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HEALTH SCIENCES

Breastfeeding duration: does parity influence? A longitudinal investigation: the pro-saude study

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Abstract: Breastfeeding experiences differ between primiparous and multiparous women. This study aims to investigate how parity influences breastfeeding duration among Brazilian women and to examine the relationship between the number of siblings and the duration of breastfeeding for each child. Data from the Pró-Saúde Study (1999-2012) were used to analyze breastfeeding duration. Differences between parity groups were tested using the chi-square test, while Kruskal-Wallis test and analysis of variance assessed variations in breastfeeding duration, with comparisons visualized using Kaplan-Meier plots. Characteristics such as maternal age and mode of delivery are relevant, especially among primiparous mothers, while maternal education and household income have a positive impact on breastfeeding duration. The use of the Cox model to analyze breastfeeding duration highlights the need for further investigation into the factors influencing this practice, especially considering the decrease in breastfeeding duration among children born in the 1990s and 2000s. These results point to the complex interaction of social, economic, and behavioral factors that should be considered in public policies aimed at maternal and child health.

Key words: breastfeeding, bresatfeeding duration, parity, survival analysis.

INTRODUCTION

The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend that mothers worldwide exclusively breastfeed their infants for the first six months to support optimal growth, development, and health. Following this period, infants should receive nutritious complementary foods while continuing breastfeeding up to two years of age or beyond. The Brazilian Dietary Guide for children under two years old aligns with this recommendation (Brasil 2019).

Breast milk is a crucial source of nutrition that reduces early childhood mortality and enhances resistance to infections. It contains a range of immunoglobulins, anti-inflammatory agents, and immunostimulant factors that bolster the infant's immune system (Passanha et al. 2010). Additionally, breastfeeding provides numerous benefits for maternal health and offers practical, environmental, and economic advantages (Williamson et al. 2012).

In Brazil, data from the National Study of Child Food and Nutrition (ENANI) indicate significant improvements in breastfeeding indicators over the past 34 years. The rate of exclusive breastfeeding among children under 4 months has increased approximately 13-fold, while among those under 6 months, the increase is about 16-fold. Breastfeeding up to 24 months has also risen by approximately 23 times compared to previous surveys (ENANI 2019).

Despite these gains, no country has yet achieved the recommended standards for exclusive breastfeeding up to six months and continued breastfeeding up to two years. Understanding the reasons behind breastfeeding

failures and early discontinuation requires further investigation to inform more effective public policies.

Studies suggest that mothers with previous breastfeeding experience tend to breastfeed for longer periods compared to first-time mothers (Hackman et al. 2015, Pérez-Escamilla et al. 1996, Lin et al. 2011). Although parity has lower evidence scores than other factors, it is still considered significant in clinical practice (Cohen et al. 2018). Thus, insights from these experiences could help explain variations in breastfeeding success.

Previous research on breastfeeding by parity is limited, often focusing solely on initiation or duration without exploring detailed experiences and influencing factors during pregnancy and postpartum (Agea-Cano et al. 2020, Martins et al. 2011). Some studies have noted a decline in breastfeeding initiation with increasing birth order (Sutherland et al. 2012, Shinde et al. 2010), while others found weak trends with low evidence (Busck-Rasmussen et al. 2014, Cohen et al. 2018).

Breastfeeding is influenced by multiple factors and exhibits diverse patterns across different contexts. This underscores the importance of regularly monitoring breastfeeding trends and employing varied approaches to identify effective support strategies (Rollins et al. 2016).

To support the achievement of the Sustainable Development Goals by 2030, promoting and supporting breastfeeding is essential. This study aims to investigate how parity influences breastfeeding duration among Brazilian women. Additionally, it examines the relationship between the number of siblings and the duration of breastfeeding for each child. We hypothesize that parity has a significant influence on breastfeeding duration among Brazilian women. Additionally, the number of children is directly related to the duration of breastfeeding. Multiparous mothers appear to have different breastfeeding knowledge and experiences compared to first-time mothers, which could be valuable for informing future breastfeeding promotion efforts.

MATERIALS AND METHODS

Study design

This study is a cross-sectional analysis using longitudinal data from the Pró-Saúde Study, which investigates technical-administrative employees at university campuses in Rio de Janeiro, Brazil. Participants completed multidimensional questionnaires at their workplace across four waves of data collection (1999-2012). For this analysis, questions related to Social Support are drawn from wave 1, while other variables are sourced from wave 4 questionnaires.

