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Inequities in Milk-Based Prelacteal Feedings in Latin America and the Caribbean: The Role of Cesarean Section Delivery

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Abstract

Background: Prelacteal feeds (ie, foods other than breast milk offered before the milk comes in) have been identified as a risk factor for shorter breastfeeding duration and neonatal mortality.

Objective: This study aimed to test for socioeconomic inequities on the risk of milk-based prelacteal feeding associated with cesarean section delivery.

Methods: We conducted secondary cross-sectional data analyses of 7 Demographic and Health Surveys conducted in Latin American and Caribbean countries between 2005 and 2010 (N = 49 253 women with children younger than 3 years of age). Multivariate logistic regression was used to test the association between cesarean section delivery and the risk of milk-based prelacteal feeding in the total samples as well as within the lowest and highest wealth quintile subsamples by country and in the pooled sample.

Results: Almost one-third of newborns received milk-based (22.9%) prelacteal feeds. Prelacteal feeding prevalence varied from 17.6% in Guiana to 55% in Dominican Republic. Cesarean section delivery was associated with significantly higher odds of introduction of milk-based prelacteals in all countries (adjusted odds ratio [AOR] range, 2.34 in Bolivia to 4.50 in Peru). The association between cesarean section delivery and risk of milk-based prelacteal feeds was stronger among the poorest than wealthiest women (AOR [95% confidence interval], 2.94 [2.58-3.67] vs 2.17 [1.85-2.54]).

Conclusion: Women of lower socioeconomic status may need additional breastfeeding support after cesarean section delivery to prevent the introduction of milk-based prelacteals. Reducing the rates of cesarean section deliveries is likely to reduce the prevalence of prelacteal feeding.

Keywords

breastfeeding, Caribbean, cesarean section, Latin America, prelacteal feeds

Well Established

Milk-based prelacteal feeds have been associated with increased risk of neonatal mortality and shorter exclusive and any breastfeeding duration. Socioeconomic and biomedical factors, including cesarean section delivery, have been associated with increased risk of prelacteal feeding.

Newly Expressed

The risk of milk-based prelacteal feeding associated with cesarean section delivery is significantly stronger among women of lower than of higher socioeconomic status.

Background

In spite of the well-known benefits of exclusive breastfeeding since birth[1] worldwide, it is relatively common to provide foods other than breast milk to neonates during the first days of life.[2-4] Prelacteal feeding has been defined as the offering of any liquid or semisolid food, including infant formula,[5] to the newborn before the onset of lactation, which happens around 3 to 4 days after birth.[6] Prelacteal feeding is a harmful practice because it can increase the risk of neonatal mortality[7-9] and reduce the duration of exclusive and any

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breastfeeding.[10-13] Risk factors for prelacteal feeding include place of residence (rural areas in Bolivia[14] or urban areas in China[15]), maternal level of formal education,[15-17] and cesarean section delivery.[16,17] The latter may be related to the delay in breastfeeding initiation associated with this surgical procedure.[18]

The incidence of cesarean section delivery is increasing globally and across socioeconomic groups,[19,20] and there are strong reasons to hypothesize that cesarean section delivery increases the risk of introduction of milk-based prelacteals.[18] From an equity lens, it is not known if the association of this major surgical procedure with the risk of milk-based prelacteal feeding is higher among women of lower versus higher socioeconomic status. We hypothesized that this association may be stronger among more impoverished women, as they may be more likely to lack the social support and lactation management support needed to overcome the risk of introduction of milk-based prelacteal feeds associated with a cesarean section. Specifically, it is likely that the more impoverished women are, the more disempowered they are to act upon their exclusive breastfeeding intentions after a cesarean section delivery.[21] Thus, the objective of this study is to estimate the prevalence and factors associated with milk-based prelacteal feedings and to test for the presence of socioeconomic inequities in the association between cesarean section and the risk of milk-based prelacteal feeding in Latin America and the Caribbean, regions of the world characterized by strong socioeconomic inequities and a high incidence of both cesarean section deliveries and use of prelacteal feeds.[19,20]

Methods

The data for these cross-sectional analyses are derived from the last wave of nationally representative Demographic and Health Surveys (DHS) conducted in 7 Latin American and Caribbean countries between 2005 and 2010. The countries included are Bolivia, 2008; Colombia, 2010; Dominican Republic, 2007; Guiana, 2009; Haiti, 2005; Honduras, 2005; and Peru, 2007. The data are public domain and were downloaded from the DHS website (www.measuredhs.com) with prior approval from DHS headquarters (Calverton, Maryland). This study was exempt from ethical approval as it included only secondary data analyses of publicly available data sets without personal identifiers.

