



ORIGINAL ARTICLE

Factors associated with infant formula supplementation in Brazilian hospitals: a cross-sectional study



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KEYWORDS

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Abstract

Objective: To analyze the factors associated with infant formula supplementation in newborns referred to rooming-in in Brazilian hospitals.

Method: Cross-sectional study with data from 14,531 postpartum women and newborns obtained from the "Birth in Brazil" survey, conducted in 2011–2012. The analysis used a logistic regression model with a hierarchical approach.

Results: In total, 21.2% newborns received infant formula during hospital stay. After adjustment, the following factors were associated with the use of infant formula: maternal age ≥ 35 years (OR = 1.51; IC95%:1.30–1.75), prenatal care in a private service (OR = 2.22; IC:1.72–2.85)/public and private service (OR = 1.67; IC:1.24–2.23), cesarean delivery (OR = 1.83; IC:1.41–2.38), multiple pregnancy (OR = 3.786; IC:2.02–7.06), non-breastfeeding in the delivery room (OR = 1.780; IC:1.43–2.21), birth in a private hospital (OR = 1.695; IC:1.02–2.79), prematurity (OR = 1.656; IC:1.32–2.06) and extremes of birth weight (< 2,500 g: OR = 2.084; IC: 1.585–2.741/ $\geq 4,000$ g: OR = 1.672; IC:1.31–2.11). Teenage age (OR = 0.651; IC:0.55–0.76), low maternal education (OR = 0.579; IC:0.43–0.77), multiparity (OR = 0.588; IC:0.510–0.678), and lower economic class (OR = 0.565; IC:0.41–0.76) significantly reduced the probability of using infant formula.

Study conducted at the Fundação Oswaldo Cruz, Instituto Nacional de Saúde da Mulher, da Criança e do Adolescente Fernandes Figueira, Rio de Janeiro, RJ, Brasil.

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Conclusions: Of the associated factors, the authors highlight cesarean delivery and non-breast-feeding in the delivery room, showing that it is necessary to strengthen policies that encourage good practices during childbirth care in order to promote exclusive breastfeeding and protect mothers and newborns from all social classes against the misuse of infant formula.

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Introduction

Breastfeeding in Brazil registered its lowest practice in the 1970s when the use of infant formula was stimulated by unregulated commercial pressures that influenced health professionals and mothers, and the institutionalization of childbirth brought mother and child separation as a routine. Since then, national movements for breastfeeding have been undertaken, and Brazil was inserted in the international context of confronting the indiscriminate marketing of products that competed with breastfeeding. As a result, a National Policy for Breastfeeding Incentive was created in 1981, and marketing of infant food was regulated in 1988.^{1,2}

With the implementation of the Baby-Friendly Hospital Initiative (BFHI) by the World Health Organization and the United Nations Children's Fund in the early 1990s, a commitment was made to transform the reality of maternity hospitals by the compliance of the Ten Steps to Successful Breastfeeding. Specifically, step six comprises "give newborn infants no food or drink other than breastmilk, unless medically indicated". Despite the guidelines that govern the appropriate use of infant formula in postpartum hospitalization in specific cases,³ its use without any indication is still common.⁴

Globally, the sales growth of formula for infants and young children was 115% between 2005 and 2019, with an accelerated growth trend, reflecting urbanization, social norms, and the baby food industry's aggressive marketing practices.⁵

In the US, one of Healthy People 2020 goals was to reduce formula supplementation in the first 2 days of life to 14.2%, while the average of this country was 17.2% for infants born in 2016, increasing to 19.2% in infants born in 2017.⁶ In Brazil, the most recent data on the use of infant formula in hospitals are from local investigations. A study performed in a public hospital in Rio de Janeiro found that 12% of newborns used infant formula during hospitalization, even though they were healthy.⁷ A cohort study in six hospitals in the city of São Paulo showed that 14.7% of newborns in rooming-in received formula.⁸ The Scientific Department of Breastfeeding of the Brazilian Society of Pediatrics warns about the use and abuse of infant formula in maternity hospitals in healthy newborns and provides support for professional practice,⁹ reinforcing the importance of more in-depth national investigations on the subject.

Therefore, this study aimed to analyze the factors associated with infant formula supplementation in rooming-in newborns from a representative sample of Brazilian maternity hospitals, considering the need to reduce the unnecessary use of infant formula during the postpartum period, understanding the economic interests involved.