Study population and variables

The analyzed sample was made up of 1.138 women, with different demographic and socioeconomic backgrounds. The exposure variable 'parity' was classified into primiparous and multiparous, in which multiparity was broken down by each child, making the variable child position birth the independent variable. The other study variables were:

Skin color, self-reported: Black, Brown and Caucasian. Indigenous and Asian skin colors were excluded from the study due to their low representation;

Household income, categorized into monthly minimum wages (MW) *per capita* (1 United States Dollar = 2.05 Brazilian Real in the year of the survey), divided into three categories: less than 3 MW, between 3 and 6 MW and more than 6 MW;

Education: completed primary school, completed secondary school and university degree or higher;

Decade of birth: variable based on the child's date of birth, stratified in 10-years intervals, from 1980 or before to the 2000s onwards;

Maternal age at childbirth: under 19 years old, 20 to 34 years old and 35 years old or older;

Prematurity: if the child was born before 37 weeks, with yes or no categories;

Weight at birth: under 2.5 kg, between 2.5 and 4 kg, and over 4 kg; and

Social support, classified as high or low, with the cutoff point being the average score for each of the following dimensions: positive social interaction and affective support, informational and emotional support, and material support (Griep et al. 2005).

Data analysis

Initially, descriptive statistics and bivariate analyses were performed. A chi-square test assessed the homogeneity of proportions between parity groups. Differences in breastfeeding duration were examined using the Kruskal-Wallis test and analysis of variance (ANOVA).

Breastfeeding duration was analyzed with Kaplan-Meier (KM) curves (Kaplan & Meier 1958), stratified by covariates to evaluate the probability of breastfeeding duration beyond 24 months. Observations were censored at 24 months, assuming that censorship was independent of survival time. Statistical significance of differences between observed and expected values across KM curves was assessed using the log-rank test (Kleinbaum & Klein 1995).

A hierarchical approach was employed to include variables in the model, starting with proximal variables and progressing to distal ones. This method is effective for understanding determinants of health behaviors, particularly in maternal and child health contexts (Victora 1997). Variables were added sequentially, and the Wald test was used to determine exclusion criteria (p-value >0.05).

The effect of covariates on breastfeeding duration was estimated using the Cox proportional hazards model. This semi-parametric model calculates the hazard ratio (HR) over the entire observation period and provides 95% confidence intervals, estimating the hazard of breastfeeding discontinuation. Covariates with a p-value <0.05 were included in the model, while those with a Wald test p-value >0.05 were excluded (Carvalho et al. 2011).

Schoenfeld residuals were analyzed to verify the proportional hazards assumption for each variable in the final model, ensuring that hazards remained consistent throughout the observation period. The analysis involved testing for linear correlation between survival time and residuals, with additional graphical analysis to identify non-linear correlations. A p-value greater than 0.05 indicated that the null hypothesis of hazard ratio equivalence was not rejected (Carvalho et al. 2011).

Data analysis and survival graph construction were conducted using RStudio version 4.1.2 (R Core Team 2023). The Pró-Saúde Study received approval from the Research Ethics Committee of the Pedro Ernesto University Hospital under records 224/1999 and 91.642/2012. Findings were reported following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

RESULTS

Breastfeeding duration and its associations

This study evaluated 1.138 women and approximately 8% reported that they had never breastfed. Among these women, 36% were primiparous, while 64% were multiparous. The

questionnaire did not cover questions related to exclusive breastfeeding, but was found that 37% of the women introduced food to their babies before the third month of life, 58% did so between three and six months, and only 4% introduced food after six months.

Among the primiparous women, 193 (51%) are white, 159 (43%) earn between three and six minimum wages, and 236 (58%) have higher education or more. As for the multiparous women, 350 (49%) are white, 356 (49%) earn less than three minimum wages, and 225 (60%) have higher education or more (Table I). Regarding the dimensions of social support, 125 (37%) are in highest tertile of positive social interaction and affective support, while 133 (36%) and 140 (38%) are in middle tertile of information and emotional support and material support, respectively.