The DHS main target groups are women of reproductive age and children younger than 5 years. The government of each country conducts the surveys with technical support from the DHS headquarters, and the US Agency for International Development is the main funder of the DHS initiative. Data are collected with standardized questionnaires translated into the local language(s). The questionnaires collect information about household socioeconomic conditions, women's fertility, sexual activity, sexually transmitted diseases, and contraceptive use, as well as breastfeeding, complementary feeding, maternal–child nutritional status, morbidity, and mortality.

Study Settings

The 7 countries studied differ in the coverage of professional maternity services by their respective health care systems. According to the Pan American Health Organization, in Colombia, Costa Rica, Dominican Republic, and Guiana, more than 95% of deliveries are attended by trained personnel; this is the case for 87% of deliveries in Peru, followed by Honduras (83%), Bolivia (74.5%), and Haiti (38%).

Sampling Frameworks

The DHS uses multistage complex sampling frameworks involving clustering and stratification procedures by urban and rural areas. Households from each stratum are randomly selected from enumeration lists based on census track information. All women in each household who are between 15 and 49 years old are eligible to be interviewed.

Analytical Sample

Women with children younger than 3 years who were alive at the time of the interview were included in these analyses. Three years was used as the upper child age cut-off point to minimize recall bias, as women were asked to report how they fed their newborn during the first 3 days after birth. If more than 1 child per household was eligible for inclusion in the analyses, the youngest was selected. We included in the analyses only mothers with singleton births who ever breastfed the index child. Of the 58 855 children with available data, 58 127 were single birth products, and of those, 49 499 were younger than 3 years at the time of the interview. Missing data on prelacteal feeds was 0.1%, yielding a final analytical sample of 49 253 women. Those with missing data were more likely to be in the bottom 2 wealth quintiles compared with those included in the analyses. Because cesarean section was the key exposure variable, only children delivered in hospitals or clinics (vs at home) were included in the final multivariate analyses (N = 42 483).

Outcome Variable

The primary outcome, milk-based prelacteal feeds, was defined as offering of any milk other than breast milk, including infant formula, to the newborn in the first 3 days of life. The DHS obtains data on milk-based prelacteals through the question, "[During the] first 3 days of life, was [child name] given infant formula and/or milk other than breast milk?" Mothers were asked to report all the response options that applied.

Independent Variable and Effect Modifier

The hypothesis being tested is if the association between cesarean section and risk of milk-based prelacteal feeding is modified by socioeconomic status. Thus, the key independent variable was cesarean section and the effect modifier tested in the analyses was household wealth index. The latter was estimated in the DHS as a scale of relative wealth generated from information on the household's ownership of assets (including appliances), home construction materials, and sanitation infrastructure. The wealth index score is generated for each household using principal component analysis, and subsequently, households are classified into 1 of the following 5 mutually exclusive wealth quintiles: poorest, poor, middle, rich, and richest.[22]

Covariates

The covariates included were those previously identified as being associated with the risk of milk-based prelacteal feeding that were available in the DHS.[13-17] These were area of residence (urban, rural); maternal level of formal education (none, elementary, secondary, college); maternal age (15-19 years, 20-34 years, and 35-45 years); number of children (1, 2, 3+); marital status (never married, currently married, previously married); child sex (male, female); birth weight (< 2500 g, 2500-4000 g, > 4000 g); gestational age at birth (< 37 weeks, ≥ 37 weeks); and pregnancy intentions (wanted then, wanted later, not wanted). The 2 contextual or cluster covariates added to the pooled analyses were region of birth (within country) and country of birth.

Statistical Analyses

We used SPSS for Windows (version 21) and R-statistics (version 3.0.3) to conduct the statistical analyses by country and for the pooled sample. All analyses adjusted for sampling weights and the standard errors were adjusted for the complex sampling design, taking into account clustering and multistage sampling.[23]

For each country and the pooled sample, we computed the proportion of milk-based prelacteal feeding as well as the distribution frequencies for the independent variables and the covariates. Level of education, wealth category, and maternal age were compared between respondents included and those excluded in the analyses because of missing data using the chi-square test. Bivariate analyses were conducted by country and the pooled sample to compare the prevalence of prelacteal feeding across independent variables and covariates categories using chi-square analyses and a P value < .05 as the criterion for statistical significance.