Methods

Study design

This was a cross-sectional study of national coverage and hospital basis, based on data from the "Birth in Brazil" survey: a national survey into labor and birth, conducted between February 2011 and October 2012.

Sample and inclusion/exclusion criteria

Complex probability sampling was performed to represent births that occurred in hospitals with ≥ 500 deliveries per year, selected with a probability proportional to the number of live births in 2007, stratified by five geographic macroregions (North, Northeast, Southeast, South, and Midwest), location (capital or countryside), and type of birth hospital (private, public, or mixed). In the second stage, a sampling method was used that determined a minimum of 7 days of stay for the team in each hospital to reach 90 interviewed mothers. In the third stage, the sample comprised postpartum women. A total of 266 hospitals from 191 Brazilian counties were sampled, and 23,894 postpartum women were interviewed.¹⁰ A detailed description of the sample design is found in Vasconcellos et al.¹¹

The research team consisted of executive, regional, and state coordinators, 50 supervisors, and 200 interviewers. The 27 state teams received local training for five consecutive days, including reading and practice use of the instrument and way of sending the data. Each interviewer and supervisor received a login and password before beginning the fieldwork, and there was enabled identification of the persons responsible for filling the form. Face-to-face interviews were conducted with the mothers within the first 24 hours after birth using a questionnaire, and their prenatal cards were photographed. A second questionnaire was filled with data from the maternal and newborn medical records. Data were collected electronically and sent by the research supervisor of each unit to the central research server.^{10,11}

Newborns referred to rooming-in were selected, excluding those born to mothers with positive human immunodeficiency virus (HIV) serology, with maternal near-miss childbirth, born with congenital malformations, or hospitalized in the neonatal intensive care unit. In addition, infants who received other liquids were excluded, as the indications for their use differed from the indications for supplementation with infant formula, the focus of the study. After applying these criteria, the final sample included 14,531 postpartum women and their newborns.

Definition of variables and data analysis

The outcome variable was the use of infant formula (yes or no), and this information was reported by the mothers during interviews or extracted from the maternal medical record. For a multivariate approach, a hierarchical conceptual model was built according to their relationship with the use of infant formula:

- Distal level - residence and maternal characteristics: geographic region of residence (North, Northeast, Southeast, South, or Midwest); area of residence (capital or interior); self-reported maternal skin color (white or non-white); maternal age (12–19 years, 20–34 years, or ≥ 35 years); maternal education (incomplete primary education, complete primary, complete secondary, or complete higher education and more); parity (primipara or multipara); economic classification (A/B, C, or D/E), based on the Brazilian Association of Research Companies – ABEP (<https://www.abep.org/criterio-brasil>); postpartum head of household (yes or no); marital status (without a partner [widow, separated, or single] or with a partner [married or living with a partner]).
- Intermediate level - prenatal care characteristics: number of prenatal consultations (1–3, 4–5, and ≥ 6); guidance during prenatal care on breastfeeding in the first hour of life (yes or no); type of prenatal care (public, private, public and private service); health professional who performed most of the prenatal consultations (physician or nurse); anti-HIV examination during pregnancy (yes or no).
- Proximal level - hospital and baby characteristics: type of delivery (vaginal or cesarean); type of pregnancy (single or multiparity); companion during hospitalization after delivery (yes or no); breastfed in the delivery room (yes or no); type of birth hospital (private, mixed, or public); Baby-Friendly Hospital (no, in-process/yes); gestational age at birth (preterm, term, or post-term); sex of the newborn (female or male); birth weight (< 2,500 g, 2,500–4,000 g, or $\geq 4,000$ g).

SPSS 22.0 was used for statistical analysis as it is suitable for the analysis of complex samples. Initially, bivariate analysis was performed using Pearson's chi-square test between independent variables and the outcome variable, estimating the crude odds ratios (OR). Variables with $p < 0.20$ were selected to build the multivariate model. In multivariate analysis, logistic regression procedures were used with a hierarchical approach at three levels, with an estimation of adjusted ORs and respective 95% confidence intervals. At each level, the variables were selected using the "backward method," and those with $p < 0.05$ were included in the final model.