Table II presents the description of the bivariate analyses between parity and mother-infant characteristics. The data showed that maternal age and delivery mode exhibit significant differences among the children, with most first-borns being born to mothers aged 20 to 34 years (70.1%) and a higher proportion of vaginal births for the fourth child (70.6%). The birth decade also varied, with an increase in the percentage of children born before 1980 as parity increases. Although prematurity did not show a significant difference ($p = 0.20$), birth weight had a statistically significant relationship with parity ($p = 0.03$), indicating that the majority of children born weighing between 2.5 and 4 kg are more common among second and third-borns. On the other hand, breastfeeding did not show significant differences between the groups ($p = 0.60$).

Table III presents a bivariate analysis of breastfeeding duration, measured in months, in relation to sociodemographic variables, maternal-infant characteristics, and dimensions of social support. The results showed that breastfeeding duration does not significantly differ among skin color categories ($p = 0.70$). However, there was a significant difference related to family income per capita ($p = 0.03$), with breastfeeding duration increasing in relation to educational level, pealing among mothers with higher education (7.0 months; $p < 0.00$). The decade of birth and the mother's age also showed significant relationships, with breastfeeding lasting longer for mothers aged 35 years or older (10.0 months; $p < 0.00$). Although some dimensions of social support, such as positive social interaction ($p = 0.03$), showed variation in breastfeeding duration, other dimensions and characteristics, as mode of delivery, prematurity, birth weight, and parity, did not show significant differences.

Construction of the model

Kaplan-Meier estimation was used to create graphs of the observed survival curves, while the log- rank test compared curves from different groups. Figure 1 shows the respective survival curves stratified by each child and parity. In the first case (Figure 1a), the likelihood ratio test resulted in 1.71 with a p-value of 0.2, indicating that there were no statistically significant differences in breastfeeding duration among different children. In the second case (Figure 1b), the test resulted in 3.41 with a p-value of 0.06, suggesting a trend towards a difference in breastfeeding duration concerning parity, although this difference did not reach the commonly accepted significance level (0.05). Thus, while breastfeeding duration did not show significant variations among children, there was a slight indication that parity may influence breastfeeding duration.

Table I. Description of the sample and bivariate analysis between parity and sociodemographic variables and dimensions of social support. Rio de Janeiro, Brazil, 2024.

Variables	Parity n (%)		p value[1]
	Primiparous	Multiparous	
Color			0.6
Caucasian	193 (51.3)	363 (48.4)	
Black	79 (21.0)	168 (22.4)	
Brown	104 (27.7)	219 (29.2)	
Total	376 (100)	750 (100)	
Household income *per person*			< 0.00
< 3 MW	131 (35.1)	373 (49.4)	
3 – 6 MW	159 (42.6)	311 (41.2)	
> 6 MW	83 (22.3)	71 (9.4)	
Total	373 (100)	755 (100)	
Highest education level			< 0.00
Primary	29 (7.8)	114 (15.1)	
Secondary	119 (31.9)	295 (39.1)	
Bachelor's or higher	225 (60.3)	345 (45.8)	
Total	373 (100)	723 (100)	
Dimensions of Social Support			
Positive social interaction and affective support			0.60
Lowest tertile	117 (34.9)	229 (34.2)	
Middle tertile	93 (27.8)	207 (30.9)	
Highest tertile	125 (37.3)	234 (34.9)	
Total	335 (100)	670 (100)	
Information and emotional			0.60
Lowest tertile	122 (33.0)	262 (35.1)	
Middle tertile	133 (35.9)	273 (36.6)	
Highest tertile	115 (31.1)	211 (28.3)	
Total	370 (100)	746 (100)	
Material			0.60
Lowest tertile	126 (34.1)	273 (36.4)	
Middle tertile	140 (37.8)	284 (37.9)	
Highest tertile	104 (28.1)	193 (25.7)	
Total	404 (100)	750 (100)	

[1] Pearson´s Chi Square Test.

Table II. Description of the sample and bivariate analysis between parity and mother-infant characteristics. Rio de Janeiro, Brazil, 2024.

