Original article

Prematurity and associated factors in Divinópolis, Minas Gerais state, Brazil, 2008-2011: analysis of the Information System on Live Births

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Abstract

Objective: to estimate prematurity prevalence and associated factors in Divinópolis, Minas Gerais state, Brazil, 2008-2011. **Methods**: this is a cross-sectional study with data from 9,987 records held on the Information System on Live Births; a multiple logistic regression model was used. **Results**: prevalence of preterm births was 8.0%; the higher likelihood of premature newborns were found to cesarean section (8.9%), mothers aged 15 or less (14.4%) and aged 35 or more (9.3%), mothers who went to 6 or fewer prenatal care visits (16.0%), and had had 4 or more live births (11.7%); after adjustment, the odds of preterm birth was higher among mothers aged under 15 years old (OR=1.22; 95%CI 1.01;1.49), mothers with 6 or fewer prenatal care visits (OR=3.76; 95%CI 3.24;4.38) and mothers undergoing cesarean section (OR=1.73; 95%CI 1.48;2.04). **Conclusion**: prematurity was associated with cesarean delivery, having fewer than 7 prenatal care visits and lower maternal age.

Key words: Child Health; Premature Birth; Health Information Systems; Prevalence; Cross-Sectional Studies.

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Introduction

Prematurity is a worldwide Public Health problem,[1] as it is the most important cause for neonatal death and the second main cause of mortality among under-5 infants.[2] A newborn is considered premature, or preterm, when they are born before 37 weeks of pregnancy.[3] Preterm newborns have higher risks of falling sick and dying due to incomplete fetal development and to their higher susceptibility to infections, which are aggravated by the manipulation and long stay in neonatal units. Many preterm babies evolve with neurological, ophthalmological or pulmonary sequelae. This event should be extensively investigated considering its determinants, in order to contribute to the reduction of infant morbidity and mortality. [4,5]

A systematic analysis[6] on the prevalence of preterm births in 184 countries in 2010 estimated a 14.9 million of premature babies. This represents 11.1% of live births worldwide, ranging from 5% in several European countries to 18% in some African countries. Of the total number of preterm births, more than half of them (60.0%) occurred in South Asia and Sub-Saharan Africa.[6]

> *Preterm newborns have higher risks of falling sick and dying due to incomplete fetal development and to their higher susceptibility to infections.*

As from the 1990s, in Brazil, maternal and child health have received more attention, although we can still observe an increase in preterm births.[7] Birth in Brazil Survey[8] identified, in 2011, an 11.3% prematurity prevalence in the country. On the other hand, a study on prevalence correction of the preterm births in Brazil found estimates from 11.7 to 11.8% in 2009-2011.[9] In Minas Gerais State (MG), this prevalence ranged from 5.2% in 1999 to 7.4% in 2008.[10]

Several factors are associated to prematurity, for instance: maternal age under 20 or over 40 years old; low socioeconomic status; preterm birth history; maternal height lower than 1.52 meters; twin pregnancy; vaginal bleeding in the 2nd trimester of pregnancy; cervical ripening; increased uterine activity before 29 weeks of pregnancy; smoking; being a single parent; maternal employment; nutritional status; mother's inadequate weight change; ethnicity/skin color; urinary tract infections; exposure to toxic substances; lack or low number of prenatal care visits; and type of delivery.[11-16]

Some of these variables are included in the Certificate of Live Birth (CLB), a document that feeds the database of the Information System on Live Births (Sinasc). Therefore, Sinasc is a system with valuable information for monitoring and evaluating maternal and child health in local services.[17,18] The information provided by Sinasc may help improve the quality of information on the conditions of birth and its applicability in monitoring and planning actions and local health services.[19] Knowing the characteristics of a population group underpins, directs, and subsidizes actions proposed by health care services, as well as their execution.[7] Assessing the conditions of premature births can provide health services useful knowledge to organize maternal and child care.

This study aimed to estimate prematurity prevalence and associated factors in Divinópolis, Minas Gerais (MG), Brazil, from 2008 to 2011.