Ethical aspects

This study conforms to the ethical precepts of Resolution no. 466/2012 of the National Health Council. The "Birth in Brazil" survey was approved by the Research Ethics Committee of the National School of Public Health - Oswaldo Cruz Foundation/Ministry of Health (opinion no. 92/10), and consent for participation was obtained using digital media.

Results

Among 14,531 postpartum women and their newborns referred to rooming-in, 3,077 (21.2%) infants received formula. Table 1 shows that most puerperal women declared themselves to be non-white, 20–34 years old, with complete primary or secondary school, multiparous and from economic class C. Most women had a partner and did not consider themselves the head of the family.

Regarding the characteristics of prenatal care, Table 2 shows that most mothers attended ≥ 6 consultations, received guidance on breastfeeding in the first hour of life, performed prenatal care in the public service, had most of the consultations performed by a doctor, and underwent an anti-HIV test. Regarding hospital characteristics, care during delivery, and newborn characteristics, most mothers had a vaginal delivery, a single fetus, did not breastfeed in the delivery room, and had a companion during postpartum hospitalization. A minority of women gave birth in a private hospital and about half in a Baby-Friendly Hospital or in process. Most babies were born at term and weighed 2,500–3,999 g (Table 2).

In the bivariate analysis, a p-value of ≤ 0.20 was observed in the test for the association between the use of infant formula and the following variables: geographic region, skin color, maternal age, education, parity, economic class (Table 1), number of prenatal consultations, type of prenatal care, a health professional who performed most of the prenatal consultations, anti-HIV testing during pregnancy, type of delivery, type of pregnancy, breastfeeding in the delivery room, companion during postpartum hospitalization, type of birth hospital, whether birth occurred in a Baby-Friendly Hospital, gestational age, sex of the newborn, and birth weight (Table 2).

Table 3 shows the hierarchical analysis according to the level of proximity to the outcome. The chance of using infant formula was greater in newborns whose mothers were ≥ 35 years old, underwent prenatal care in the private service or in the public and private sector, had a cesarean section, had twins, did not breastfeed in the delivery room, gave birth in a private hospital, had premature babies, had low-birth-weight babies or macrosomic babies. Age of 12–19 years, lower maternal education, multiparity, and lower economic class significantly reduced the probability of using infant formula.

Discussion

In Brazilian maternity hospitals, 21.2% of newborns received infant formula. Despite including healthy and rooming-in newborns and excluding those who received other liquids, the percentage exceeded that estimated by the National Demographic and Health Survey in 2006, which showed that 20.5% of newborns received other liquids before breast milk, including other types of milk.¹² It is, however, important to note the methodological differences between the studies.

Evidence indicates that formula feeding is associated with considerable economic losses and that the use of formula before hospital discharge increases the risk of infections and infant hospitalization.^{13–15} The negative

Table 1 Use of infant formula in newborns in rooming in according to maternal geographic and sociodemographic characteristics. Brazil, 2011–2012 ($n = 14,531$).

Variables	n (%)	Use of infant formula (%)	OR crude (95% CI)	p-value
Geographic region				0.071
North	1,775 (12.2)	13.3	1	
Midwest	937 (6.4)	30.8	2.88 (1.48–5.60)	
South	1,990 (13.7)	21.0	1.72 (0.94–3.13)	
Northeast	4,349 (29.9)	19.7	1.58 (0.84–2.97)	
Southeast	5,482 (37.7)	23.3	1.97 (1.48–5.60)	
Area of residence				0.705
Capital	5,692 (39.2)	21.9	1	
Interior	8,839 (60.8)	20.7	0.92 (0.62–1.37)	
Self-reported skin color				< 0.001
White	4,581 (31.5)	25.3	1.41(1.19–1.67)	
Non-white	9,946 (68.5)	19.3	1	
Maternal age				< 0.001
12–19 years	2,971 (20.4)	15.6	0.66 (0.56–0.78)	
20–34 years	10,198 (70.2)	21.8	1	
≥ 35 years	1,358 (9.4)	28.5	1.43 (1.24–1.64)	
Education				< 0.001
Incomplete primary education	4,058 (28.1)	15.0	0.30 (0.21–0.43)	
Complete primary education	3,888 (26.9)	17.3	0.35 (0.25–0.49)	
Complete secondary education	5,499 (38.0)	25.7	0.59 (0.44–0.78)	
Complete higher education plus	1,017 (7.0)	36.8	1	
Parity				< 0.001
Primipara	6,593 (45.4)	25.4	1	
Multipara	7,938 (54.6)	17.7	0.63 (0.55–0.71)	
Economic class				< 0.001
A or B	3,085 (21.4)	30.2	1	
C	7,641 (53.0)	21.1	0.61 (0.47–0.79)	
D or E	3,683 (25.6)	14.0	0.37 (0.27–0.51)	
Head of the family (the woman herself)				0.848
Yes	1,532 (10.7)	21.4	1.02 (0.78–1.35)	
No	12,749 (89.3)	21.0	1	
Marital status				0.659
Without a partner	2,739 (18.9)	20.5	0.95 (0.76–1.18)	
With a partner	11,777 (81.1)	21, 3	1	