Multivariate logistic regressions were conducted by country and in the pooled sample to estimate the adjusted odds ratios (AORs) and corresponding 95% confidence intervals (95% CIs) describing the association of each independent variable and covariates with the risk of milk-based prelacteal feeding. To make the multivariate analyses comparable across countries, all the covariates that were significantly associated with milk-based prelacteal feeding in the univariate analyses in at least 1 country were included in the regression models of all countries and the pooled sample. The analytical strategy used to test the study hypothesis by country and in the pooled sample was based on estimating the AORs of cesarean section corresponding to the risk of milk-based prelacteal feeding within the subsamples of women living in the highest wealth versus lowest wealth quintile households. The differential risk of milk-based prelacteal feeding as a function of wealth index category could not be examined in Haiti as there were only 15 women who delivered via cesarean section and who were in the bottom wealth quintile. Thus, in the case of Haiti, the lower wealth subgroup was represented by the 2 bottom wealth quintiles combined. For the multivariate analyses we only included hospital or clinic deliveries, since cesarean sections, the key exposure variable, cannot be conducted when deliveries take place at home.

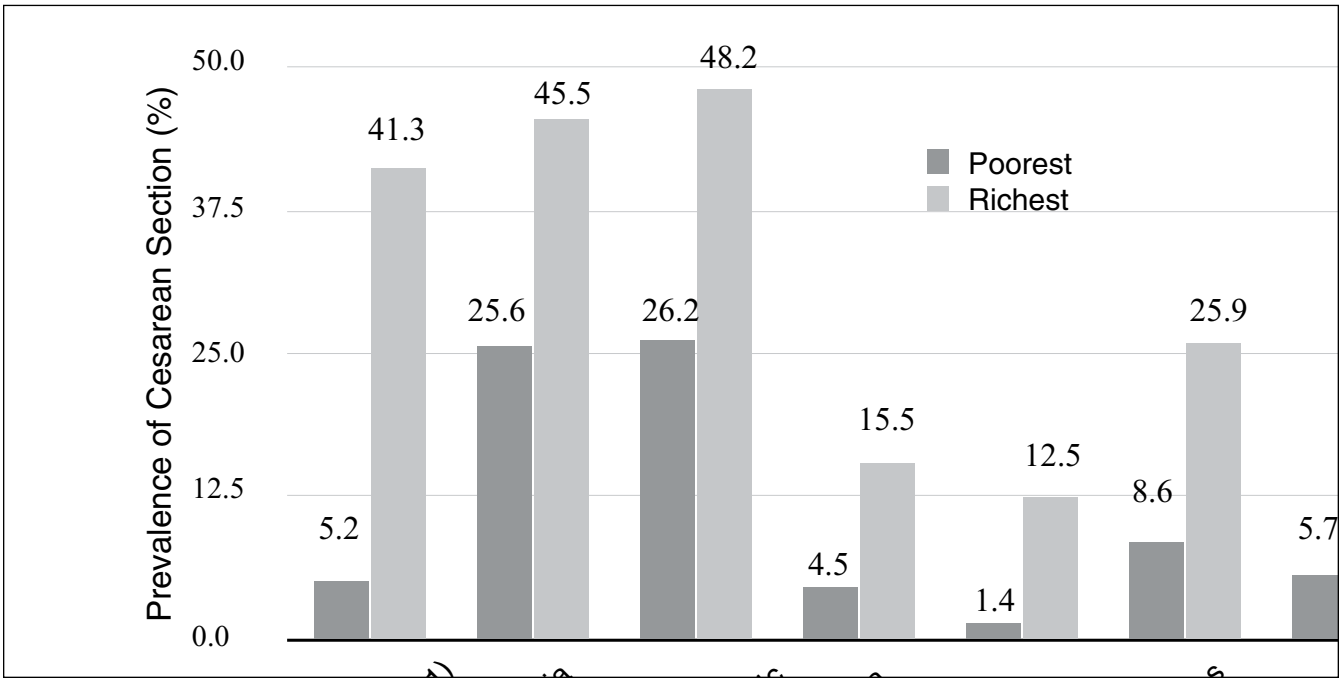
Last, a binomial multilevel model was conducted in the pooled sample including country and region within country as random variables, and the intercept level was estimated. The intraclass correlation coefficients were estimated for country and region to estimate the proportion of variance unexplained by the individual characteristics. This multilevel approach has the advantage of assuming that the clusters (country and regions in each country) include unmeasured contextual confounders.