Methods

This is a cross-sectional study of hospital births in Divinópolis-MG, from 2008 to 2011. Sinasc's database, provided by Regional Health Superintendence of the Extended West Region of Minas Gerais, was used as the source data for the study. Sinasc was implemented in Brazil in 1990 in order to have an information system on conditions of childbirth, pregnancy, delivery, and mother's characteristics.[18]

Divinópolis, the largest city in the Extended West Region of Minas Gerais, has an approximate population of 228,643 inhabitants and a municipal human development index (M-HDI) of 0.764.[20] Its health system consists of 32 Family Health Strategy (FHS) units, 10 traditional health units (THU), a municipal emergency room, and 4 hospitals, of which, one is philanthropic and the other 3 are private.

The study population included 10,266 live births of residents in Divinopolis. Of those, twin births were excluded, for having a common frequency of prematurity, regardless of the influence of other risk factors.[11] Births under 22 weeks of pregnancy – which includes abortions – were also excluded, resulting in 279 (2.7%) exclusions. Thus, this study included 9,987 records of single institutional live births of residents in Divinopolis-MG.

The study outcome was the pregnancy duration, categorized in preterm (22 to 36 weeks and 6 days) and at term (37 to 41 weeks and 6 days). The independent variables were: newborn's sex (female, male); mother's age (in years: 15 or less; 16 to 19; 20 to 34; 35 or over); mother's education level (in years of schooling: 8 or less; 9 to 11; 12 or more); type of delivery (vaginal, cesarean section); number of prenatal care visits (6 or less; 7 or more); number of live births in previous pregnancies (less than 4; 4 or more). Birth weight (low birth weight: lower than 2,500 grams; appropriate weight: greater than or equal to 2,500 grams) and number of stillbirths (less than 2; 2 or more) were used only for describing the study population. The other variables listed in the CLB –mother's marital status; mother's ethnicity/skin color; maternal occupation; detection of any congenital malformation and/or chromosomal abnormality – were not evaluated due to incompleteness higher than 20%, considered as bad classifications in CLB's fields.[21]

Descriptive statistics included the calculation of prematurity prevalence for the total sample according to categories of the selected variables, as well as the estimates of their respective 95% confidence intervals. Pearson's chi-square test was conducted to evaluate possible associations between covariates and prematurity, with a 5% significance level. The strength of association was estimated by calculating the odds ratio and their 95% confidence intervals. To control possible confounding factors, we used multivariate logistic regression analysis. The Wald test was used to verify the significance of the variables. The multivariate model used all variables with a p-value <0.20 in crude analysis – except for birth weight, which was used only to describe the study population. The stepwise method was applied to select variables, which included, initially, the variable of largest association with the outcome, and so on, evaluating possible interactions between them and keeping variables with a <0.05 p-value in the final model. We used the Hosmer-Lemeshow test to assess whether the proposed model could explain properly what was observed. For data analysis, we used Statistical Package for Social Sciences (SPSS®) software 17.0.

This study followed the ethical principles of the National Health Council (CNS) No. 466, dated December 12, 2012, and was accepted by the Ethics Research Committee of *Campus Centro-Oeste Dona Lindu*, of the Federal University of São João Del Rei: Registration No. 392702.

Results

In the studied sample, 73.6% of mothers were aged between 20 and 34 years old; 61.0% of them had between 9 to 11 years of schooling; 75.0% presented to 7 or more prenatal care visits, and 62.0% underwent cesarean section. Most of them had less than 4 living children (96.8%) and less than two dead children (98.8%). As for the newborns, 91.0% of them had weight equal to or greater than 2,500 grams, and just over half of them were male (51.3%) (Table 1).

Among the 9,987 birth records analyzed, 797 (8.0%) were of preterm babies. We noticed an increase in prematurity in the period, ranging from 7.7% in 2008 to 9.6% in 2011 (Figure 1).

Higher prematurity prevalence was observed among mothers aged 15 or less (14.4%) and aged 35 or over (9.3%) when compared to women who were from 20 to 34 years old (7.6%). Prematurity was three times higher (16.0%) among mothers who had 6 or fewer prenatal care visits, in comparison to those who had 7 or more visits (5.3%). Regarding the type of delivery, there was a higher frequency of preterm infants in cesarean sections (8.9%) than in vaginal deliveries (6.5%). There was also a higher frequency of preterm births among mothers who had four or more living children (11.7%) (Table 2). In the crude analysis of association between prematurity and covariates, the variables newborn's 'Sex' (p=0.237) and mother's 'education level ' (p=0.632) were not statistically significant. As they presented a p>0.20 value, they were excluded from the adjusted model.

