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Spatial Distribution of Risk Factors Associated to Adolescent Mothers

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ABSTRACT

Objective: To analyze the spatial distribution of risk factors associated with adolescent mothers.

Methods: Case-control study, with a sample of 279 cases (newborns <2, 500 g) and 558 controls (new borns ≥ 2, 500 g), collected from the Live Birth Information System. In the unadjusted analysis, Pearson's chi-square was used, with a descriptive value of $p < 0.20$. In the adjusted multivariate model, $p < 0.05$ was considered. In the spatial analysis, the distribution of points and Kernel density was used.

Results: The significant variables were: number of children born alive, weeks of gestation, number of prenatal consultations and type of pregnancy. In the spatial distribution, clusters were observed in regions of greater socioeconomic vulnerability.

Conclusions: The identification of risk factors for pregnancy in adolescence may indicate rapid and effective preventive strategies to avoid low birth weight.

INTRODUCTION

Adolescence is a peculiar phase of life between childhood and adulthood, marked by bio psychosocial transformations that affect the behaviour of young people, making them susceptible to risks and injuries that affect their health [1]. Among the risks to which teenagers are exposed, early pregnancy stands out due to the biological, psychological and social repercussions it can have at this stage of life [2]. Faced with the issue of pregnancy, despite advances in technology and information, in the field of contraception and assistance in the field of reproductive and sexual health, many adolescents continue to get pregnant without planning. In Brazil, in 2015 there were 3, 017, 668 births, 26, 700 of which were born to girls aged 10 to 14 years and 520, 864 to adolescents aged 15 to 19 years, representing 0.9% and 17.3%, respectively. In the same year, in the Northeast region, 847, 082 live births (NV) were registered, of which 10, 074 were girls aged 10 to 14 years and 170, 286 were adolescents aged 15 to 19 years, representing 1.2% and 20.1%, respectively. In the State of Ceará, in 2015, 1, 420 LB of mothers aged from 10 to 14 years old and 24, 369 aged from 15 to 19 years old were accounted for, equivalent, respectively, to 1.1% and 18.4%. In Sobral, in that same year, there were 24 pregnant women aged 10 to 14 years old and 577 adolescents aged 15 to 19 years old, corresponding, respectively, to 0.7% and 16.6% [3]. The Brazilian health system needs information to ensure planning of public policies and actions, resource management and assessment at different levels of care, with a focus on the context of maternal and child health. Given this geoprocessing can be defined as mathematical and computational techniques for the treatment of geographic information that increasingly influence several areas [4] including Public Health. The application of this technique in the health area is seen through disease mapping, risk assessment, planning of health actions and evaluation of care networks [5]. That said,

the spatial analysis provided by geo processing enables the characterization of vulnerabilities and potentialities in the assistance to the population registered in the territories, which favours the monitoring of health conditions [6] and contributes to the reduction of maternal and child mortality and hospital care costs to the binomial. Given the relevance of the issue in the health sector and the need to better represent the specific population and its contexts social historical political cultural and environmental. in which they are inserted we chose to use geo processing. Still the application of this analysis technique can contribute to the processing and understanding of spatial data and produce different forms of data aggregation, for the improvement and facilitation of decision-making in public/collective health, aimed at pregnant adolescents. Therefore the objective was to analyse the spatial distribution of risk factors associated with adolescent mothers.