	1st child n (%)	2nd child n (%)	3rd child n (%)	4th child n (%)	p value[1]
Mother's age					< 0.00
13-<19	18 (4.9)	4 (0.8)	6 (3.4)	3 (3.6)	
20-<34	258 (70.1)	350 (70.1)	112 (62.6)	42 (50)	
35+	92 (25)	145 (29.1)	61 (34)	39 (46.4)	
Total	368 (100)	499 (100)	179 (100)	84 (100)	
Birth decade					< 0.00
Before 1980	51 (13.9)	64 (12.8)	36 (20.1)	29 (34.5)	
1980s	116 (31.5)	160 (32.1)	59 (33)	21 (25)	
1990s	128 (34.8)	173 (34.7)	50 (27.9)	11 (13.1)	
2000's	73 (19.8)	102 (20.4)	34 (19)	23 (27.4)	
Total	368 (100)	499 (100)	179 (100)	84 (100)	
Delivery mode					< 0.00
Unplanned C-section	118 (31.8)	110 (22.6)	42 (23.9)	10 (14.7)	
Scheduled C-section	113 (30.5)	233 (47.9)	77 (43.8)	10 (14.7)	
Vaginal birth	140 (37.7)	143 (29.4)	57 (32.4)	48 (70.6)	
Total	371 (100)	486 (100)	176 (100)	68 (100)	
Premature					0.20
Yes	52 (14.3)	54 (11.3)	25 (15)	4 (6.2)	
No	312 (85.7)	422 (88.7)	142 (85)	61 (93.8)	
Total	364 (100)	476 (100)	167 (100)	65 (100)	
Birth weight					0.03
< 2.5 kg	39 (10.7)	31 (6.4)	15 (8.9)	5 (8)	
2.5 - 4 kg	306 (83.6)	425 (87.8)	146 (86.9)	48 (77.5)	
> 4 kg	21 (5.7)	28 (5.8)	7 (4.2)	9 (14.5)	
Total	366 (100)	484 (100)	168 (100)	62 (100)	
Breastfeeding					0.60
Yes	338 (91.1)	444 (92.5)	156 (95.5)	60 (90.9)	
No	33 (8.9)	36 (7.5)	9 (5.5)	6 (9.1)	
Total	371 (100)	480 (100)	165 (100)	66 (100)	

[1] Pearson´s chi square test.

Table III. Bivariate analysis of breastfeeding duration, in months, and sociodemographic variables, mother-infant characteristics and dimensions of social support. Rio de Janeiro, Brazil, 2024.

Variables	Median (IQC[1])	P value[2]
Color		0.70
Black	6.0 (6.2)	
Brown	6.0 (7.4)	
Caucasian	6.0 (6.7)	
Household income *per person*		0.03
< 3 MW	6.0 (6.6)	
3 – 6 MW	6.0 (6.8)	
> 6 MW	6.0 (6.1)	
Highest education level		< 0.00
Primary	6.0 (6.9)	
Secondary	6.0 (6.3)	
Bachelor's or higher	7.0 (6.7)	
Birth decade		< 0.00
Before 1980	6.0 (12.0)	
1980s	6.0 (10.1)	
1990s	8.0 (12.6)	
2000's	10.0 (10.3)	
Mother's age		< 0.00
13-<19	6 (16.9)	
20-<34	6 (10.7)	
35+	10 (12.3)	
Dimensions of Social Support (1999)		
Positive social interaction and affective support		0.05
Lowest tertile	6 (6.4)	
Middle tertile	6 (6.8)	
Highest tertile	6 (6.9)	
Information and emotional		0.2
Lowest tertile	6 (6.4)	
Middle tertile	6 (6.5)	
Highest tertile	6 (6.9)	
Material		0.7

Table III. Continuation.

Lowest tertile	6 (6.3)	
Middle tertile	6 (6.6)	
Highest tertile	6 (7.0)	
Delivery mode		0.6
Unplanned C-section	8 (11.6)	
Scheduled C-section	7 (10.8)	
Vaginal birth	8 (12.1)	
Premature		0.3
Yes	7 (11.7)	
No	8 (9.4)	
Birth weight		0.07
< 2.5 kg	6 (9.7)	
2.5 - 4 kg	6 (12.8)	
> 4 kg	8 (11.6)	
Parity		0.5
Primiparous	6 (7.3)	
Multiparous	6 (6.3)	
Child's birth position		0.2
First child	6 (11.3)	
Second child	8 (11.5)	
Third child	8 (11.6)	
Fourth child	9 (11.8)	

[1] IQC: interquartile range. [2] Kruskal test.

