with it")<br><br>• Unsure how to determine how much milk the infant is getting ("so I know how much formula my baby is getting")<br><br>• Breastfeeding more inconvenient, difficult, or time-consuming than formula feeding<br><br>• Too tired to breastfeed at times ("I was tired and needed a break from my baby crying") |

| Main category | Description of main category | Examples of maternally reported reasons, grouped under each main category[b] |
|---|---|---|
|  |  | • Breastfeeding is more difficult than formula feeding: at night, because of a C-section, etc. ("was in a lot of pain and couldn't hold my baby; wanted someone else to feed him") <br><br> • The baby isn't satisfied for long-enough stretches ("baby wants to breastfeed all the time") |
| **Breastfeeding pain** | Report that sore breasts or painful nipple led to formula supplementation | • Sore, damaged, bleeding, painful nipples ("to rest nipples, which have blisters and cracks") <br><br> • Breast pain ("engorgement") |
| **Maternal incapacitation** | Report of being too incapacitated to breastfeed | • Mother was told by health care professional that she was too incoherent/heavily medicated to breastfeed ("was too out of it to breastfeed-I had lost a lot of blood') |
| **Maternal medication** | The effect a medication has on breastfeeding ability or safety, regardless of true medical indication. | • Mother believes that a medication has affected her milk supply or the breastfeeding process ("concerned my baby is not getting enough because he's sleepy from magnesium") <br><br> • Health care provider said that lactation is contraindicated ("had to ingest dye for radiology-the radiologist said not to breastfeed for 24 hours") |

[a]Mothers were asked at the Day 3 interview to provide reasons for formula supplementation (if any) for each 24-hour interval since birth.

[b]Mothers could give multiple reasons in their open-ended response, and some reasons were coded under more than one main category. Examples of maternally reported reasons under main categories are enclosed in parentheses.

**Table 5**

Characteristics of In-hospital Formula Use§ and Corresponding Odds Ratios of Not Fully Breastfeeding Days 30–60 and Breastfeeding Cessation By Day 60

| Variable | Category | Number in category (%)# | Not Fully Breastfeeding Days 30–60* | | | | Breastfeeding Cessation By Day 60** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | OR€ [95%CI] | Adjusted OR& [95%CI] | P-value£ | % | OR€ [95%CI] | Adjusted OR& [95%CI] | P-value£ |
| Exclusive breastfeeding in-hospital (H-EBF)@ | | 210 (54%) | 36.7% | Referent | Referent | n/a | 10.5% | Referent | Referent | n/a |
| Any in-hospital formula use | | 183 (47%) | 67.8% | 3.6 (2.4,5.5) | 3.9 (2.2,6.5) | <0.0001 | 32.8% | 4.2 (2.4,7.1) | 4.4 (2.2,8.7) | <0.0001 |
| **Characteristics of In-hospital Formula Use** | | | | | | | | | | |
| Volume (0–72 h) | | | | | | 0.016¶ | | | | 0.10¶ |
| | None | 210 (54%) | 36.7% | Referent | Referent | n/a | 10.5% | Referent | Referent | n/a |
| | 1–30 mL | 48 (12%) | 56.2% | 2.2 (1.2,4.2) | 1.9 (0.95,4.0) | | 18.8% | 2.0 (0.84,4.6) | 2.0 (0.77,5.2) | |
| | 31–60 mL | 26 (7%) | 76.9% | 5.8 (2.2,15.0) | 7.1 (2.5,20.0) | | 38.5% | 5.3 (2.2,13.2) | 7.3 (2.5,21.6) | |
| | 61–180 mL | 58 (15%) | 65.5% | 3.3 (1.8,6.0) | 4.5 (2.2,9.6) | | 31.0 % | 3.8 (1.9,7.8) | 5.7 (2.3,14.1) | |
| | >180 mL | 46 (12%) | 82.6% | 8.2 (3.6,18.5) | 10.5 (3.9,28.5) | | 50.0% | 8.5 (4.1,17.7) | 8.7 (3.2,23.2) | |
| **Number of formula feeds 0–72 h** | | | | | | 0.002¶ | | | | 0.003¶ |
| | 1–3 | 68 (17%) | 57.4% | 2.3 (1.3, 4.1) | 2.3 (1.2, 4.3) | | 20.6% | 2.2 (1.1, 4.6) | 2.2 (0.9, 5.1) | |
| | 4–8 | 55 (14%) | 61.8% | 2.8 (1.5, 5.2) | 4.1 (1.9, 8.7) | | 25.5% | 2.9 (1.4, 6.2) | 5.6 (2.1, 15) | |
| | 9–31 | 60 (15%) | 85% | 9.8 (4.6, 21) | 14 (5.2, 35) | | 53.3% | 9.8 (5.0, 19) | 12 (4.7, 30) | |
| **Method of feeding∑** | | | | | | | | | | |
| | Bottle - yes | 115 (39%) | 74.8% | 5.1 (3.1,8.5) | 5.3 (2.9,9.8) | 0.011Ω | 40% | 5.7 (3.2,10.2) | 5.3 (2.6,10.9) | 0.068Ω |
| | Method(s) did not include bottle use | 56 (15%) | 53.6% | 2.0 (1.1,3.6) | 2.1 (1.1,4.4) | | 19.6% | 2.1 (0.9,4.6) | 2.6 (1.01,6.7) | |
| | Cup - yes | 27 (7%) | 66.7% | 3.4 (1.5,8.1) | 4.8 (1.8,13.1) | 0.57Ω | 33.3% | 4.3 (1.7,10.7) | 5.9 (2.0,17.9) | 0.57Ω |
| | SNS¥ - yes | 27 (7%) | 66.7% | 3.4 (1.5,8.1) | 5.9 (2.2,15.5) | 0.18Ω | 22.2% | 2.4 (0.9,6.7) | 4.6 (1.4,15.1) | 0.97Ω |
| | Syringe - yes | 86 (23%) | 73.3% | 4.7 (2.7,8.2) | 5.7 (2.9,11.1) | 0.042Ω | 32.6% | 4.1 (2.2,7.8) | 5.3 (2.4,11.8) | 0.31Ω |
| | Finger- yes | 11(3%) | 72.7% | 4.6 (1.2,17.9) | 8.2 (1.8, 36.6) | 0.21Ω | 27.3% | 3.2 (0.8,13.0) | 8.5 (1.7,42.1) | 0.55Ω |

# Percent is of all infants with follow-up data, n=393; n/a = not applicable; BF= breastfeeding; EBF= exclusive breastfeeding;

*
51.1% of total received supplemental formula days 30–60;

**
20.9% of total experienced breastfeeding cessation before day 60;

€
OR [95%CI] =Odds ratio [95% confidence interval]; Referent group for all odds ratios is exclusive breastfeeding in-hospital;

£
p-value for adjusted odds ratio;

&
Adjusted for maternal demographics (age, education, type of insurance), length of hospital stay and prenatally assessed Infant Feeding Intention rank;

£
P-value is for difference among categories of formula use;

¶
P-value for trend test among H-formula users;

¥
Supplemental nursing system;

Σ
Multiple supplementation methods could be used;

Ω
p-value is for supplemented infants with vs. without that method of feeding;

No significant differences noted by timing of first in-hospital formula use, whether breastfed prior to in-hospital formula use or by whom recommended formula use (physican, nurse, lactation consultant or maternal preference).