CI, confidence interval.

implications of the use of formula in hospitals in the duration of breastfeeding^{16–18} also can impact the family budget.

Socioeconomic factors and maternal, prenatal care, delivery, and baby's characteristics were associated with the use of infant formula in healthy newborns in the maternity ward in this study. Therefore, the use of formula appears to be related to factors at different levels, which creates a complex scenario, suggesting that the necessary reduction in supplementation with infant formula without indication depends on the coordinated action of multiple sectors of the social system.

Regarding maternal sociodemographic characteristics, lower economic class and education were associated with a lower probability of infant formula use. An investigation using data from 90 low-income countries found that the use of infant formula was positively associated with family

wealth.¹⁹ The use of formula may increase as countries become wealthier, enabling families to afford it.

In this study, formula supplementation at the hospital was significantly lower among multiparous women, consistent with that reported in an Indonesian study.²⁰ Mothers with experience in breastfeeding are likely to be more confident and their newborns to be less likely to receive infant formula. However, mothers aged ≥35 years had a greater chance of the outcome, a result similar to that found in 4 hospitals in Ontario, where maternal age above 34 years was associated with lower rates of exclusive breastfeeding during hospitalization, probably because the culture of formula use is more ingrained in older mothers.²¹

Among the characteristics of prenatal care, only monitoring pregnancy in a private service was associated with the outcome. It is possible that guidance on the importance of

Table 2 Use of infant formula in roomed-in newborns according to prenatal care characteristics, hospital characteristics, delivery care, and baby characteristics. Brazil, 2011–2012 (n = 14,531).

Variables	n (%)	Use of infant formula (%)	OR crude (95% CI)	p-value
Number of PN queries				< 0.001
1–3 consultations	1,372 (9.7)	18.3	0.76 (0.60–0.96)	
4–5 consultations	2,664 (18.9)	16.8	0.68 (0.57–0.81)	
≥6 consultations	10,048 (71.3)	22.7	1	
Guidance in PN care on breastfeeding in the first hour of life				0.579
Yes	9,368 (65.4)	21.4	1	
No	4,952 (34.6)	20.8	0.96 (0.82–1.11)	
Type of PN care				< 0.001
Public service	10,924 (76.1)	16.6	1	
Private service	2,870 (20.0)	37.2	2.97 (2.27–3.88)	
Public and private service	555 (3.9)	28.7	2.02 (1.53–2.66)	
Health professional who provided most of the PN consultations				< 0.001
Doctor	10,236 (72.2)	23.8	1	
Nurse	3,942 (27.8)	14.9	0.56 (0.42–0.74)	
Anti-HIV exam during pregnancy				< 0.001
Yes	8,593 (80.7)	20.7	1	
No	2,058 (19.3)	15.4	0.69 (0.52–0.91)	
Delivery type				< 0.001
Cesarean	6,427 (44.2)	30.7	2.80 (2.25–3.48)	
Vaginal	8,104 (55.8)	13.6	1	
Type of pregnancy				< 0.001
Single	14,438 (99.4)	20.9	1	
Multiple	93 (0.6)	65.2	7.08 (4.18–12.01)	
Breastfed in the delivery room				< 0.001
Yes	3,045 (21.2)	12.9	1	
No	11,341 (78.8)	22.9	1.99 (1.58–2.51)	
Companion during hospitalization after delivery				< 0.001
Yes	9,027 (80.7)	23.1	1	
No	2,161 (19.3)	17.9	0.72 (0.55–0.95)	
Type of birth hospital				< 0.001
Private	1,465 (10.1)	44.7	3.80 (2.36–6.13)	
Mixed	5,982 (41.2)	19.7	1.15 (0.76–1.75)	
Public	7,084 (48.8)	17.5	1	
Baby-Friendly Hospital status				< 0.001
Yes/ In process	7,127 (49.4)	17.0	1	
No	7,291 (50.6)	25.5	1.67 (1.18–2.36)	
Gestational age				< 0.001
Preterm	869 (6.0)	31.8	1.80 (1.50–2.17)	
Term	13,283 (91.4)	20.5	1	
Post-term	375 (2.6)	19.3	0.92 (0.55–1.53)	
Sex of newborn				0.176
Male	7,432 (51.2)	20.6	1	
Female	7,093 (48.8)	21.8	1.07 (0.96–1.19)	
Birth weight				< 0.001
< 2,500 g	624 (4.3)	38.2	2.47 (1.98–3.08)	
2,500–4,000 g	13,123 (91.1)	20.0	1	
≥ 4,000 g	660 (4.6)	28.8	1.62 (1.30–2.01)	

