Infant Feeding Policies in Maternity Wards and Their Effect on Breast-Feeding Success: An Analytical Overview

Rafael Pérez-Escamilla, PhD, Ernesto Pollitt, PhD, Bo Lönnerdal, PhD, and Kathryn G. Dewey, PhD

ABSTRACT

Objectives. The purpose of this review is to examine the plausibility of a causal relationship between maternity ward practices and lactation success.

Methods. Studies were located with MEDLINE, from our personal files, and by contacting researchers working in this field. Of the 65 studies originally reviewed, 18 met our inclusion criteria (i.e., hospital-based intervention, experimental design with randomization procedures, or quasi-experimental design with adequate documentation).

Results. Meta-analysis indicated that commercial discharge packs had an adverse effect on lactation performance. The impact of early mother-infant contact on lactation success was unclear. Rooming-in and breast-feeding guidance in a rooming-in context had a beneficial impact on breast-feeding among primiparae. Breast-feeding on demand was positively associated with lactation success. In-hospital formula supplementation of 48 mL per day was not associated with poor breast-feeding performance.

Conclusions. Hospital-based breast-feeding interventions can have a beneficial effect on lactation success, particularly among primiparous women. (*Am J Public Health.* 1994;84:89–97)

Introduction

The recent interest in maternity ward practices demonstrated by international health agencies[1] is justified. Rooming-in can have a beneficial impact on the health of the newborn,[2–4] and, as this review will show, there are strong reasons to believe that beneficial infant feeding policies in the maternity ward can contribute to lactation success. In 1989, the World Health Organization (WHO), in conjunction with the United Nations Children's Fund (UNICEF),[1] made several recommendations to promote breast-feeding in institutions that provide maternity services. These recommendations included rooming-in throughout the hospital stay, breast-feeding on demand, early initiation of breast-feeding, breast-feeding guidance by health personnel, and avoidance of supplementary fluids. Given the high number of births attended in clinics or hospitals worldwide,[4,5] an in-depth assessment of the impact of such policies is worthwhile.

In 1980, Winikoff and Baer[6] concluded that maternity ward policies similar to those advocated by WHO and UNICEF could have a positive impact on breast-feeding. However, they did not fully address the methodological limitations of the studies included in their review. Although Margen et al.[7] recognized that the majority of such studies did not account for confounders, they too concluded that lactation performance can be improved by encouraging mother-infant contact, providing breast-feeding information, and restricting bottle-feeding. Their conclusion may have been premature, however, since the only published study[8,9] on which they based their conclusion regarding long-term effects had serious methodological limitations.[10]

Bernard-Bonnin et al.[11,12] integrated the results of nine studies and used meta-analysis to test the effects of four different maternity ward policies on breast-feeding success. The authors concluded that lactation success was improved by both early mother-infant contact and breast-feeding support by health personnel with phone follow-up, but that in-hospital formula supplementation and breast-feeding support without phone follow-up had no significant impact. Their review did not consider policies such as discharge packs, rooming-in, and breast-feeding on demand, and it did not include any studies in developing countries.

Considering the limitations of these previous reviews, it is worthwhile to reexamine this issue. The intent of our review is to examine the plausibility of a causal relationship between maternity ward practices and lactation success, using the procedures of meta-analysis whenever possible.

Methods

This review is restricted to articles on the relationship between maternity ward practices and lactation success published in English or Spanish between 1951

Rafael Pérez-Escamilla, Bo Lönnerdal, and Kathryn G. Dewey are with the Department of Nutrition and the Program in International Nutrition, Dr Lönnerdal is also with the Department of Internal Medicine, and Ernesto Pollitt is with the Department of Pediatrics and the Program in International Nutrition, University of California at Davis.

Requests for reprints should be sent to Kathryn G. Dewey, PhD, Department of Nutrition, University of California at Davis, Davis, CA 95616-8669.

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TABLE 1—Randomized Studies on the Effect of Commercial Discharge Packs on Lactation Performance

Authors	Reference No.	n	Intervention	Study Location	Population Characteristics
Bergevin et al.[a]	27	406	One 120-mL bottle One 235-mL ready-to-feed formula can One 120-g can formula powder Reusable plastic nipple Three pamphlets w/formula advertisements	Montreal, Canada	Well educated, urban, Caucasian, primiparae and multiparae, mean birthweight: 3.4 kg, mean gestational age: 39 weeks
Evans et al.[a]	28	95	One 4-oz ready-to-feed formula One 13-oz can concentrated formula One 16-oz can powdered formula	Seattle, Wash	Well educated, urban, Caucasian primiparae and multiparae[b]
Feinstein et al.[a]	29	166	*Commercial* Two water bottles Three breast-feeding pamphlets 32-oz can ready-to-feed formula *Research* Two water bottles Three breast-feeding pamphlets	Chicago, Ill	Urban Black primiparae and multiparae
Dungy et al.[c]	30	87	*Commercial* Infant formula *Research* Manual breast pump Breast pads Breast cream	Iowa	White, middle class, well educated[bd]
Frank et al.[e]	31	324	*Commercial* Two bottles of water Two nipples Health education pamphlets including formula advertisements *Research* Breast pads and breast-feeding pamphlets *without* formula advertisements	Boston, Mass	Low income, urban, Black, primiparae and multiparae, mean birthweight: 3.4 kg, mean gestational age: 39 weeks
Guthrie et al.[c]	32	134	One 454-g can of powdered infant formula	Cebu City, Philippines	Low income, urban, mean parity: 2.5–3.0[b]