After adjustment, the variable 'Number of live births in previous pregnancies' lost statistical significance. The chance of prematurity was higher among infants of mothers who had 6 or fewer prenatal care visits (OR=3.76, 95%CI 3.24;4.38), who had a cesarean section (OR=1.73; 95%CI 1.48;2.04), and those younger than 15 years old (OR=1.22; 95%CI 1.01;1.49). The model proved to be well adjusted, according to Hosmer-Lemeshow test (p=0.669) (Table 2).

Discussion

In this study, we observed that mothers who had 6 or fewer prenatal care visits, those who underwent cesarean sections, and who were younger were more likely to have preterm births. Most preterm newborns analyzed

Table 1 – Sample characteristics according to maternal, newborn, pregnancy and delivery conditions, according to the Information System on Live Births (Sinasc) in Divinópolis, Minas Gerais. 2008-2011

Variable		n (%)
Mother's age (in completed years) (n= 9,963)	≤15	111 (1.1)
	16-19	1,009 (10.1)
	20-34	7,330 (73.6)
	≥35	1,513 (15.2)
Mother's education level (n=9,897)	≤8	1,978 (20.0)
	9-11	6,039 (61.0)
	≥12	1,880 (19.0)
Prenatal care visit (n=9,899)	1-6	2,475 (25.0)
	≥7	7,424 (75.0)
Type of delivery (n=9,962)	Vaginal	3,785 (38.0)
	Cesarean section	6,177 (62.0)
Newborn's sex (n=9,962)	Male	5,109 (51.3)
	Female	4,853 (48.7)
Live births (n=9,817)	<4	9,501 (96.8)
	≥4	316 (3.2)
Stillbirth (n=9,779)	<2	9,666 (98.8)
	≥2	113 (1.2)
Newborn's weight (n=9,963)	<2,500g	895 (9.0)
	≥2,500g	9,068 (91.0)

presented between 32 and 36 weeks of pregnancy, and more than half of them were delivered through caesarean section. The prevalence of mothers with insufficient number of prenatal care visits (25.0%) is also high, in disagreement with the recommendations by the National Policy for Obstetric and Neonatal Care.[3]

The prematurity prevalence identified in Divinopolis-MG, in the first three years analyzed, proved to be similar to those in the state of Minas Gerais (7.4%) and its Extended West Region (7.4%) for the same period,[10] but it was lower when compared to Brazil's prevalence (11.3%) in 2011.[8] In that year, preterm births in Divinopolis-MG increased by 28.0%, compared to 2010. This is an alarming fact, and it may be related to health care, particularly prenatal care, and type of delivery, among other factors related to unfavorable socioeconomic status of those populations that directly influence these prevalences.[7,8,22]

Prenatal care visits and type of delivery were associated with prematurity. Pregnant women who have a sufficient number of prenatal care visits are less likely to have premature births.[23-25] In 2010, a study[14] conducted in a medium-sized public maternity hospital in the state of Maranhão found that almost 60% of postpartum mothers of preterm babies had had less than 5 prenatal care visits and were five times more prone to prematurity, compared to mothers of babies born at term. The Ministry of Health establishes preferably one prenatal care visit in the first trimester, two in the second, and three in the third and final trimester of pregnancy.[3] In addition to noticing the number of prenatal care visits, it is necessary to evaluate the quality of such care: pregnant women may even have the recommended number of visits; however, they might not be sufficiently qualified.[26,27] Women who underwent a caesarean section had greater chances of giving birth to preterm babies. These findings are similar to studies conducted in the states of Minas Gerais[28] and Santa Catarina.[13] In 2010, according to Sinasc, the proportion of cesarean sections at the local studied was higher than Brazil's (52.3%) and some Brazilian municipalities, such as São Paulo-SP (53.9%), Pelotas-RS (58.0%) and Belo Horizonte-MG (49.7%).[10] The increase in cesarean sections occurred due to factors related to the mother's or the health professionals' decision.[6] A Brazilian research has showed that municipalities in wealthier regions presented higher prematurity prevalence, which may be related to a higher number of necessary and possible medical interventions, given their superior structure and chances of survival of a preterm newborn in those regions, in contrast with the North and Northeast regions.[9] It is important to

