



Published in final edited form as:

Birth. 2023 December ; 50(4): 916–922. doi:10.1111/birt.12742.

A dose–response relationship found between the Ten Steps to Successful Breastfeeding indicators and in-hospital exclusive breastfeeding in US hospitals

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Abstract

Background: In-hospital exclusive breastfeeding (EBF) is associated with longer breastfeeding durations, yet only 64% of US newborns are EBF for 7 days. The Ten Steps to Successful Breastfeeding (Ten Steps) are a set of evidenced-based maternity practices shown to improve breastfeeding outcomes; these were updated in 2018.

Methods: Using hospital-level data from the 2018 Maternity Practices in Infant Nutrition and Care Survey ($n = 2045$ hospitals), we examined the prevalence of implementation of Ten Steps indicators (each step and total number of steps implemented). Using linear regression, we also examined the association between the steps and EBF prevalence adjusted for hospital characteristics and all other steps. Discharge support was not included in the models since it primarily occurs after hospital discharge.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Results: The most frequently implemented step was the provision of prenatal breastfeeding education (95.6%). Steps with low implementation included rooming-in (18.9%), facility policies supportive of breastfeeding (23.4%), and limited formula supplementation (28.2%). After adjusting for hospital characteristics and all other steps, limited formula supplementation (difference = 14.4; 95% confidence interval [CI]: 12.6, 16.1), prenatal breastfeeding education (difference = 7.0; 95% CI: 3.3, 10.8), responsive feeding (difference = 6.3; 95% CI: 3.7, 9.0), care right after birth (skin-to-skin; difference = 5.8; 95% CI: 4.2, 7.4), and rooming-in (difference = 2.4; 95% CI: 0.4, 4.6) were associated with higher in-hospital EBF prevalence. We found a dose-response relationship between the number of steps implemented and in-hospital EBF prevalence.

Conclusion: Increased implementation of the updated Ten Steps may improve EBF and infant and maternal health outcomes.

Keywords

Exclusive breastfeeding; Ten Steps to Successful Breastfeeding

1 | INTRODUCTION

A growing body of evidence supports that exclusive breastfeeding (EBF) during the hospital stay following birth is associated with increased breastfeeding duration.^{1,2} Although EBF is recommended for the first 6 months of life,³⁻⁵ 64% of US newborns are EBF at 7 days and only 26% meet the recommendation of EBF for 6 months.⁶

The first few days of life, which are often spent in maternity care facilities, are important for providing support to successfully breastfeed.⁷ The Baby-Friendly Hospital Initiative (BFHI) is a global program that supports broad-scale implementation of the evidenced-based Ten Steps (Ten Steps) to Successful Breastfeeding at facilities providing maternity and newborn services.⁷ These facilities can elect to implement the Ten Steps to achieve Baby-Friendly hospital designation, which certifies that the hospital implements policies and practices that uphold the highest standards of infant feeding care set by a team of global experts.⁷ Hospitals seeking designation register with Baby-Friendly USA and then work to complete all requirements: (1) discovery (self-appraisal), (2) development (a plan is developed to implement the steps), (3) dissemination (implementation of the plan), and (4) designation (on-site assessment by an external committee).⁸ Originally released by the World Health Organization and UNICEF in 1991, the Ten Steps were updated in 2018.⁷ Examples of key updates include explicitly incorporating full compliance with the International Code of Marketing of Breastmilk Substitutes into the Ten Steps (step 1a), establishing ongoing internal monitoring of clinical practices (step 1c), focusing on competency assessment of staff rather than staff training (step 2), preparing mothers for potential breastfeeding difficulties is the focus for practical support (step 5), and counseling mothers on the use and risks of artificial teats instead of prohibiting them (step 9).⁷ Although many hospitals may implement some of the Ten Steps, only hospitals that have fully implemented all Ten Steps and have completed the BFHI designation process can earn the Baby-Friendly designation.⁷