Results

Slightly more than half of the children were male. The percentage of households located in urban areas ranged from 24.5% in Guiana to 73.7% in Colombia, more than three-quarters of deliveries took place in hospitals or clinics (39.1% in Haiti to 95.6% in Colombia), and about 1 of every 5 newborns was delivered via cesarean section (Figure 1). About one-third of mothers were primiparous (26.6% in Bolivia to 39.4% in Colombia), about 10% were adolescents (6.1% in Peru to 11.6% in Honduras), and only 11.5% of women had a postsecondary education (3.3% in Haiti to 23.1% in Peru). About 7% of women reported that their children had a birth weight < 2500 g (3.6% in Bolivia to 11.8% in Guiana) (Table 1).

One of every 3 children received any prelacteal feeds (18% in Guiana to 55.2% in Dominican Republic) and 23% were milk-based (3.2% in Haiti to 50.7% in Dominican Republic) (Table 2). Higher prevalence of milk-based prelacteal feeding was associated with living in an urban area (except for Guiana), higher levels of education, wealthier households, lower parity, cesarean section delivery, delivery in a private hospital (vs public hospital or home), and delivery in a public hospital (vs home) (Table 3).

Figure 1. Prevalence of Cesarean Section among Poorest and Richest Quintiles of Wealth[a] in 7 Latin American and Caribbean Countries. Demographic and Health Surveys, 2005-2010.



[a]The wealth index was estimated in Demographic and Health Surveys as a scale of relative wealth generated from information on the household's ownership of assets (including appliances), home construction materials, and sanitation infrastructure. The wealth index score is generated for each household using principal component analysis, and subsequently, households are classified into 1 of the following 5 mutually exclusive wealth quintiles: poorest, poor, middle, rich, and richest.

Cesarean section delivery was associated with significantly higher odds of introduction of milk-based prelacteals in all countries (AOR range, 2.34 in Bolivia to 4.50 in Peru). The pooled sample findings showed that the association between cesarean section delivery and risk of milk-based prelacteal feeds was significantly stronger among the poorest than the wealthiest women (AOR [95% CI], 2.94 [2.58-3.67] vs 2.17 [1.85-2.54]), with a dose-response association found only in Honduras and Peru. At the country level, these socioeconomic-related risk differentials were particularly strong in Honduras (AOR, 6.53 vs 2.30), Peru (6.04 vs 3.82), and Haiti (9.93 vs 2.07) and pointed in the same direction in Bolivia and Dominican Republic. Guiana was an exception, as in that country, the socioeconomic differential related to the risk of cesarean section delivery was in the opposite direction (AOR, 1.21 vs 6.20 in the lowest vs top wealth quintiles, respectively), but this difference was not statistically significant (Table 4).

The adjusted multilevel model documented that the intraclass correlation coefficient (ICC) attributed to the country level was 9.2% and the ICC for region level was 5.7%. These results indicate that the great majority of the variance is explained by individual level characteristics independently of the country (or regions within countries) where the respondents lived.

Discussion

To our knowledge, this is the first study to document a socioeconomic inequity in the risk of milk-based prelacteal feeding associated with cesarean section delivery. Our findings provide strong support to our original hypothesis that the association between milk-based prelacteal feeding and cesarean section delivery is stronger among women in the poorest compared to the wealthiest quintiles. Findings suggest that women in general and low-income women in particular are in special need of additional support to prevent the introduction of prelacteal feeds after a cesarean section delivery.[13,18,24-26] Women who deliver via cesarean section do not have an increased risk of breastfeeding failure if there is adequate support with breastfeeding initiation during the hospital stay in the maternity ward.[27-30] However, it is reasonable to expect that women of lower socioeconomic status and lower education level are more disempowered to garner the social and lactation management support for them to prevent the introduction of infant formulas or other milk-based prelacteal feeds after a cesarean section even if they were not planning to do so before the birth of their offspring.[21] This implies that from an equity perspective, it is crucial that low-income women are offered strong support to meet their breastfeeding intentions, including preventing the introduction of milk-based prelacteals.

Table 1. Descriptive Characteristics of Mothers with Children Younger Than 3 Years Who Were Ever Breastfed across 7 Latin American and Caribbean Countries. Demographic and Health Surveys, 2005-2010.[a]