[a]Interviewer(s) were blind to group assignment; subjects were unaware of study design.
[b]Mean birthweight and gestational age were not specified.
[c]Interviewer(s) were not blind to group assignment; not known if subjects were aware of study design.
[d]Parity was not specified.
[e]Interviewer(s) were blind to group assignment; subjects were aware of study design.

and 1991. Studies were located with MEDLINE, from our personal files, and by contacting researchers working in this field.

The initial screening criterion was that the studies should involve randomized trials or quasi-experimental designs. Of the 65 studies that were identified,[8,9,13–76] 35 met this criterion. Next, those studies with questionable internal validity (i.e., those that contained between-group socioeconomic differences [two studies],[24] self-selection of participants,[16,22,35] assignment to group based on physician's wishes,[20] and exceedingly high and unevenly distributed attrition rates[63] were eliminated. Also eliminated were those studies that did not provide enough information for their internal validity to be determined (i.e., they had unreported attrition,[40,64] poorly documented methodology,[21,37] or were unpublished brief communications[39,71]). Studies based on planned (vs practiced) breast-feeding behavior[46] or confounded by birth method (vaginal vs c-section)[65] or postdischarge breast-feeding interventions[66–68] were also excluded. In total, 12 out of 28 randomized studies and 5 out of 7 quasi-experimental studies were subsequently excluded.

Whenever possible, meta-analysis[77] was used to pool and interpret results across studies.

Results

The studies were grouped according to several of the policies in the WHO/UNICEF recommendations. The categories are commercial discharge packs, rooming-in and breast-feeding guidance, early maternal-infant contact, breast-feeding on demand, and in-hospital formula supplementation.

Commercial Discharge Packs

Following the 1981 WHO code for the marketing of breast milk substitutes,[78] five clinical trials were conducted in developed countries[27–31] and one in a developing nation[32] to test the effects of commercial discharge packs on lactation success (Table 1). Sample size ranged from 87 to 406 subjects. All the studies were conducted in urban areas, but there were differences between studies in the ethnic and socioeconomic characteristics of subjects.

In all studies, women were randomly assigned either to a group that received commercial discharge packs or to a control group. In half of the studies,[29–31] women in the control group received a research discharge pack (i.e., a pack with breast-feeding promotion materials); in the remaining three studies,[27,28,32] there was no intervention for controls. The content of the discharge packs is described in Table 1. We used meta-analysis[77] to examine the effect of commercial discharge packs on (1) any breast-feeding at 1 month, (2) full breast-feeding (i.e., breast milk as the only source of milk) at 1 month, and (3) any breast-feeding at 4 months. The results (Table 2, Figure 1) indicate that the distribution of commercial discharge packs had a detrimental effect ($P < .05$) on full breast-feeding at 1 month and on any breast-feeding at 4 months, and a marginal effect on any breast-feeding at 1 month.

The study conducted by Guthrie et al.[32] was the only one carried out in a developing country. Initially, the authors collected data for 8 months postpartum from poor women delivering in two public hospitals (hospitals A [n = 134] and B [n = 79]) in the Philippines. In each hospital, women were randomly assigned to a group receiving a free can of formula at hospital discharge or to a control group not given formula. In hospital A there was a trend toward lower breast-feeding rates among formula recipients, but in hospital B formula recipients tended to be more likely to breast-feed. However, the results from hospital B do not warrant conclusive inferences since the experimental group was very small (only 17 subjects at the end of the study). The authors "replicated" their original study in a third hospital and concluded that formula recipients were not less likely to breast-feed than controls. However, these women were followed for only 2 months rather than for 8 months.

We reanalyzed the data from hospital A using survival analysis[79] (instead of the chi-square analyses at different time points conducted in the original paper) and found that women who received the free can of formula were less likely to breast-feed ($P < .05$, one tail) during the first 8 months after delivery (Figure 2). This suggests that commercial discharge packs can have a negative impact on the lactation success of women in developing countries.