Previously conducted national analyses have examined trends in individual components of Ten Steps indicators such as hospitals implementing a model breastfeeding policy,⁹

skin-to-skin contact,¹⁰ the provision of non-breast milk supplements to healthy breastfed newborns,¹¹ and rooming-in¹² and have found increasing prevalence of implementation of these policies and practices over time. In addition, an analysis that examined the implementation of some indicators for each of the Ten Steps found an increase in implementation from 2007 to 2013.¹³ An analysis using 2013 data found that most individual maternity care practices related to the Ten Steps were significantly associated with in-hospital EBF prevalence.¹⁴

National hospital implementation of each of the updated Ten Steps and the association between implementation and in-hospital EBF prevalence has not been described. To address this gap, we aimed to describe the national maternity hospital implementation of available indicators of the revised Ten Steps and the association with in-hospital EBF prevalence.

2 | METHODS

Data for this analysis were obtained from the 2018 Maternity Practices in Infant Nutrition and Care (mPINC) survey.¹⁵ The mPINC survey is conducted biennially by the CDC, and all maternity care hospitals in the US and territories are invited to participate.¹⁵ Of the 2913 eligible maternity hospitals, 2045 hospitals responded, which is approximately 70% of all maternity care hospitals in the US and territories.¹⁵ Facilities report information on infant feeding policies, infant feeding practices, and routine maternity care. The manager of the labor and delivery unit or the mother–baby nurse manager is contacted to help identify the most knowledgeable staff person to receive the survey, and the survey is typically completed by a group of staff.

The outcome for this analysis was in-hospital EBF prevalence, which included responses to the mPINC survey question on the percent of healthy newborns fed only breast milk during the hospital stay reported for each hospital. The exposures included indicators of implementation for each of the Ten Steps and the total number of the Ten Steps implemented. The mPINC Ten Steps Assessment Tool, which aligns the 2018 mPINC survey questions with the updated 2018 BFHI Implementation Guidance, was used to identify survey questions related to each of the Ten Steps (Table S1).¹⁶ Although the tool aligns mPINC survey questions with the Ten Steps, the mPINC questions do not comprehensively assess each step; therefore, it provides indicators related to each step. mPINC survey questions that were not related to EBF were not included as indicators of the Ten Steps, including skin-to-skin contact after vaginal or cesarean delivery if not breastfeeding and instructions of formula feeding techniques and safe preparation and handling of formula. Indicators for most of the Ten Steps included multiple survey questions. All responses were dichotomized (implementing the ideal standard or not implementing the ideal standard) based on the mPINC Ten Steps Assessment Tool.¹⁷ Hospitals were then categorized as either “implementing the Ten Step indicator” if they reported the ideal standard for each survey question related to the respective step or as “not implementing the Ten Step indicator” if at least one of the responses was not the ideal standard. The predictors are derived from the Ten Steps; however, since the outcome for the linear regression (EBF) occurs in-hospital, care at discharge (step 10) was not included in the linear regression. Therefore, implementation of the steps for the linear

regression refers to steps 1–9. The total number of steps implemented by each hospital was calculated and categorized into low (0 to 3 steps), mid (4 to 6 steps), and high (7 to 9 steps) implementation. Hospital characteristics were covariates and included hospital type (nonprofit, private, government, or military), teaching hospital (yes or no), and total live births (annual number of births categorized as 1–499, 500–999, 1000–1999, or 2000).