METHODS

This study was approved by the Ethics Committee of the Universidade Estadual do Ceará (UECE). This is an epidemiological, retrospective, case and control study with a descriptive and analytical approach, carried out in Sobral, in the interior of the State of Ceará, from January 2007 to December 2017. The municipality of Sobral-CE is part of a hierarchical and regionalized health care network, with a health care structure at different levels of complexity, being a reference in maternal and child health care for 55 municipalities. In order to carry out comprehensive care for the population enrolled in these territories, public policies were developed in this aspect of care, such as the strategies involved in the Mother and Child Health Care Network, Rede Cegonha [7]. The study population consisted of teenage mothers with NV children. The sample consisted of 837 adolescents, 279 cases and 558 controls. As inclusion criteria, statements referring to NV children of adolescent mothers aged 10 to 19 years old, residents and who delivered births in the municipality corresponding to the study setting were collected. Mothers who did not present data regarding the new-born's weight at birth and/or did not have information regarding the place were excluded. The chosen variables had as outcome: LB children's weight (< 2,500 g; ≥ 2,500 g). The following variables were considered as associative: social demographic (age, occupation, marital status, education and place of occurrence); related to pregnancy and childbirth (number of LB children, number of prenatal consultations, type of delivery, type of pregnancy) and related to the new-born (NB) (gestational age, sex, weight and congenital malformation). Data were extracted from the Information System on Live Births (SINASC), through the database of the local Municipal Health Department. After obtaining the data for the composition of the cases, the controls that made up the specific database for this study were selected, which contained the characteristics of pregnancy, delivery and birth conditions. The collected data were stored in Excel 2013 and analysed using the Statistical Package for Social Sciences (SPSS), version 23.0®. At first, statistical analysis was carried out, followed by spatial analysis. In the statistical analysis, descriptive frequency (absolute values and percentages) and inferential data were described, using Pearson's Chi-square association tests and, when this was not possible, Fisher's exact test was used, at the level 5% significance level. In the unadjusted analysis, the descriptive level of $p<0.20$ of the variables for inclusion in the adjusted model was considered, with only the significant variables remaining in the final model ($p<0.05$). Logistic Regression was used in order to obtain the Odds Ratio (OR) to quantify the association between the variables.

For the spatial distribution, the software Quantum GIS 2.18.18® was used. This has free access, and features a free geo processing software, with the residence address as the unit of analysis. In this sense, the street, number, neighbourhood and geographic coordinates were used as a reference through the Google Maps tool. As for the constructed map, we opted for the exploratory point pattern analysis of the cases referring to pregnant adolescents, by place of residence, and then the Kernel estimate was used, which is a reference technique to measure the density of events related to the investigated variables.

RESULTS

Geo referencing was performed on the pattern of spatial distribution and its relationship with the most vulnerable territories, using the following variables: mothers with less than 37 weeks of gestation; mothers with double/triple pregnancy; mothers with less than six visits during prenatal care and mothers with at least one live-born child (LB). In the unadjusted model, the existence of an association between birth weight and the exposed variables was verified. It was also observed that children born alive weighing less than 2, 500 g were associated ($p<0.20$) with the following variables: occupation of the student mother (OR=1.98; 95% CI=1.345-2.901; p =0.001); number of live births, (OR=1.73; 95% CI=1.178-2.529; p=0.005), gestational weeks (OR=20.5; 95% CI=13.737-30.581; p<0.001); number of prenatal consultations (OR=4.95; 95% CI=3.582-6.850; p<0.001); type of pregnancy (OR=7.63; 95% CI=0.978-1.740; p<0.001) and sex (OR=1.3; 95% CI= 0.978-1.740; p=0.070) **(Table 1).**

Table 1. Number and percentage of adolescents, according to birth weight of children born alive by variables, with respective Odds Ratio, 95% Confidence Interval and p-value of Chi-square Pearson.

Variables	< 2.500 g		≥ 2.500 g					
	N=279*	%	N=558*	%	OR not adjusted	IC95%		P-value
Age								
10 to 14	7	26, 9	19	73, 1	0, 73	0, 303	1, 758	0, 481
15 to 19	272	33, 5	539	66, 5	1, 00			