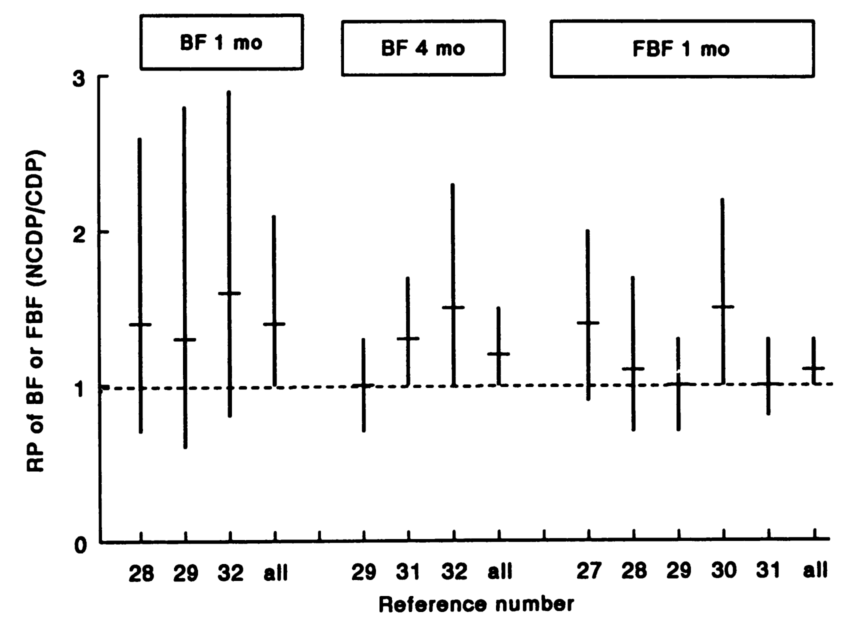
Another study that deserves further discussion is that of Bergevin et al.,[27] who documented that the negative impact of commercial discharge packs is more pronounced among vulnerable subgroups (e.g., primiparae, mothers with less education, and mothers who were ill after delivery). Evans et al.[28] could not replicate these findings; however, the sample sizes of the subgroups in their study were very small.

To summarize, commercial discharge packs are linked to poor lactation

TABLE 2—Homogeneity Test and Fisher's Combined Test of Studies Comparing Lactation Performance among Recipients (CDP) and Nonrecipients (NCDP) of Commercial Discharge Packs

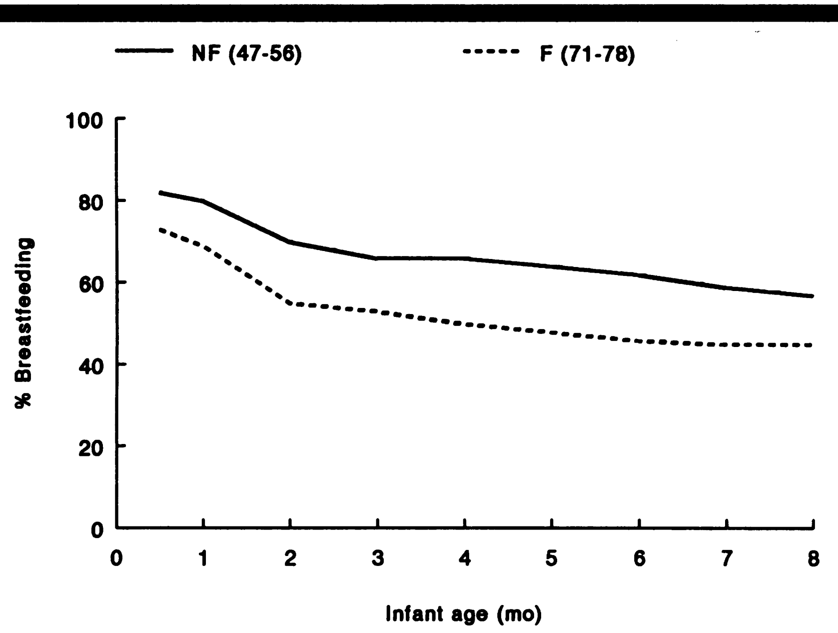
Study	CDP Breast-Feeding % (n)	NCDP Breast-Feeding % (n)	One-Tail P	Y^a	Homogeneity Test[b]	"χ^2"[c]	Fisher's Combined Test[d]
Any breast-feeding at 1 month							
Evans et al.[28]	65 (55)	75 (40)	.16	0.02	$\chi^2_{df=2} = 0.43$ ($P > .05$)	3.7	$\chi^2_{df=6} = 12.1$ ($.05 < P < .10$)
Feinstein et al.[29]	84 (76)	88 (90)	.25	0.23		2.8	
Guthrie et al.[32]	69 (78)	80 (56)	.06	0.18		5.6	
Full breast-feeding at 1 month							
Bergerin et al.[27]	78 (212)	84 (194)	.06	0.31	$\chi^2_{df=4} = 4.1$ ($P > .05$)	5.6	$\chi^2_{df=10} = 18.6$ ($P < .05$)
Evans et al.[28]	54 (55)	57 (40)	.39	0.04		1.9	
Feinstein et al.[29]	56 (76)	54 (90)	.54[f]	0.85		1.2	
Dungy et al.[30]	35 (44)	55 (43)	.02	2.49		7.8	
Frank et al.[31]	55 (167)	57 (157)	.34	0.40		2.1	
Any breast-feeding at 4 months							
Guthrie et al.[32]	50 (74)	67 (51)	.03	0.96	$\chi^2_{df=2} = 2.8$ ($P > .05$)	7.0	$\chi^2_{df=6} = 14.4$ ($P < .05$)
Feinstein et al.[29]	58 (76)	56 (90)	.62[f]	1.74		1.0	
Frank et al.[31]	55 (167)	65 (156)	.04	0.12		6.4	