Descriptive analyses were conducted to report the hospital characteristics and the prevalence of hospital implementation of the indicators of the steps. We conducted linear regression to examine the relationship between implementation of steps 1–9 and in-hospital EBF prevalence using three sets of models. The first set of models examined the bivariate associations between each of the nine steps individually and EBF prevalence. The second set of models included each step individually and EBF prevalence adjusted for hospital characteristics (hospital type, teaching status, total live births, and region). The third model was the same as the second model, additionally adjusted for all other steps 1–9. Effect measure modification occurs when the measure of association changes over values of another variable. In our analysis, we examined effect measure modification by Baby-Friendly hospital designation status (designated or not designated) to determine whether EBF prevalence differed by Baby-Friendly hospital designation. To test this effect, we examined models with steps 1–9 that were found to be statistically significant in the third model and effect measure modification terms between each statistically significant step and Baby-Friendly hospital designation with EBF prevalence as the outcome. We dropped the effect measure modification term with the highest p-value in the following models with the goal of identifying terms that were statistically significant. However, the results were not statistically significant for any of the effect measure modification terms, and they were not included in the subsequent models. Next, we examined the association between the total number of steps implemented and the association with EBF prevalence using bivariate linear regression and multivariable linear regression to adjust for hospital characteristics. Model diagnostics were conducted, the residuals were normally distributed, and multicollinearity was not found among the variables using a cutoff of <0.10 for tolerance. The predicted values of percent in-hospital EBF for the models fell between 0.26 and 0.77, which supports the use of a linear regression model. Statistical significance was set at $p < 0.05$. Analyses were completed using SAS 9.4 (SAS Institute Inc., Cary, NC). The Internal Review Board of Emory University determined that this research did not involve human participants since no identifiable, individual data were obtained.

3 | RESULTS

Hospital characteristics are reported in Table 1. Of the 2045 responding hospitals, 24.7% were Baby-Friendly designated. The majority of hospitals were nonprofit hospitals (76.7%) and teaching hospitals (69.0%). Hospitals with 499 births or less represented the largest category of total live births (35.1%).

The provision of prenatal information (step 3) was the most frequently reported step (95.6%) (Table 2). The next most frequently reported steps were responsive feeding (step 8; 87.8%) and care at discharge (step 10; 79.5%). Steps with low levels of implementation were

rooming-in (step 7; 18.9%), hospital policies (step 1; 23.4%), and limited supplementation (step 6; 28.2%).

The average in-hospital EBF prevalence was 55.1%. Positive, significant bivariate associations were found between indicators of each of the steps examined and EBF prevalence (Table 3). Similarly, the steps remained positively and significantly associated with EBF prevalence after adjusting for hospital characteristics. In the model adjusted for hospital characteristics and the other steps, limited supplementation (step 6) was associated with the greatest difference in EBF prevalence; the EBF prevalence for hospitals was 14.4 percentage points higher than for hospitals that did not implement this step (95% confidence interval [CI]: 12.6, 16.1). The provision of prenatal breastfeeding information (step 3; difference = 7.0; 95% CI: 3.3, 10.8), responsive feeding (step 8; difference = 6.3; 95% CI: 3.7, 9.0), care right after birth (step 4; difference = 5.8; 95% CI: 4.2, 7.4), and rooming-in (step 7; difference = 2.4; 95% CI: 0.4, 4.6) were significantly and positively associated with EBF prevalence. We tested effect measure modification by Baby-Friendly designation status for the steps found to be statistically significant in the third model using backward elimination; however, the results were not statistically significant. Therefore, the estimated percentage point difference associated with implementing each step did not differ by Baby-Friendly hospital designation status in a significant way.

The total number of steps implemented and the association with in-hospital EBF prevalence are reported in Table 4. Low implementation of steps (0–3 steps) was reported by 24.5% of hospitals, mid implementation (4–6 steps) was reported by 48.9% of hospitals, and high implementation (7–9 steps) of steps was reported by 26.6% of hospitals. The average EBF prevalence was 46.0% for hospitals with low implementation, 54.6% for hospitals with mid implementation, and 64.4% for hospitals with high implementation. Mid implementation of the steps was associated with 8.5 percentage points higher EBF prevalence (95% CI: 15.4, 19.8) compared with low-level implementation.

4 | DISCUSSION

Using national hospital data on maternity care practices in infant nutrition and care, we examined maternity hospital implementation of indicators of the Ten Steps to Successful Breastfeeding and the associations with in-hospital EBF prevalence. We found that the most frequently implemented step was the provision of prenatal breastfeeding education (step 3). The least frequently implemented step was rooming-in (step 7). Limited supplementation of breastfed newborns (step 6) was associated with the greatest difference in EBF prevalence compared with hospitals that did not implement this step. In addition, the provision of prenatal breastfeeding education (step 3), care right after birth (step 4), rooming-in (step 7), and responsive feeding (step 8) were significantly associated with higher in-hospital EBF prevalence after adjusting for hospital characteristics and all other steps 1–9. We also found a dose–response relationship between the number of steps implemented and in-hospital EBF prevalence.