	Bolivia (n = 6351)[b]	Colombia (n = 12 391)[b]	Dominican Republic (n = 7512)[b]	Guiana (n = 1315)[b]	Haiti (n = 4975)[b]	Honduras (n = 7864)[b]	Peru (n = 8665)[b]	All (n = 49 253)[c]
Type of place of residence								
Urban	57.7	73.7	68.5	24.5	37.5	46.8	65.2	46.5
Rural	42.3	26.3	31.5	75.5	62.5	53.2	34.8	53.5
Mother's highest education level								
No education	5.7	1.8	3.8	2.9	19.7	4.6	3.1	6.7
Primary	50.1	23.7	38.5	20.4	42.1	58.0	28.5	40.4
Secondary	31.1	54.5	39.2	69.3	34.9	32.2	45.3	41.4
Higher	13.1	20.0	18.5	7.4	3.3	5.2	23.1	11.5
Wealth index[d]								
Poorest	22.7	22.9	23.4	25.5	20.8	23.1	24.2	31.3
Poor	19.8	22.4	22.4	21.2	20.3	20.6	23.5	23.1
Middle	22.6	22.7	20.5	19.0	21.8	19.9	21.6	19.6
Rich	19.8	18.7	18.3	16.8	21.5	20.7	17.3	15.3
Richest	15.1	13.3	15.4	17.5	15.6	15.7	13.4	10.7
Mother's age, y								
13-19	7.7	10.9	11.0	11.5	7.1	11.6	6.1	9.9
20-34	67.8	71.0	74.9	69.7	68.2	71.4	67.6	69.6
35-49	24.5	18.1	14.1	18.8	24.7	17.0	26.3	20.5
Number of living children								
1	26.6	39.4	32.2	32.2	32.4	33.5	34.7	31.4
2	23.4	30.6	26.1	24.1	23.0	26.4	27.6	24.8
3+	50.0	30.0	41.7	43.7	44.6	40.1	37.7	43.8
Marital status								
Never married	7.3	11.7	3.6	12.5	6.2	6.0	6.2	7.3
Currently married[e]	85.2	72.7	75.1	79.8	85.0	78.9	85.5	81.3
Formerly married	7.5	15.6	21.3	7.7	8.8	15.1	8.3	11.5
Cesarean section delivery								
No	78.9	63.9	55.9	85.8	94.1	80.9	75.4	78.8
Yes	21.1	36.1	44.1	14.2	5.9	19.1	24.6	21.2
Place of delivery								
Home	27.8	4.4	1.1	7.9	60.9	15.3	14.9	22.0
Public hospital	60.1	95.5	77.1	79.9	28.1	79.6	76.2	69.9
Private hospital	12.1	0.1	21.8	12.2	11.0	5.1	8.9	8.1
Sex of child								
Male	51.7	51.7	51.6	50.1	50.0	52.1	51.2	51.1
Female	48.3	48.3	48.4	49.9	50.0	47.9	48.8	48.9
Birth weight[f]								
< 2500 g	3.6	7.0	9.2	11.8	5.2	7.2	6.8	7.1
2500-4000 g	62.8	66.0	77.7	68.4	13.5	66.9	78.9	67.7
> 4000 g	9.3	5.7	10.7	9.9	7.8	11.1	7.2	8.9
Not weighted or do not know	24.3	21.3	1.4	9.9	73.3	14.8	7.0	23.4

Abbreviation: NA, not applicable.
[a]All values are percentages.
[b]Adjusted for sampling weights and design.
[c]Pooled data sample with inverted sample size.
[d]The wealth index was estimated in Demographic and Health Surveys as a scale of relative wealth generated from information on the household's ownership of assets (including appliances), home construction materials, and sanitation infrastructure. The wealth index score is generated for each household using principal component analysis, and subsequently, households are classified into 1 of the following 5 mutually exclusive wealth quintiles: poorest, poor, middle, rich, and richest.
[e]Formally married or living with partner.
[f]Birth weight reported by mother or card registry.

Table 2. Prevalence of Prelacteal[a] Feeds Offered to Newborns in 7 Latin American and Caribbean Countries. Demographic and Health Surveys, 2005-2010.[b]

Prelacteal	Bolivia (n = 6351)[c]	Colombia (n = 12 391)[c]	Dominican Republic (n = 7512)[c]	Guiana (n = 1315)[c]	Haiti (n = 4975)[c]	Honduras (n = 7864)[c]	Peru (n = 8665)[c]	All (n = 49 253)[d]
Milk-based prelacteal	14.1	27.8	50.7	12.1	3.2	31.0	30.2	22.9
Milk other than breast milk	0.6	0.9	19.2	7.2	2.1	0.1	1.5	4.4
Infant formula	5.3	27.0	31.7	5.9	1.2	30.8	28.8	17.5
Powdered/canned milk	8.3	NA	NA	NA	NA	NA	NA	NA
Goat milk	0.1	NA	NA	NA	NA	0.1	NA	NA
Any prelacteal[e]	28.9	36.3	55.2	18.0	20.3	44.3	33.4	32.8

Abbreviation: NA, not applicable.
[a]Prelacteal: newborn received any food, other than breast milk, during the first 3 days of life.
[b]All values are percentages.
[c]Adjusted for sampling weights and design.
[d]Pooled data sample with inverted sample size weight.
[e]Total may be less than addition of subtotals because the same child could have received more than 1 type of prelacteal.