[a] $Y = w(d - \bar{d})^2$, where $d = 2*r/(1 - r^2)^{1/2}$, $r = (\chi^2/N)^{1/2}$, $w = 2*N/(8 + d^2)$, $\bar{d} = \Sigma wd/\Sigma w$. N = study sample size, χ^2 = chi-square value.[77]
[b] Based on formula $\chi^2 = \Sigma w^* (d - \bar{d})^2$, with $K - 1$ degrees of freedom (where K = number of independent studies).[77]
[c] "χ^2" $= -2^* \log_e$ (one-tailed P).[77]
[d] $\chi^2 = \Sigma$"χ^2" with $2n$ degrees of freedom (where n = number of independent studies).[77]
[e] Breast-feeding 6 to 7 weeks after delivery.
[f] CDP group had higher breast-feeding rates than NCDP group. Therefore, $P_{1tail} = 1 - P_{2tail}/2$.[77]



Note. The horizontal lines indicate the RP of BF or FBF. The vertical lines depict the upper and lower bounds of the 95% confidence interval (CI) of the RP of BF or FBF (based on Mantel-Haenszel statistics). The RP of BF at 1 month with all studies combined (all) is 1.4 (95% CI:1.0, 2.1). The RP of BF at 4 months with all studies combined (all) is 1.2 (95% CI:1.0, 1.5). The RP of FBF at 1 month with all studies combined (all) is 1.1 (95% CI:1.0, 1.3).

FIGURE 1—Relative probability (RP) of postpartum breast-feeding (BF) or full breast-feeding (FBF) associated with receipt of commercial discharge packs (CDP) vs nonreceipt (NCDP), by study.



Note. F (n = 71–78) = can of powdered formula at discharge; NF (n = 47–56) = no formula provided at discharge. Based on data from Guthrie et al.[49]

FIGURE 2—Effect of formula samples at discharge on lactation success of Filipino women.

success, particularly among vulnerable subgroups such as primiparae and poor women in developing countries.

Rooming-In and Breast-Feeding Guidance

Only two studies that examined rooming-in and breast-feeding guidance[33,34] met our inclusion criteria. Since one of these two studies evaluated both rooming-in *and* breast-feeding guidance, these policies are discussed jointly in this section.

Lactation success of low-income primiparous women was studied in Managua, Nicaragua.[34] During the first 3 months of recruitment, mothers were randomly assigned to one of two groups: (1) complete maternal/infant separation throughout hospitalization with little or no breast-feeding promotion (n = 123), or (2) 45 minutes of maternal/infant contact immediately after birth followed by complete separation until discharge (n = 136). Women in the latter group received breast-feeding promotional messages. During the fourth and last month of recruitment, all eligible subjects were assigned to total rooming-in and to receive breast-feeding promotional messages (n = 116). Mothers and interviewers were blind to the study's hypotheses.

Groups were similar in several socioeconomic and demographic characteristics but differed in birthweight and obstetric procedures. None of the variables that differed was associated with lactation performance. At 1 week, the total rooming-in plus breast-feeding promotion group had a higher incidence ($P < .05$) of exclusive (63% vs 32%) and of any breast-feeding (93% vs 82%) when compared with the complete separation group. At 4 months, the differences between groups were not significant, but when the complete separation and the early contact plus breast-feeding promotion groups were combined, their breast-feeding rate at 4 months was lower ($P < .05$) than that of the total rooming-in plus breast-feeding promotion group (39% vs 50%). Thus, rooming-in accompanied by breast-feeding promotional messages had a positive impact on short- and longer-term breast-feeding success. However, this conclusion is tentative since, as recognized by the authors, the groups were not all randomly assigned, and between-group differences at baseline were identified. It was not possible to examine the effect of rooming-in by itself since breast-feeding messages were also provided to the total rooming-in group.