Previously conducted national analyses using mPINC data have found increasing implementation of components of the Ten Steps. Hospitals reporting having a model

breastfeeding policy increased from 14.1% in 2009 to 33.1% in 2015.⁹ Skin-to-skin contact improved from 40.4% in 2007 to 83.0% in 2015 for vaginal births and 29.3% in 2007 to 69.9% in 2015 for cesarean births.¹⁰ The provision of non-breast milk supplements to healthy breastfed newborns to at least 50% of newborns decreased from 31.5% in 2009 to 23.3% in 2013.¹¹ Rooming-in increased from 27.8% in 2007 to 51.4% in 2015.¹² The mPINC survey was redesigned for the 2018 implementation, including wording of the questions and cutoffs for categorization of response options, so data from this survey cannot be directly compared with previous survey cycles. In addition, this analysis used more than one component or question for the indicators for most of the steps versus previous studies of the Ten Steps using mPINC data which have typically used only one survey item as a proxy to represent the implementation of one of the Ten Steps.

The provision of prenatal breastfeeding education (step 3) was reported to be the most frequently implemented step and was associated with EBF prevalence that was 7.0 percentage points higher (compared with nonimplementing hospitals). Step 3 has previously been reported to be one of the most difficult to implement steps as it is often provided in outlying primary healthcare clinics and hospitals may not have direct authority over the care delivered in these settings.^{7,17} The quality of prenatal breastfeeding education has been previously reported to be less consistently delivered at outlying clinics compared with clinics that are located within hospitals.¹⁸ However, BFHI Implementation Guidance recommends that hospitals work with outlying clinics to ensure that mothers and families receive prenatal breastfeeding education.⁷ BFHI Implementation Guidance recommends not only providing information on the importance of breastfeeding but also on the importance of Baby-Friendly practices and the basics of breastfeeding positioning and latching.⁷ BFHI Implementation Guidance also supports delivering prenatal breastfeeding education to both pregnant women and their families.⁷ A systematic review that examined step 3 found that prenatal breastfeeding education is most effective at increasing breastfeeding outcomes (including exclusive breastfeeding) if they also include the support of women's partners or family.¹⁹ Based on the indicator used in our analysis that is available through the 2018 mPINC survey, we are unable to determine the topics covered and the delivery method. Further work is needed to understand the relationship between the quality of implementation of step 3 (e.g., topics covered and involvement of partners/family) and the association with in-hospital EBF.

We found that immediate postnatal care, in which mothers and newborns remain in uninterrupted skin-to-skin contact until the first breastfeeding is completed after vaginal and cesarean deliveries (step 4), was significantly associated with 5.8 percentage points higher EBF prevalence (compared with nonimplementing hospitals). Another study using mother–infant dyad-level electronic medical records similarly found that skin-to-skin contact for 1 h reduced the risk of infant formula supplementation by 44% compared with mother–infant dyads that did not complete skin-to-skin contact for 1 h.²⁰ Immediate skin-to-skin contact helps to facilitate early initiation of breastfeeding, accelerate lactogenesis II, and can be critical to establishing a milk supply.⁷

Limited formula supplementation (step 6) was one of the least frequently implemented steps (28.2%); however, step 6 was significantly associated with the greatest difference in

EBF prevalence (14.4 percentage points). Step 6 includes not providing breastfed newborns any food or fluids other than breast milk, unless medically indicated.⁷ The Academy of Breastfeeding Medicine Clinical Protocol on Supplementary Feedings in the Healthy Term Breastfed Neonate outlines possible medical indications for formula supplementation, and there are some circumstances (e.g., hypoglycemia and hyperbilirubinemia), in which supplementation should occur.²¹ This protocol also supports proper assessment of medical indications, supports strategies to prevent supplementation (e.g., skin-to-skin and rooming-in), recommends the provision of lactation management support before supplementation, and recommends expressed breast milk from the infant's mother as the first choice for supplementation.²¹ Furthermore, the American Academy of Pediatrics also places emphasis on the need to discontinue policies that provide non-breast milk supplements to breastfed infants.⁴ Additional work is needed to examine whether appropriate steps to prevent supplementation with non-breast milk supplements are implemented in hospitals.