PN, prenatal; CI, confidence interval; OR, odds ratio.

Table 3 Models of factors associated with the use of infant formula in rooming-in newborns, Brazil, 2011–2012 (n = 14,531).

Variables	Use of infant formula		
	aOR	95% CI	p-value
Distal level			
Maternal age			< 0.001
12–19 years	0.651	(0.550–0.769) ^a	
20–34 years	1		
≥35 years	1.515	(1.309–1.753) ^a	
Education			< 0.001
Incomplete elementary school	0.579	(0.431–0.777) ^a	
Complete primary education	0.585	(0.450–0.762) ^a	
Complete secondary education	0.765	(0.615–0.953) ^a	
Complete higher education plus	1		
Parity			< 0.001
Primipara	1		
Multipara	0.588	(0.510–0.678) ^a	
Economic class			0.002
A or B	1		
C	0.794	(0.642–0.981) ^a	
D or E	0.565	(0.415–0.769) ^a	
Intermediate level^b			
Type of PN care			< 0.001
Public service	1		
Private service or health plan	2,221	(1.729–2.852) ^a	
Public and private service	1.670	(1.247–2.237) ^a	
Proximal level^c			
Delivery type			< 0.001
Caesarean	1.837	(1.414–2.385) ^a	
Vaginal	1		
Pregnancy type			< 0.001
Single	1		
Multiple	3.786	(2.028–7.066) ^a	
Breastfed in the delivery room			< 0.001
Yes	1		
No	1.780	(1.430–2.216) ^a	
Type of hospital at birth			0.246
Private	1.695	(1.026–2.798) ^a	
Mixed	0.985	(0.609–1.591)	
Public	1		
Gestational age			0.006
Preterm	1.656	(1.326–2.068) ^a	
Term	1		
Post-term	1.045	(0.586–1.865)	
Birth weight			< 0.001
< 2,500 g	2.084	(1.585–2.741) ^a	
2,500–4,000 g	1		
≥ 4,000 g	1.672	(1.318–2.119) ^a	

aOR, adjusted odds ratio; CI, confidence interval.

^a $p < 0.05$.^b Adjusted for distal level variables.^c Adjusted for distal and intermediate level variables.

exclusive breastfeeding is less frequent in private services, contributing to maternal misinformation and subjection to inadequate hospital routines. In recent decades, in Brazil, there has been an increased emphasis on the Family Health

Program within the scope of the Unified Health System, where care provides the formation of a bond between the multidisciplinary team and the woman, differing from private services work process. Strategies in the context of

community-based primary health care are based on health education, promotion, and support for breastfeeding, home visits, and women's participatory groups.²²

Cesarean sections were significantly associated with the use of infant formula, as verified in a study performed at a University Hospital in New York city²³ and in Indonesia.²⁰ This association may be related to postoperative care routines, which delay the interaction between the mother and the baby and also breast stimulation, which in turn may influence the delay of lactogenesis II and favor the use of formula. Studies have shown that cesarean sections negatively affect breastfeeding initiation, especially elective ones.^{24,25} Furthermore, mothers undergoing cesarean section may not have received additional professional support to position themselves, and the baby to the breast, and the need for this assistance in post-surgical recovery is expected.²⁴