Pérez-Escamilla et al. conducted a study[33] among 165 low-income urban Mexican women who planned to partially or exclusively breast-feed. Women delivered in two different public hospitals. In one, infants were kept in a nursery (n = 58) and their diets were routinely supplemented with formula. In the other, rooming-in was the policy and formula supplementation was not allowed; in this hospital, women were randomly assigned to a group that received individual breast-feeding guidance during the hospital stay (n = 53) or to a control group in which normal routines were followed (n = 54). The groups were very similar in demographic and socioeconomic characteristics, prenatal care, breast-feeding motivation, previous breast-feeding exposure, maternal and infant anthropometry, and infant gender. None of the women mentioned infant feeding policies as a reason for choosing to deliver in a particular hospital.

Among primiparae, rooming-in (vs nursery) was associated with higher rates of full breast-feeding in the shorter but not in the longer term, whereas rooming-in plus breast-feeding guidance was associated with higher full breast-feeding rates throughout the 4-month study. These results suggest that rooming-in might not have a long-term effect unless it is accompanied by breast-feeding guidance. Rooming-in did not have any impact on lactation performance of multiparae. The quasi-experimental nature of this part of the study precludes causal inferences. However, the similarities in characteristics of the groups at baseline lend strength to the conclusions.

Among primiparae in the rooming-in hospital, the rate of decline in breast-feeding was significantly faster among those women who were only rooming-in than among those women who were rooming-in and receiving breast-feeding guidance. No significant differences between groups were found among multiparae. Because this part of the study included random assignment, it was concluded that the better lactation performance observed among primiparae in the rooming-in plus breast-feeding guidance group was indeed a result of the breast-feeding guidance intervention.

To summarize, the two studies that met our inclusion criteria suggest that both rooming-in and breast-feeding guidance in a rooming-in context can have a positive impact on lactation success among primiparae.

Early Maternal-Infant Contact

The handling of the newborn in most maternity wards involves routine procedures that cause maternal/infant separation soon after delivery. This separation may last a few (2 to 4) hours in wards with rooming-in or might continue until hospital discharge in wards with separate nurseries.[4,7]

TABLE 3—Randomized Studies on the Effect of Early Contact on Lactation Performance

Authors	Reference No.	n	Intervention	Country	Population Characteristics
Sosa et al.[a]	24	40	Initiated with nude infant on delivery table Duration: 45 min Dyad separated after contact and reunited 12–24 h postpartum	Guatemala	Urban poor primiparae Vaginal delivery Healthy term infant Birthweight: 2.04–3.85 kg
Ali and Lowry[b]	25	72	Skin-to-skin contact initiated shortly after delivery Contact duration: 45 min Dyad reunited 9 h after delivery	Jamaica	Urban poor primiparae and multiparae Vaginal delivery Full-term newborn Mean birthweight: 3.1 kg
Strachan-Lindenberg[b]	34	259	Initiated immediately after birth Duration: 45 min Dyad separated after contact and reunited until discharge Breast-feeding promotional messages	Nicaragua	Poor neighborhoods Primiparae Vaginal delivery Full-term newborn Mean birthweight: 3.1 kg
de Chateau et al.[a]	22, 23	40	Skin-to-skin contact initiated 10 min after delivery Duration: 10–15 min Midwife placed newborn at breast Husband present	Sweden	Middle-class primiparae Vaginal delivery Healthy term infant
Salariya et al.[c]	17	108	Initiated 10 min postpartum Midwife placed newborn at breast	United Kingdom	Primiparae "Normal healthy" infants Birthweight: 3.35 kg
Thomson et al.[b]	38	30	Skin-to-skin contact initiated 15–30 min postpartum Duration: 15–20 min Dyad separated after contact and reunited 12–24 h postpartum Partners welcomed	Canada	Primiparae Vaginal delivery Full-term newborn Birthweight > 2500 g Apgar ≥ 8
Taylor et al.[b]	36	50	Initiated 36–39 min postpartum Duration: 46 min Partners welcomed	United States	Vaginal delivery Full-term newborn Mean birthweight: 3.4 kg Mean Apgar: 8.3

[a]Not known if interviewer(s) were blind to group assignment and if subjects were unaware of study design.
[b]Interviewer(s) were blind to group assignment; subjects were unaware of study design.
[c]Mailed questionnaire; not known if subjects were unaware of study design.