Rooming-in (step 7) was significantly associated with EBF prevalence; implementing hospitals were 2.4 percentage points higher than nonimplementing hospitals; however, it was the least frequently reported implemented step (18.9%). In 2015, >50% of hospitals reported implementation of rooming-in.¹² However, the 2018 survey included additional components of this indicator including routine procedures completed in the mother's room and observation protocols to ensure safety while rooming-in, which may have resulted in lower frequency of implementation of this step compared with the 2015 results. Rooming-in is an important structural component of the maternity care workflow, which may have implications for other steps.²² For example, if step 7 is not properly implemented, separated mother–infant dyads cannot comply with step 4 (care right after birth), in which newborns receive skin-to-skin contact with their mothers after delivery, or step 8 (responsive feeding), in which mothers are taught to respond to early infant feeding cues and to breastfeed as long and often as the newborn wants.²² Therefore, increasing implementation of this step may facilitate increased implementation of other steps.

We found a positive association between hospitals that implemented a greater number of steps and higher in-hospital EBF prevalence. The Ten Steps have previously been found to have a dose–response relationship between the number of steps implemented and breastfeeding outcomes.²² Our findings further support the need for implementation of steps 1–9 to increase the prevalence of in-hospital EBF.

There are three key limitations for this analysis. First, hospitals may or may not routinely collect the data collected in the survey; therefore, the responses may be based on estimates made by the survey respondent.¹⁵ The CDC takes steps to deliver the survey to the person deemed most knowledgeable of survey topics, and the survey is often completed by a group of hospital staff.¹⁵ Second, nonresponse bias is possible; however, 70% of US maternity care hospitals responded to the 2018 mPINC survey. It is unclear whether the nonresponse bias may under or overestimate the true average. Third, this analysis used some indicators for each of the Ten Steps, but these indicators are not comprehensive for each step. Some elements of the Ten Steps are not collected in the mPINC survey.

5 | CONCLUSIONS

Indicators of the updated Ten Steps to Successful Breastfeeding were associated with increased in-hospital EBF prevalence. However, the majority of hospitals did not implement most steps. Hospitals that completed the mPINC survey can use these results, along with the mPINC Ten Steps Assessment Tool to examine their progress toward implementing the Ten Steps, particularly in relationship to overall national performance. Greater implementation of steps 1–9 may be important considering the dose–response relationship between the number of steps implemented and higher EBF prevalence.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

FUNDING INFORMATION

This document was financially supported by the National Association of County and City Health Officials (NACCHO) to support the *Reducing Disparities in Breastfeeding through Continuity of Care Project* through funding from the Centers for Disease Control and Prevention (CDC), award number 18NU38OT000306. This document was also financially supported by the Emory Maternal and Child Health Center of Excellence, with support from Health Resources and Services Administration (HRSA) Maternal and Child Health (MCH) Bureau under award T76MC28446. The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention; Emory Maternal and Child Health Center of Excellence; Health Resources and Services Administration (HRSA) Maternal and Child Health (MCH) Bureau; National Association of County and City Health Officials

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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TABLE 1

Characteristics of the 2045 hospital respondents to the 2018 Maternity Practices in Infant Nutrition and Care survey.