The overall duration observed in this cohort at 24 months was 11.8% (95% confidence interval - CI: 10.4,13.3). To test breastfeeding duration, parity and other covariates simultaneously, Cox-proportional Hazards models were used as a survival regression model. Cox models have achieved great popularity, because they do not require the assumption of a particular survival distribution for the data; instead, these models use a hazard function. In estimating the baseline hazard function. The lack of a parametric form of the survival distribution gives the Cox model its other name, the semi-parametric model, as the only parameters to be estimated in the model are those describing how the predictors affect the hazard (George et al. 2014).

A hierarchical approach was employed to include variables in the model, starting with proximal variables and progressing to distal ones. This method is effective for understanding determinants of health behaviors, particularly in maternal and child health contexts (Victora 1997). The variables parity and mother's age were the first to be included (Model 1), followed by the

highest education level and household income (Model 2), and finally the decade of birth (Model 3). The variables preserved their statistical significance throughout the construction of the models. Model 3 was assumed to be the final model in the Cox analysis.

The multivariate analysis presented in Table IV examines the duration of breastfeeding in months. The results indicated that, regarding parity, multiparous mothers did not show a significant difference in breastfeeding duration compared to primiparous mothers. Concerning age, older mothers (35 years or older) tend to breastfeed for longer, while mothers aged 20 to 34 showed no difference when compared to adolescent mothers. As for educational level, mothers with higher education exhibited a slight tendency to breastfeed for longer, but with confidence intervals that include one. Household income did not reveal clear effects on breastfeeding duration, and children born in the 1990s and 2000s showed a significant reduction in breastfeeding duration compared to those born before 1980. The Wald test indicated that there is a statistically significant difference in the analyzed variables.

In agreement with the current literature, maternal age increases the chances of continuing breastfeeding (Lechosa-Muñiz et al. 2020). Women aged 35 years and older are 15% more likely to breastfeed up to 24 months than younger women. The variable decade of birth showed statistically significant differences in all crude analyses, as well as adjusted in the model. The youngest children in this study had the lowest risk of weaning before 24 months when compared to children born in previous decades. The decade of birth with the highest risk of earlier breastfeeding cessation was the 1980s.

DISCUSSION

The fact that 8% of women reported never breastfeeding, with a higher proportion of primiparous mothers (36%) among those who did not breastfeed, suggests that maternal experience may influence decisions about breastfeeding. The early introduction of complementary foods—with 37% of women did so before the third month—indicates a trend that contrasts with recommendations for exclusive breastfeeding in the first six months of life.

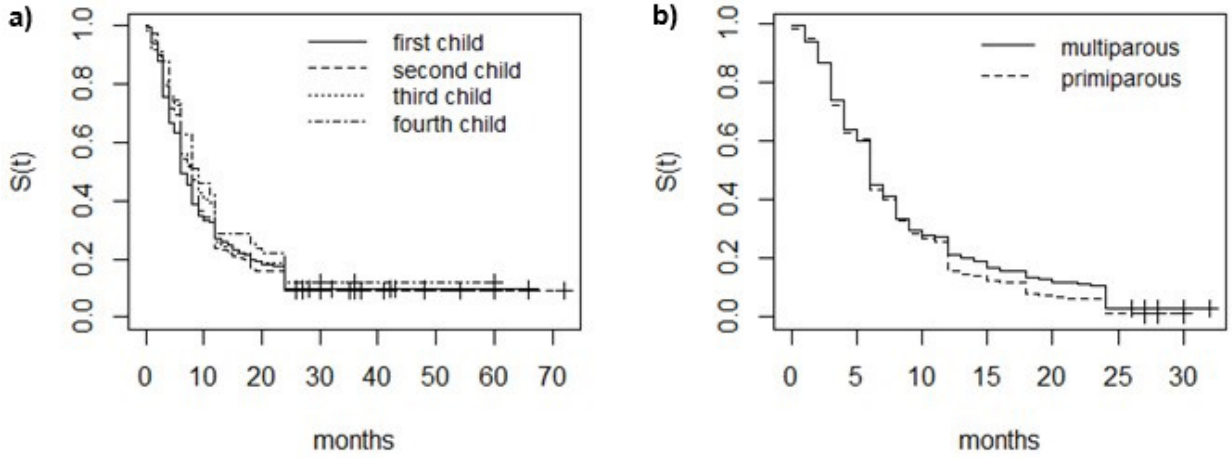

Figure 1. Breastfeeding duration curves, in months. Rio de Janeiro, Brazil, 2024. a) Stratified by each child (months). Likelihood ratio test= 1.71, p=0.2. b) Stratified by parity (months). Likelihood ratio test= 3.41, p=0.06.