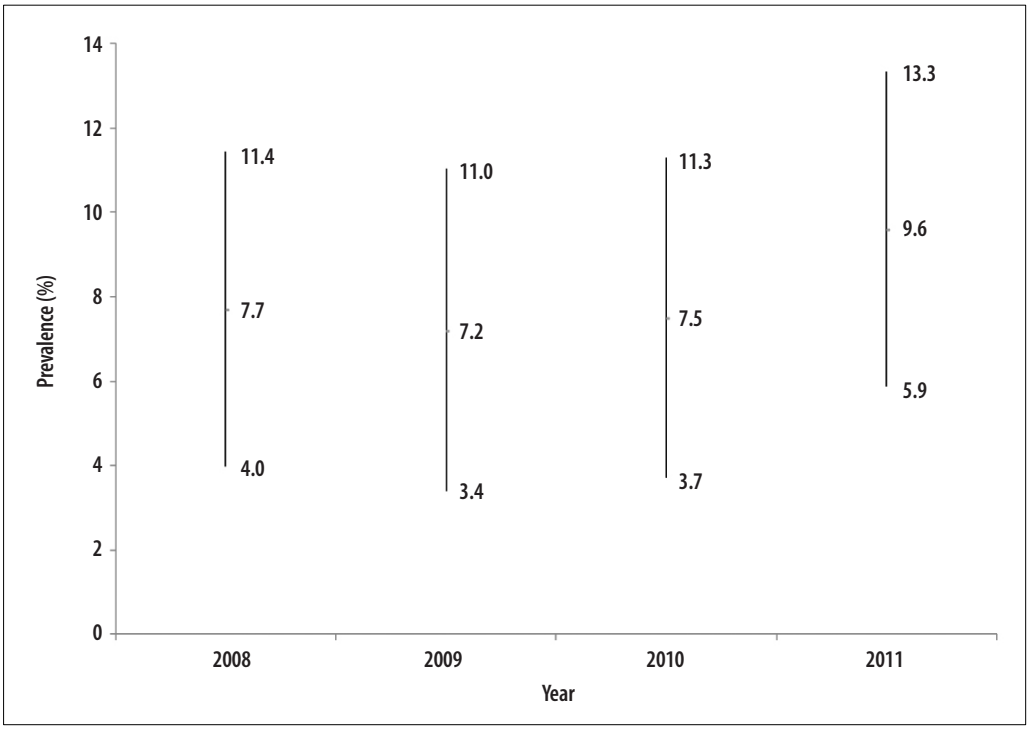

Figure 1 – Prevalence (%) of premature births and 95% confidence interval according to the Information System on Live Births (Sinasc) in Divinópolis, Minas Gerais, 2008-2011

highlight that the contribution of medical interventions, such as caesarean sections, to the increase in preterm births has been discussed in Brazil.[7,13,27]

Maternal age under 15 years was associated with prematurity, after adjustment. Other studies have showed that mothers' extreme ages influence prematurity.[11,12,14,28] The frequency of preterm and post-term births, low birth weight, and macrossomia, in addition to stillbirths, are higher among women older than 35 years.[28] For adolescents, socioeconomic and geographic conditions and low access to health care services can enhance the intercurrences related to pregnancy, such as prematurity.[12]

No association between prematurity and the mother's education level was found, corroborating with results of other Brazilian studies, such as the one conducted in the state of Santa Catarina[13] and others, conducted in Guarapuava-PR[12] and Imperatriz-MA.[14] In Brussels,[23] an analysis on the relation between prenatal care and the risk of preterm birth also found that the mother's level of education did not interfere with prematurity. Nevertheless, a mother's low level of education is likely to predispose situations of maternal and child risk, such as poor access to information and to measures for health promotion and prevention, intellectual restrictions on their rights and obligations as citizens, of self-care ability and of searching for assistance.[12]