One of every 3 children who were breastfed in the 7 Latin American and Caribbean countries examined received foods other than breast milk during the first 3 days of life. It is likely that this prevalence was underestimated, since only children who were alive at the time of the survey were included and it has been established that prelacteal feeding increases the risk of neonatal mortality.[7-9] Prelacteal feeding also increases the risk of breastfeeding failure.[24] Thus, it is crucial to identify modifiable risk factors to prevent this undesirable and unnecessary infant feeding practice from happening.

Our findings also have major implications from the perspective of addressing the increasing and, for the most part, excessive prevalence of cesarean sections worldwide.[19,20] In agreement with previous studies conducted in different world regions,[17,27,28,31,32] we found that cesarean section delivery substantially increased the risk of introduction of milk-based prelacteals among all countries studied. This finding may be explained by the previously reported associations of this major surgical procedure with a delay in offering the breast for the first time[18,26] and a delayed onset of lactation and other breastfeeding difficulties, perhaps resulting from stress-related factors[29,33] and/or the use of anesthesia.[29]

An interesting finding from our analyses was that milk-based prelacteal feeding was significantly higher in private versus public hospitals. It is possible that private hospitals have higher cesarean section rates and offer significantly less breastfeeding support during the maternity ward stay. Future studies focusing on the use of prelacteal feeds should include private hospitals in their samples whenever possible. We also recommend for the DHS to include questions about Baby-Friendly steps compliance via maternal recall. Our analyses documented that countries and regions within a country represent unmeasured contextual confounders that explain part of the variance in milk-based prelacteal feeding.[34] The significant variability across health care system access and coverage across the countries included may indeed be an important country-related contextual factor that needs to be taken into account when addressing milk-based prelacteal feeding practices.

Our study has important methodological strengths, as it allowed us to test our hypothesis using nationally representative samples from 7 countries in the same world region but with substantially different prevalences in both cesarean section and milk-based prelacteal feeds. In addition, the pooled analyses were instrumental in allowing us to summarize the effect sizes of the associations in the whole sample and by opposite wealth strata extremes. It is important, however, to also acknowledge several study limitations. First, analyses were cross-sectional and the prelacteal feeding intentions of the mothers before the birth of their children are not known. Because the analytical samples were based on children who were ever breastfed, the assumption being made is that few of those women would have been planning to introduce infant formulas or other milk-based prelacteal feeds during the first 3 days of life. This assumption is based on the almost universal breastfeeding initiation in those countries, varying from 92.0% in Dominican Republic to 98.6% in Peru. Indeed, the fact that cesarean section delivery (vs vaginal delivery) has been consistently associated with both a delayed breastfeeding initiation[18] and the risk of milk-based prelacteal feeding supports this assumption. Second, the DHS does not capture breastfeeding support offered in the maternity ward; thus, we cannot test the hypothesis that among women delivering via cesarean section, women of lower socioeconomic status received less breastfeeding support than their more advantaged counterparts. In the future, the DHS may consider asking women to recall several aspects of breastfeeding support when the index child was born, as it is currently done in the USA Infant Feeding

Table 3. Prevalence of Milk-Based Prelacteal[a] Feeds Offered to Newborns in 7 Latin American and Caribbean Countries by Socioeconomic, Demographic, and Biomedical Characteristics. Demographic and Health Surveys, 2005-2010.[b]