Based on our initial screening criteria (i.e., randomized trials or quasi-experimental designs), we reviewed 14 studies[13,17,22,24(3 studies),25,34,35–40] on the effect of early contact on lactation success. Six of these studies were subsequently excluded[24(2 studies),35,37,39,40]; three of these[35,37,39] reported a positive impact of early contact on postpartum breast-feeding success whereas three[24,40] did not. Of the eight controlled trials that will be discussed, one[13] did not include a follow-up and therefore was not included in the meta-analysis. All except one of the trials in the meta-analysis[25] (Table 3) included only primiparae; three[24,25,34] were conducted in developing countries. Sample sizes ranged from 30 to 259. In all studies, women were randomly assigned to an "early contact" or a control group. In general, early contact meant that mother and newborn were allowed to have skin-to-skin contact beginning up to 39 minutes after delivery and lasting 10 to 45 minutes. In three studies,[22,34,38] mothers were encouraged to breast-feed during the period of early contact; there is no information on this issue in the remainder of the studies. It was reported that partners of the women were allowed to be present during early contact in three studies.[22,36,38] In four studies,[24,25,34,38] the infants were separated from their mothers after early contact and reunited later (within 9 to 24 hours, or at discharge). In the remaining studies, it is not clear if the newborns remained with their mothers after early contact.

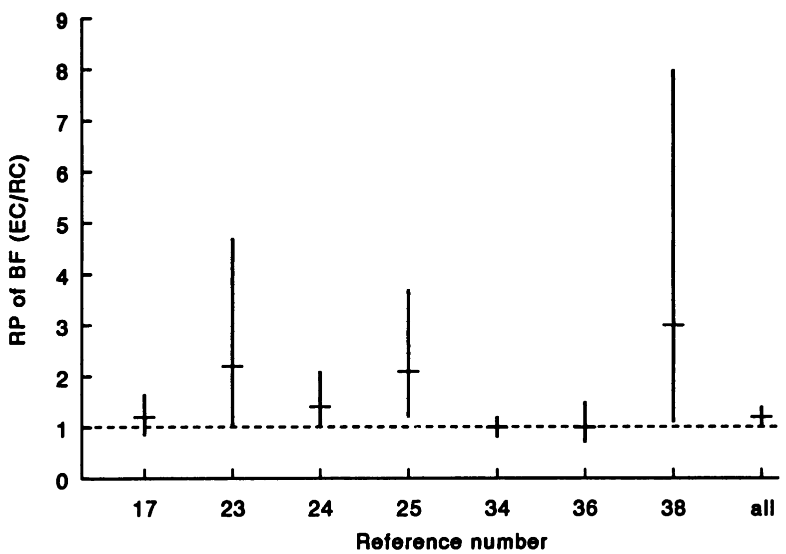
Meta-analysis indicated that early contact had a beneficial effect ($P < .05$) on the likelihood of breast-feeding at 2 to 3 months among primiparae (Table 4, Figure 3). However, these results should be interpreted with caution for two reasons. First, the effect size across studies was heterogeneous. This was mainly due to the study conducted in Nicaragua,[34] which found very similar breast-feeding rates among early and delayed contact groups. Second, it may not be possible to attribute improved breast-feeding rates directly to early contact since several studies also included breast-feeding guidance by health personnel or the presence of the father during early contact.

Woolridge et al.[13] conducted a clinical trial in Thailand to study the effect of early contact on the onset of milk production. Twelve dyads (i.e., mother-infant pairs) were randomly assigned to the comparison group, which included infants placed in a separate nursery and given water but not formula. About 24 hours after delivery, the newborns were returned to their mothers, who bedded-in throughout the hospital stay. Thirteen dyads were assigned to the early contact group, in which the newborns were brought to their mothers, fasted 2 to 4 hours after delivery, and remained with their mothers thereafter. The onset of milk production was assessed by test weighing a single feed each day on days 2 to 5 postpartum.

TABLE 4—Homogeneity Test and Fisher's Combined Test of Studies Comparing Lactation Performance at 2–3 Months among Regular Contact and Early Contact Groups

Study	Regular Contact % Breast-feeding (n)	Early Contact % Breast-feeding (n)	One-Tail P	Y[a]	Homogeneity Test[b]	"χ^2"[c]	Fisher's Combined Test[d]
Sosa et al.[24]	59% (20)	85% (20)	.04	1.2		6.4	
de Chateau et al.[23]	26% (19)	58% (21)	.02	1.8		7.8	
Strachan-Lindenberg[34, e]	51% (123)	50% (136)	.58	4.0	$\chi^2_{df=6} = 13.4$	1.1	$\chi^2_{df=14} = 40.9$
Salariya et al.[17]	51% (53)	60% (55)	.17	0.04	($P < .05$)[f]	3.5	($P < .05$)
Thomson et al.[38, g]	20% (15)	60% (15)	.01	3.1		9.2	
Ali and Lowry[25, g]	27% (37)	57% (35)	.005	3.0		10.6	
Taylor et al.[36]	68% (19)	71% (31)	.31	0.3		2.3	