A meta-analysis has reported that skin-to-skin contact reduces infant stress and has a positive effect on breastfeeding. After birth, there is a sensitive period for the baby's innate behaviors, such as seeking and sucking the breast, and the separation of the mother–child dyad interrupts this behavior.²⁶ In this study, babies who were not breastfed in the delivery room were 78% more likely to use infant formula, a finding also found in studies in Sacramento, California,¹⁶ New York,²³ and the city of Rio de Janeiro.⁸

In the present study, the lack of accreditation in the BFHI was associated with the outcome in bivariate analysis, but this association was not maintained in the multivariate analysis, possibly because the type of hospital financing offered greater explanatory power for the outcome. Being born in private hospitals significantly increased the probability of a newborn using the formula, compared to being born in public hospitals, a finding similar to that of a population-based study performed in Australia.²⁷ It is possible that private hospitals adopt the use of infant formula more routinely than public hospitals.

Regarding multiple pregnancies, in general, the percentage of premature and early term among twins is higher,²⁸ leading to greater difficulties in breastfeeding, physiological immaturity, and unstable conditions. However, in the present study, 56.9% of twins were born at term. Although 80.2% of them were early term, participants who had conditions that impeded and/or harmed the initiation of breastfeeding were excluded from the analysis. Mothers of twins need additional support to breastfeed more than one child.^{28,29} A plausible hypothesis is that these mothers did not receive the support they needed to breastfeed their children and that misguided beliefs contributed to the use of formula, such as concerns about insufficient milk supply.

Premature babies had a greater chance of receiving supplements in the hospital. As soon as the newborn is able to start breastfeeding, when clinically stable and without contraindications related to breastfeeding, breast milk should be the only source of food.³⁰ The mother–infant dyad demands special attention to overcome the physiological and emotional challenges related to lactation and breastfeeding in preterm infants.²⁸

Babies with an extreme weight had greater use of infant formula in the hospital; those with a birth weight of < 2,500 g were twice as likely to receive formula supplementation compared to those with a birth weight of 2,500–4,000 g, a finding similar to that reported by a study

performed in Australian hospitals.²⁷ Low-birthweight babies are more likely to have medical problems, so they have a higher risk of infant formula supplementation.

Despite including a representative nationwide sample and dealing with the reality of different geographic regions and public and private sector institutions, this study has some limitations. The study design did not allow for a causal interpretation of the factors associated with the use of formula in maternity hospitals. In addition, there was no information on whether the mother received help and guidance on breastfeeding during hospitalization. However, to the best of our knowledge, there is no nationally representative survey on the determinants for the use of infant formula in maternity hospitals with interviews shortly after birth, which would reduce recall bias. On the other side, as the authors did not interview mothers at discharge, the information about formula supplementation did not cover all the hospital stay period, limitation partially covered by the extraction of this information from medical records.

In Brazil, the prevalence of formula use in postpartum hospitalization did not decrease compared to the last national survey¹² conducted through a household survey and was more frequent in older mothers, primiparous mothers, from a higher economic class and with a high level of education. Attention should be focused on the characteristics of health care, which are certainly modifiable factors; cesarean sections were associated with an 83% greater chance of a newborn using infant formula in the hospital environment, and not being breastfed in the delivery room was associated with a 78% increase in the chance of using formula, showing that it is necessary to strengthen policies that consider good practices during child-birth care, especially in the private network.

Therefore, the authors recommend a review of hospital routines, preventing the high volume of cesarean sections and favoring breastfeeding at birth. To reduce the risks of supplementation after cesarean sections, measures such as skin-to-skin contact at birth, early breast stimulation, and professional breastfeeding counseling are required. Thus, formula supplementation without indication can be avoided to achieve exclusive breastfeeding during the hospital stay. The realization of these measures will depend, to a large extent, on the training of professionals involved in maternal care and childcare. The results of this study allow us to reflect on the relevance of evidence-based care practices and intersectoral actions at various levels, from local to national. As Brazil is a developing country, urgent measures are needed to support and promote breastfeeding across all social classes and change the reality of many mothers and their children, protecting them from the use of infant formula resulting from social and institutional conventions and industrial interests.

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Conflicts of interest

The authors declare no conflicts of interest.

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