	Country							
Factor/Category	**Bolivia (n = 6351)[c]**	**Colombia (n = 12 391)[c]**	**Dominican Republic (n = 7512)[c]**	**Guiana (n = 1315)[c]**	**Haiti (n = 4975)[c]**	**Honduras (n = 7864)[c]**	**Peru (n = 8665)[c]**	**All (n = 49 253)[d]**
Place of residence								
Urban[e]	18.8	29.8	52.6	8.4	4.9	38.7	39.2	30.5
Rural	7.6	22.2	46.7	13.3	2.1	24.2	13.4	16.2
P value[f]	< .001	< .001	.002	.128	.001	< .001	< .001	< .001
Highest education level								
No education	4.9	19.4	28.8	2.9	1.5	17.8	9.2	9.8
Primary	9.6	22.3	42.3	10.2	2.4	24.8	14.4	20.4
Secondary	17.1	27.3	54.4	12.9	4.5	40.2	30.3	29.7
Higher[e]	27.9	36.3	65.0	14.5	7.8	54.0	52.6	45.2
P value[f]	< .001	< .001	< .001	.385	< .001	< .001	< .001	< .001
Wealth index factor[g]								
Poorest	6.6	22.8	34.9	8.9	0.7	15.1	9.9	16.6
Poor	8.4	27.6	46.4	11.8	2.3	26.4	21.8	24.2
Middle	12.2	29.0	52.8	9.7	3.1	33.3	33.1	28.4
Rich	19.7	29.1	62.6	14.0	4.6	38.9	45.4	33.9
Richest[e]	28.3	33.0	64.3	18.2	5.6	47.0	57.6	40.3
P value[f]	< .001	< .001	< .001	.073	.124	< .001	< .001	< .001
Maternal age, y								
15-19	12.5	26.4	48.6	9.0	4.0	27.9	27.1	27.0
20-34[e]	14.3	28.1	52.5	13.7	2.9	31.6	29.8	28.2
35-49	14.1	27.8	48.1	8.4	3.6	30.4	32.1	25.7
P value[f]	.693	.600	.250	.128	.474	.143	.205	< .001
Number of living children								
1[e]	20.2	33.9	59.3	15.1	4.8	37.6	38.4	34.3
2	14.3	24.9	56.1	14.1	3.1	31.5	30.8	28.3
3+	9.5	22.9	40.7	8.9	2.0	25.1	22.3	21.2
P value[f]	< .001	< .001	< .001	.028	.001	< .001	< .001	< .001
Marital status								
Never married	20.0	28.7	56.3	12.2	3.4	35.7	34.1	28.4
Formerly married	13.6	27.9	50.7	12.4	2.9	30.2	29.5	26.8
Currently married[f,h]	13.6	26.6	49.8	9.6	5.7	33.2	35.1	31.8
P value	.007	.523	< .001	.794	.124	.059	.039	< .001
Cesarean section delivery								
Normal/vaginal[e]	10.7	20.9	39.1	9.5	2.6	25.3	19.4	19.3
Cesarean section	29.3	40.0	65.4	27.7	12.3	55.2	63.7	49.8
P value	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
Place of delivery								
Home	6.5	16.4	12.1	10.9	2.0	12.1	7.7	6.7
Public hospital[e]	14.3	28.1	43.5	9.3	3.9	32.4	30.5	28.8
Private hospital	30.7	33.1	77.6	32.5	7.4	65.3	66.9	55.4
P value[f]	< .001	< .001	< .001	< .001	< .001	.001	< .001	< .001
Sex of child								
Male[e]	14.3	28.3	49.3	12.5	3.2	32.3	31.0	27.9
Female	13.8	27.4	52.3	11.8	3.1	29.5	29.4	27.2
P value[f]	.662	.359	.106	.787	.769	.027	.225	< .001

(continued)

Table 3. (continued)

Factor/Category	Country							
	Bolivia (n = 6351)[c]	Colombia (n = 12 391)[c]	Dominican Republic (n = 7512)[c]	Guiana (n = 1315)[c]	Haiti (n = 4975)[c]	Honduras (n = 7864)[c]	Peru (n = 8665)[c]	All (n = 49 253)[d]
Birth weight[i]								
< 2500 g	36.9	47.3	54.4	12.0	4.8	39.3	42.0	40.9
2500-4000 g[e]	14.9	26.5	51.1	12.8	4.0	32.8	29.9	30.4
> 4000 g	15.8	30.8	47.8	13.7	4.6	36.1	43.2	31.9
Not weighed or do not know	7.8	24.8	33.9	5.6	2.7	14.8	9.7	11.8
P value[f]	< .001	< .001	.019	.199	.140	< .001	< .001	< .001
Time wanted pregnancy								
Then[e]	17.2	29.4	53.6	12.9	3.6	31.6	33.1	24.5
Later	16.3	27.9	51.3	10.6	3.5	31.7	31.2	25.2
No more	9.3	24.7	39.7	11.7	1.8	26.9	23.3	16.7
P value[f]	< .001	.001	< .001	.682	.084	.037	< .001	< .001

Abbreviation: NA, not applicable.
[a]Prelacteal: newborn received any food, other than breast milk, during the first 3 days of life.
[b]All values are percentages.
[c]Adjusted for sampling weights and design.
[d]Pooled data sample with inverted sample size weight.
[e]Reference group.
[f]*P* value obtained from chi-square test with confidence interval of 95%.
[g]The wealth index was estimated in Demographic and Health Surveys as a scale of relative wealth generated from information on the household's ownership of assets (including appliances), home construction materials, and sanitation infrastructure. The wealth index score is generated for each household using principal component analysis, and subsequently, households are classified into 1 of the following 5 mutually exclusive wealth quintiles: poorest, poor, middle, rich, and richest.
[h]Formally married or living with partner.
[i]Birth weight reported by mother or card registry.