[a] $Y = w(d - \bar{d})^2$, where $d = 2{*}r/(1 - r^2)^{1/2}$, $r = (\chi^2/N)^{1/2}$, $w = 2{*}N/(8 + d^2)$, $\bar{d} = \Sigma wd/\Sigma w$. N = study sample size, χ^2 = chi-square value.[77]
[b] Based on formula $\chi^2 = \Sigma w{*}(d - \bar{d})^2$ with $K - 1$ degrees of freedom (where K = number of independent studies).[77]
[c] "χ^2" = $-2\Sigma \log_e$ (1-tailed P).[77]
[d] $\chi^2 = \Sigma$ "χ^2" with $2n$ degrees of freedom (where n = number of independent studies).[77]
[e] Breast-feeding at 4 months.
[f] If reference 34 is excluded from meta-analysis, the effect size of remaining studies is homogeneous ($\chi^2_{df=5} = 6.3$ [$P > .05$]).
[g] Full breast-feeding at 2–3 months.



Note. The horizontal lines indicate the RP of BF. The vertical lines depict the upper and lower bounds of the 95% confidence interval (CI) of the RP of BF (based on Mantel-Haenszel statistics). The RP of BF at 2–3 months with all studies combined (all) is 1.2 (95% CI:1.0, 1.4).

FIGURE 3—Relative probability (RP) of breast-feeding (BF) 2–3 months after delivery associated with early contact (EC) vs regular contact (RC), by study.

The groups were similar in birthweight, parity, infant gender, and time of day at which milk intake was estimated on day 5. There was a difference of 21.5 hours in mean age at first contact and of 22.4 hours in mean age at first breast-feeding episode between the early contact and comparison groups, but there were no significant differences in milk production. However, the authors caution that the external validity of their findings may be limited since the study was conducted in a traditional society where the infants not only roomed-in but also bedded-in with their mothers. They also acknowledge that the effect of contact within the first 1 to 2 hours after delivery on the initiation of lactation was not studied.

Results presented in this section suggest that early maternal-infant contact might have a beneficial effect on lactation performance. However, to confirm this finding, additional studies with more rigorous methodology are needed.

Breast-Feeding on Demand

Three experimental studies[17,18,42] examined the impact of breast-feeding on demand.

Salariya et al.[17] studied the effect of both the timing of initiation of breast-feeding and the frequency of nursing during the hospital stay on the lactation success of 111 primiparous women. Women were stratified according to age and social class and were randomly assigned to follow one of four sets of feeding instructions: (1) 2E = early initiation (within 10 minutes after delivery), followed by nursing every 2 hours (n = 29); (2) 4E = early initiation, then nursing every 4 hours (n = 27); (3) 2L = later initiation (4 to 6 hours after delivery), followed by nursing every 2 hours (n = 27); and (4) 4L = later initiation, then nursing every 4 hours (n = 28). A questionnaire was mailed at 6 weeks, 12 weeks, and 18 months after delivery to assess infant feeding practices.

At 48 hours, the mothers who breastfed every 2 hours (2E and 2L) were more likely to report onset of milk production than those who fed every 4 hours (4E and 4L) (54% vs 18%). Compared with infants fed every 4 hours, significantly fewer newborns fed every 2 hours required supplementary formula feeding (28% vs 9%). Median breast-feeding duration was longest in group 2E (182 days), followed by 4E (140 days), 2L (112 days), and 4L (77 days). It was concluded that both early initiation and increased frequency of breast-feeding improved lactation success. However, these results should be interpreted with caution because compliance by the mothers and blindness of interviewers to group assignment were not documented, the methodology used to evaluate the onset of milk production was not described, and no statistical tests comparing the median breast-feeding durations were reported.

De Carvalho et al.[18] conducted a study in the United States to investigate the effects of frequent and unrestricted breast-feeding on infants' milk intake and growth during the first month. Mothers delivering in July and August were told to feed their infants following the 3- to 4-hour hospital schedule (control group). Mothers delivering during September and October were encouraged to nurse on demand (experimental group). Breast-feeding began within 6 hours after delivery. During the first 14 days, mothers recorded each breast-feeding. Milk intake was measured by test weighing on days 15 and 35. Initially, there were 47 control subjects and 28 experimental subjects. The dropout rates at 1 month were 66% and 57%, respectively.

Maternal age and parity were similar between groups, but mean birthweight was 478 g higher in the experimental group. Nursing frequency during the first 14 days was significantly higher in the experimental than in the control group (9.9 ± 1.9 vs 7.3 ± 1.4), but total nursing duration was similar (135 vs 138 min/24 h). Infants in the experimental group consumed significantly more milk on day 15 (725 vs 502 mL/24 h) and had gained significantly more weight since birth (561 vs 347 g) than those in the control group. At 35 days, nursing frequency was still significantly higher in the experimental group (9.8 ± 2.4 vs 6.8 ± 1.2), but the difference in total nursing duration was again not significant (177 vs 152 min/24 h). Infant milk intake on day 35 was marginally higher ($P = .08$) in the experimental group (841 vs 681 mL/24 h).