The bivariate analysis revealed that characteristics such as maternal age and mode of delivery are relevant to breastfeeding, especially among primiparous mothers, who tend to be younger. The data indicated that maternal education and household income have a positive impact on breastfeeding duration, corroborating literature that shows mothers with higher educational levels tend to breastfeed for longer. The relationship between increased breastfeeding duration and maternal age is also confirmed, with mothers aged 35 and older breastfeeding significantly longer than younger mothers. This may be due to a bond of support and trust that allows them to face the

Table IV. Multivariate analysis for duration of breastfeeding, in months. Rio de Janeiro, Brazil, 2024.

HR[1] (CI95%)				
Variable	**Crude HR[1]**	**Model 1 N=1,009**	**Model 2 N=993**	**Model 3 N=993**
Parity				
Primiparous	1.00	1.00	1.00	1.00
Multiparous	0.99 (0.85,1.15)	1.00 (0.86,1.16)	0.98 (0.84,1.15)	1.00 (0.85,1.16)
Mother's age				
13-<19	1.00	1.00	1.00	1.00
20-<34	1.02 (0.68,1.55)	1.02 (0.68,1.54)	1.02 (0.67,1.54)	1.11 (0.72,1.74)
35+	0.71 (0.46,1.08)	0.71 (0.47,1.08)	0.70 (0.45,1.07)	0.90 (0.56,1.44)
Highest education level				
Primary	1.00		1.00	1.00
Secondary	1.04 (0.83,1.30)		1.09 (0.87,1.37)	1.07 (0.85,1.33)
Bachelor's or higher	1.09 (0.88,1.35)		1.16 (0.91,1.47)	1.16 (0.92,1.47)
Household income *per person*				
< 3 MW	1.00		1.00	1.00
3 – 6 MW	1.04 (0.91,1.20)		1.03 (0.88,1.20)	0.99 (0.85,1.16)
> 6 MW	1.07 (0.7, 1.14)		0.87 (0.70,1.08)	0.83 (0.66,1.03)
Birth decade				
Before 1980	1.00			1.00
1980s	1.12 (0.92,1.37)			1.13 (0.91,1.40)
1990s	0.74 (0.61,0.91)			0.75 (0.60,0.94)
2000's	0.64 (0.51,0.79)			0.68 (0.52,0.88)
Wald test (p-value)		< 0.001	< 0.001	< 0.001

[1] Hazard Ratio.

difficulties inherent to that moment with greater confidence (Gebuza et al. 2018).

The use of Cox models to analyze breastfeeding duration, allowing for the inclusion of multiple variables, strengthened the understanding of the determinants of breastfeeding in social and economic contexts. The fact that parity did not show significant differences in breastfeeding duration may call for further investigation into the factors influencing mothers' decisions about breastfeeding in each pregnancy.

The decrease in breastfeeding duration among children born in the 1990s and 2000s compared to those born before 1980 is also alarming and may reflect changes in social norms and health practices. This information highlights the need for interventions that address new family and social dynamics to promote breastfeeding. Strengthening policies and programs for the promotion, protection and support of breastfeeding are essential to reach the proposed levels, given the influence that a temporal variable had on breastfeeding duration.

In summary, the results indicated a complex interaction between social, economic, and behavioral factors that should be considered in public policies aimed at maternal and child health. For mothers who need to work to make up the family income, breastfeeding can be affected (Rattner & Moura 2016). However, the studied sample was composed of statutory employees, with legal guarantees that protect breastfeeding. Informal work and unemployment can interfere with the practice of breastfeeding, posing as a risk factor for weaning (Vasconcelos et al. 2006).

The strength of this study is its the large database, composed of successive pregnancies. This rich source of data provided unique opportunities to study social support issues and socioeconomic characteristics across different decades. Additionally, limitations included the lack of qualitative questions about expectations and difficulties regarding breastfeeding, as well as the study design, which collected information at a different time than when breastfeeding was taking place, thus introducing the possibility of recall bias. Although the present study brought about interesting finding regarding breastfeeding duration, it should be noted that the data are over 10 years older compared to the present day.

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