Table 4. Association between Cesarean Section Delivery and Risk of Milk-Based Prelacteal[a] Feeds Offered to Infants Born in Hospitals in 7 Latin American and Caribbean Countries, 2005-2010.

Country	Unadjusted OR (95% CI), No.[b,c]	All Subjects, AOR (95% CI), No.[b,c,d]	Poorest, AOR (95% CI), No.[b,c,e]	Richest, AOR (95% CI), No.[b,c,e]
Bolivia	3.05 (2.49-3.74), 4654	2.36 (1.90-2.94), 4654	2.64 (1.24-5.65), 617	1.53 (1.04-2.25), 917
Colombia	2.42 (2.19-2.68), 12 770	2.26 (2.04-2.50), 12 770	2.29 (1.83-2.85), 3681	2.35 (1.75-3.17), 1409
Dominican Republic	2.92 (2.53-3.38), 7152	2.18 (1.88-2.53), 7152	2.50 (2.03-3.06), 2552	1.11 (0.71-1.74), 692
Guiana	3.72 (2.33-5.92), 1214	3.32 (1.97-5.61), 1214	1.30 (0.36-4.68), 354	5.10 (1.53-16.91), 174
Haiti	3.83 (2.24-6.56), 1825	3.26 (1.78-5.99), 1825	9.93[f] (1.69-58.13), 138	2.07 (0.93-4.64), 465
Honduras[f]	3.11 (2.68-3.61), 6711	2.72 (2.34-3.18), 6711	6.43 (4.49-9.21), 1548	2.37 (1.65-3.38), 934
Peru	6.18 (5.24-7.29), 7768	4.53 (3.80-5.41), 7768	5.88 (3.93-8.81), 1586	3.68 (2.45-5.56), 793
Pooled countries	3.35[g] (3.15-3.56), 42 483	2.64[g,h] (2.46-2.81), 42 483	2.94[g,i] (2.58-3.67), 10 429	2.17[g,i] (1.85-2.54), 5005

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio.
[a]Prelacteal: newborn received any food, other than breast milk, during the first 3 days of life.
[b]Reference group: vaginal deliveries.
[c]Adjusted for sampling weights and design.
[d]Logistic regression model adjusted for mother's education level, age, marital status, place of residence, place of delivery, wealth index factor, birth weight, pregnancy intention, and parity.
[e]Logistic regression model adjusted for mother's education level, age, marital status, place of residence, place of delivery, birth weight, pregnancy intention, and parity.
[f]Pooled sample of the 2 lower quintiles of wealth index factor: only 15 poorest mothers (1.4% of this subsample) had cesarean section delivery.
[g]Pooled data sample with inverted sample size weight to ensure equal representation from each country.
[h]Logistic regression model adjusted for mother's education level, age, marital status, place of residence, place of delivery, wealth index factor, birth weight, pregnancy intention, parity, and country of residence.
[i]Logistic regression model adjusted for mother's education level, age, marital status, place of residence, place of delivery, birth weight, pregnancy intention, parity, and country of residence.

Practices Study II.[35] Third, recall bias may have been present, as women were asked to recall infant feeding practices during the first 3 days of life and the samples included children up to 3 years of age.[36,37]

Conclusion

Our findings show that the poorest women exposed to cesarean delivery are at a higher risk of feeding milk-based prelacteals to their newborns compared to their wealthier counterparts. These findings have 2 important implications. First, women of lower socioeconomic status may need additional breastfeeding support after cesarean section delivery to prevent the introduction of milk-based prelacteals. The Baby-Friendly Hospital Initiative should explicitly acknowledge this need.[38] Indeed, helping women control their pain and properly position the newborn at the breast is likely to improve breastfeeding outcomes among women experiencing cesarean deliveries.[39] Second, reducing excessive rates of cesarean section deliveries should be a top priority for all maternity hospitals, as this outcome would likely significantly reduce the introduction of milk-based prelacteal feeds throughout the Latin American and Caribbean regions and beyond.

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