With regard to the quality of the information available on Sinasc, an analysis of CLB's completeness showed an 100% completeness of the variables 'Birth Weight', 'Age', 'Type of Delivery', 'Type of pregnancy', and 'Sex'. The incompleteness of the variables 'Level of Education', 'Number of weeks of pregnancy', 'Number of prenatal care visits', 'Number of live births', and 'Number of fetal deaths/abortions' ranged from 0.2 to 1.8 %, a rate considered excellent (under 5%).[21] There has been improvement on Sinasc's coverage,[21] in its data reliability,[29] and in the completeness in filling CLB's data fields.[21] Regarding the field 'Number of weeks of pregnancy', for example, the number of births with no records on this variable was reduced.[30]

Some limitations regarding information quality should be considered in this study. Some CLB's data fields, such as 'Marital status', 'Mother's Ethnicity/Skin color', 'Occupation', 'Congenital abnormality and/or malformation', albeit important for this analysis, were not included due to incompleteness rates above 20%

Table 2 – Preterm live birth prevalence (%) and analysis of association with maternal, newborn, pregnancy and delivery characteristics according to the Information System on Live Births (Sinasc) in Divinópolis, Minas Gerais, 2008-2011

Variable	Preterm (%)	p-value [a]	Crude OR (95%CI) [b]	Adjusted OR (95%CI) [c]	p-value [d]
Mother's age (in years)					
≤15	14.4		1.27 (1.04;1.53)	1.22 (1.01;1.49)	
16-19	8.5		0.61 (0.35;1.06)	0.65 (0.36;1.15)	0.029
20-34	7.6	0.007	1.00	1.00	
≥35	9.3		1.10 (0.83;1.46)	1.07 (0.80;1.43)	
Prenatal care visit					
≥7	5.3		1.00	1.00	
≤6	16.0	<0.001	3.43 (2.96;3.98)	3.76 (3.24;4.38)	<0.001
Type of delivery					
Vaginal	6.5		1.00	1.00	
Cesarean section	8.9	<0.001	1.40 (1.20;1.64)	1.73 (1.48;2.04)	<0.001
Live birth					
<4	7.8			1.00	
≥4	11.7	0.012	1.56 (1.09;2.22)	1.29 (0.89;1.88)	0.176
Mother's level of education (in years of schooling)					
≥12	7.8		1.00	–	
9-11	7.8	0.632	0.99 (0.82;1.21)		
≤8	8.5		0.91 (0.73;1.15)		
Newborn's sex					
Male	8.3		1.00	–	
Female	7.7	0.237	1.09 (0.95;1.26)		

a) p-value: probability value – Pearson's chi-squared test
b) OR (odds ratio) and 95%CI (95% confidence interval) – crude analysis
b) OR (odds ratio) and 95%CI (95% confidence interval) – adjusted analysis
d) p-value: probability value – Wald test

in CLB. Perhaps this information has been neglected, either due to unawareness on the importance of those variables for the analysis of maternal and child health status or due to lack of discernment between a blank field and an ignored field when performing data entry.[2] Another limitation in this study refers to a selection bias, namely, survivorship, common in cross-sectional studies. Not including stillbirths in the series of cases might have underestimated the associations found. The possibility of reverse causality in the association between the number of prenatal care visits and preterm births is also noteworthy. This bias may result from the fact that some women with preterm babies have had fewer prenatal care visits because their pregnancy was interrupted early.

Sinasc is one of the most successful initiatives among national databases, and an important source of information on the conditions of births in a certain location. However, we should consider the remaining incompleteness in some fields of the Certificate of Live Birth, the underutilization of data, and poor dissemination of information.[19] The use of health information for researching, monitoring, and evaluating health services, programs and policies favors the quality of information itself and the production of new knowledge, which can improve services and established public policies.

In conclusion, prematurity was associated with mothers who had cesarean delivery, who had less than 6 prenatal care visits, and who were under 15 years old. We recommend health managers and professionals to review the organization of health care services related to prenatal care and childbirth, in its structural and process aspects, so as to give proper attention to prenatal care and discourage elective cesarean section. These actions may contribute to the reduction in prematurity.

Authors' Contributions

Guimarães EAA, Vieira CS, Nunes Januário FDD and GC contributed to the conception of the study, data collection and analysis and drafting the article. Oliveira VC and Tiburcio JD contributed to the analysis of data and proofreading of the article. All authors have approved the final version of the manuscript and declared to be responsible for all aspects of this study, ensuring its accuracy and integrity.

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