Characteristic	<i>n</i> (%)
Baby-Friendly hospital designation	
Designated	504 (24.7%)
Not designated	1541 (75.4%)
Hospital type	
Nonprofit	1569 (76.7%)
Private	385 (18.8%)
Government or military	91 (4.5%)
Teaching hospital	
Yes	1411 (69.0%)
No	634 (31.0%)
Total live births	
1–499	717 (35.1%)
500–999	437 (21.4%)
1000–1999	450 (22.0%)
2000	441 (21.6%)
Region	
Western	270 (13.2%)
Southwest	323 (15.8%)
Southeast	328 (16.0%)
Northeast	186 (9.10%)
Mountain Plains	225 (11.0%)
Midwest	488 (23.9%)
Mid-Atlantic	225 (11.0%)

TABLE 2

Percentage of hospitals with ideal standard on indicators of the Ten Steps to Successful Breastfeeding, 2018
Maternity Practices in Infant Nutrition and Care survey.

Ten Steps	<i>n</i> (%)
Step 1: Hospital policies	478 (23.4%)
Step 2: Staff competency	979 (47.9%)
Step 3: Prenatal education	1955 (95.6%)
Step 4: Care right after birth	1133 (55.4%)
Step 5: Support with breastfeeding	1350 (66.0%)
Step 6: Limited supplementation	576 (28.2%)
Step 7: Rooming-in	386 (18.9%)
Step 8: Responsive feeding	1796 (87.8%)
Step 9: Bottles, nipples, and pacifiers	1539 (75.3%)
Step 10: Care at discharge	1626 (79.5%)

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In-hospital exclusive breastfeeding prevalence and the association with indicators of steps 1–9 of the Ten Steps to Successful Breastfeeding.

TABLE 3

Ten Steps	Multivariable		
	Bivariate	Adjusted for hospital characteristics ^a	Adjusted for hospital characteristics ^a and all other steps 1–9
	Difference in exclusive breastfeeding prevalence (95% CI)^b		
Step 1: Hospital policies	7.7 (5.6, 9.8)*	8.1 (6.2, 10.1)*	1.8 (-0.2, 3.8)
Step 2: Staff competency	2.7 (0.9, 4.6)*	4.9 (3.3, 6.5)*	-1.06 (-2.7, 0.6)
Step 3: Prenatal education	11.9 (7.5, 16.4)*	12.3 (8.2, 16.4)*	7.0 (3.3, 10.8)*
Step 4: Care right after birth	11.7 (9.9, 13.4)*	10.2 (8.6, 11.8)*	5.8 (4.2, 7.4)*
Step 5: Support with breastfeeding	6.5 (4.6, 8.4)*	6.4 (4.6, 8.1)*	-0.9 (-2.9, 1.1)
Step 6: Limited supplementation	20.8 (18.9, 22.6)*	17.1 (15.4, 18.8)*	14.4 (12.6, 16.1)*
Step 7: Rooming-in	7.8 (5.5, 10.1)*	7.7 (5.6, 9.8)*	2.4 (0.4, 4.6)*
Step 8: Responsive feeding	13.5 (10.8, 16.3)*	12.3 (9.8, 14.8)*	6.3 (3.7, 9.0)*
Step 9: Bottles, nipples, and pacifiers	8.7 (6.6, 10.8)*	8.8 (6.9, 10.7)*	-0.3 (-1.9, 2.6)

^a Adjusted for hospital type, teaching hospital, total live births, and region.

^b Difference in in-hospital exclusive breastfeeding prevalence between hospitals fully implementing the step compared with hospitals that have not fully implemented the step.

* *p*-value < 0.05.

Level of implementation of ideal standard of steps 1–9 of the Ten Steps to Successful Breastfeeding and the association with in-hospital exclusive breastfeeding prevalence.

TABLE 4

Number of steps implemented	n (%)	Mean % of infants exclusively breastfed	Bivariate analysis	Adjusted for hospital characteristics ^a
Low (0–3 Steps)	501 (24.5%)	46.0 ± 20.7	Ref.	
Mid (4–6 Steps)	1000 (48.9%)	54.6 ± 20.6	8.6 (6.4, 10.7) *	8.5 (6.6, 10.4) *
High (7–9 Steps)	544 (26.6%)	64.4 ± 18.0	18.4 (16.0, 20.9) *	17.6 (15.4, 19.8) *

^a Adjusted for hospital type, teaching hospital, total live births, and region.

* *p*-value < 0.05.