The authors concluded that frequent and unrestricted breast-feeding increases early milk production and infant weight gain. However, the between-group difference in birthweight is a potentially important confounding variable. Previous work by the same authors[41] indicated that birthweight was positively associated with nursing frequency and duration at 2 weeks, and others have shown that birthweight is correlated with breast milk intake.[80] In addition, the dropout rates were high and unevenly distributed across groups, and the potential self-selection bias caused by this was not assessed.

Illingworth et al.[42] conducted a study to determine the effect of in-hospital nursing on demand on the lactation performance of 241 mothers in Great Britain. All infants roomed with their mothers and in the first 2 days were breast-fed every 6 hours. On the third day, infants on one floor were fed every 4 hours (n = 106) while those on another floor were fed on demand (n = 131).

There were no significant between-group differences in parity or length of hospital stay. On the ninth day, significantly more newborns in the on-demand group had regained their birthweight as compared with the group fed on schedule (49% vs 36%). At 1 month, significantly more infants in the on-demand group were fully breast-fed (80% vs 64%). Moreover, significantly fewer mothers in that group had experienced sore nipples (13% vs 27%) or breast engorgement (17% vs 34%). Despite the intervention, there were no significant between-group differences in nursing frequency during the first week. However, it must be noted that nursing frequency for the group fed on schedule was assumed to be the six feedings that were scheduled.

In this study it is not known if the nurses, follow-up interviewers, and mothers were blind to the main goals of the study, and the assumption about group equivalence was based on two parameters only.

Although the three studies reviewed above all indicated a significant relationship between advice to breast-feed on demand and lactation success, serious methodological problems preclude any definitive conclusions.

In-Hospital Formula Supplementation

The practice of supplementing infants' diets with formula in the maternity ward is still pervasive. Only one study on this issue met our inclusion criteria.

Gray-Donald et al.[43] conducted a clinical trial in Montreal, Canada, to study the effect of in-hospital formula supplementation on the duration of breast-feeding. Subjects were assigned, based on bedspace availability, to one of two similar but separate maternity wards. In the formula supplementation group, the usual hospital routine was followed: all infants were given formula at 2 AM unless the mothers requested otherwise. Glucose water feedings were not restricted. The usual postpartum stay was 4 days. In the restricted formula nursery, mothers were routinely awakened at 2 AM to breast-feed; their infants were not supplemented with formula unless the mother requested it. Women were interviewed at 9 weeks postpartum by an interviewer blind to group assignment. Breast-feeding was defined as no more than one bottle-feeding per day.

The restricted formula (n = 388) and formula supplementation (n = 393) groups were very similar in birthweight and in socioeconomic and demographic characteristics. The percentage of infants unsupplemented in the hospital was significantly lower in the restricted formula than in the formula supplementation group (15% vs 63%), but the percentage receiving glucose water was similar. The percentage of mothers breast-feeding was very similar between groups at both 4 (71% vs 68%) and 9 weeks (55% vs 54%). No significant differences were observed even after reanalyzing the data using various breast-feeding definitions and within vulnerable subgroups.

The authors caution against generalizing from their findings. In-hospital supplementation was only 48 mL of formula per day. This contrasts sharply with the much higher amount of supplementation that has been reported in maternity wards in developing countries.[7]

Conclusions

This review presents strong evidence that several of the infant feeding policies recommended by WHO and UNICEF (i.e., discontinuation of commercial discharge packs, rooming-in, and breast-feeding guidance) can have a positive impact on lactation success. On the other hand, it also shows that the impact of other maternity ward policies (i.e., breast-feeding on demand) could not be properly evaluated because of serious methodological problems in the studies. Although our analysis suggests that early mother-infant contact might be related to lactation success, the meta-analysis was not easily interpretable due to study heterogeneity. Further clinical trials that control for confounders, such as husband's presence and breast-feeding guidance by health personnel, are required to confirm this relationship. The lack of effect of in-hospital formula supplementation on lactation performance of Canadian women[43] does not preclude the possibility that this practice has a negative impact on breast-feeding in settings where much higher levels of formula supplementation are common.[7] The potential differential impact of breast-feeding promotion efforts within vulnerable subgroups (e.g., low-income women and primiparae) deserves further consideration.

This review was restricted to infant feeding policies in maternity wards; we know almost nothing about the potential synergistic effect that these policies might have when combined with prenatal and postnatal breast-feeding interventions. It is important to fill in these gaps in knowledge in order to tailor cost-effective interventions whose aim is to increase the chances of lactation success and ultimately improve infant health. □

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