Occupation								0, 002
Student	60	46, 9	68	53, 1	1, 98	1, 345	2, 901	0, 001
Others	11	30, 6	25	69, 4	0, 99	0, 476	2, 040	0, 968
Housewife	205	30, 9	459	69, 1	1, 00			
Situation								
Single	152	34, 9	283	65, 1	1, 15	0, 865	1, 540	0, 329
Stable union	127	31, 8	273	68, 3	1, 00			
Education								
0 to 7 years	72	35, 3	132	64, 7	1, 13	0, 811	1, 577	0, 467
8 and more	204	32, 5	423	67, 5	1, 00			
Place of occurrence								
Others	3	60, 0	2	40, 0	3, 02	0, 502	18, 189	0, 222*
Hospital	276	33, 2	556	66, 8	1, 00			
Number of children born alive								
1 or more children	57	44, 2	72	55, 8	1, 73	1, 178	2, 529	0, 005
None	222	31, 4	484	68, 6	1, 00			
Gestation weeks								
Less than 37 weeks	172	80, 8	41	19, 2	20, 50	13, 737	30, 581	<0, 001
Greater than or equal to 37 weeks	105	17, 0	513	83, 0	1, 00			
Number of consultations								
Prenatal								
Less than or equal to 6 consultations	138	59, 7	93	40, 3	4, 95	3, 582	6, 850	<0, 001
Greater than or equal to 7 consultations	139	23, 1	464	76, 9	1, 00			
Type of delivery								
Cesario	103	32, 4	215	67, 6	0, 93	0, 692	1, 253	0, 637
Vaginal	176	34, 0	342	66, 0	1, 00			
Type of pregnancy								
Pair	18	78, 3	5	21, 7	7, 63	2, 801	20, 769	<0, 001
Only	261	32, 1	553	67, 9	1, 00			
Sex								
Female	150	36, 3	263	63, 7	1, 30	0, 978	1, 740	0, 070
Male	129	30, 4	295	69, 6	1, 00			.
Malformation								
Yes	3	60, 0	2	40, 0	3, 01	0, 500	18, 124	0, 223*
Not	276	33, 3	554	66, 7	1, 00			

Fonte: SINASC da Secretaria de Saúde de Sobral (2018).
Note: In some variables the sample presented did not correspond to the sample size established for the research, due to lack of information.

Fisher's exact test

In the adjusted model, the variables with the respective confidence intervals and Odds Ratio were significant: number of children born alive (OR=1.78; 95% CI=1.094-2.894; p=0.020), gestational age (OR=15.68; 95% CI=10.341-23.780; p<0.001), number of prenatal consultations (OR=3.39; 95% CI=2.282-5.029; p<0.001) and type of pregnancy (OR=3.88; 95% CI =1.152-13.058; p=0.029) **(Table 2).**

Table 2. Model adjusted with Odds Ratio, 95% Confidence Interval and Pearson Chi-square p-value. Sobral, Ceará, Brazil from 2007 to 2017.

Variables	Adjusted OR	95% CI		P-value
Number of Live Born Children				
1 or more children	1, 78	1, 094	2, 894	0, 020
None	1, 00			.
Gestational age				
Less than 37 weeks	15, 68	10, 341	23, 780	<0, 001
Greater than or equal to 37 weeks	1, 00			.

Number of Queries prenatal				
Less than or equal to six queries	3, 39	2, 282	5, 029	<0, 001
Greater than six queries	1, 00			.
Type of Pregnancy				
Pair	3, 88	1, 152	13, 058	0, 029
Only	1, 00			

Thus the variables whose mothers were more likely to have a live-born child with low birth weight (LBW) were: number of live-born children, in which LBW was verified in 1.78 times to occur in adolescents with one or more living children. Similarly, gestational age was approximately 15 times more likely to have a low birth weight child among mothers with less than 37 weeks of gestation than those with 37 weeks or more. It was also found that mothers with up to six weeks of gestation were approximately three times more likely to have a child with LBW than those with more than six weeks of gestation. Furthermore, LBW was identified as approximately three times more likely to occur among mothers with a double pregnancy, compared to those who had a single pregnancy **(Table 2)**. In the analysis of the spatial distribution, the variables that were statistically significant for the occurrence of teenage pregnancy and new-borns with LBW were used.

In **Figure 1**, Kernel density maps were generated, which show the cases that occurred, mostly, in the county seat. It is noteworthy that the spatial distribution of pregnant women with fewer than six prenatal consultations showed spatial clusters both at the headquarters and in the districts of the rural area of the municipality

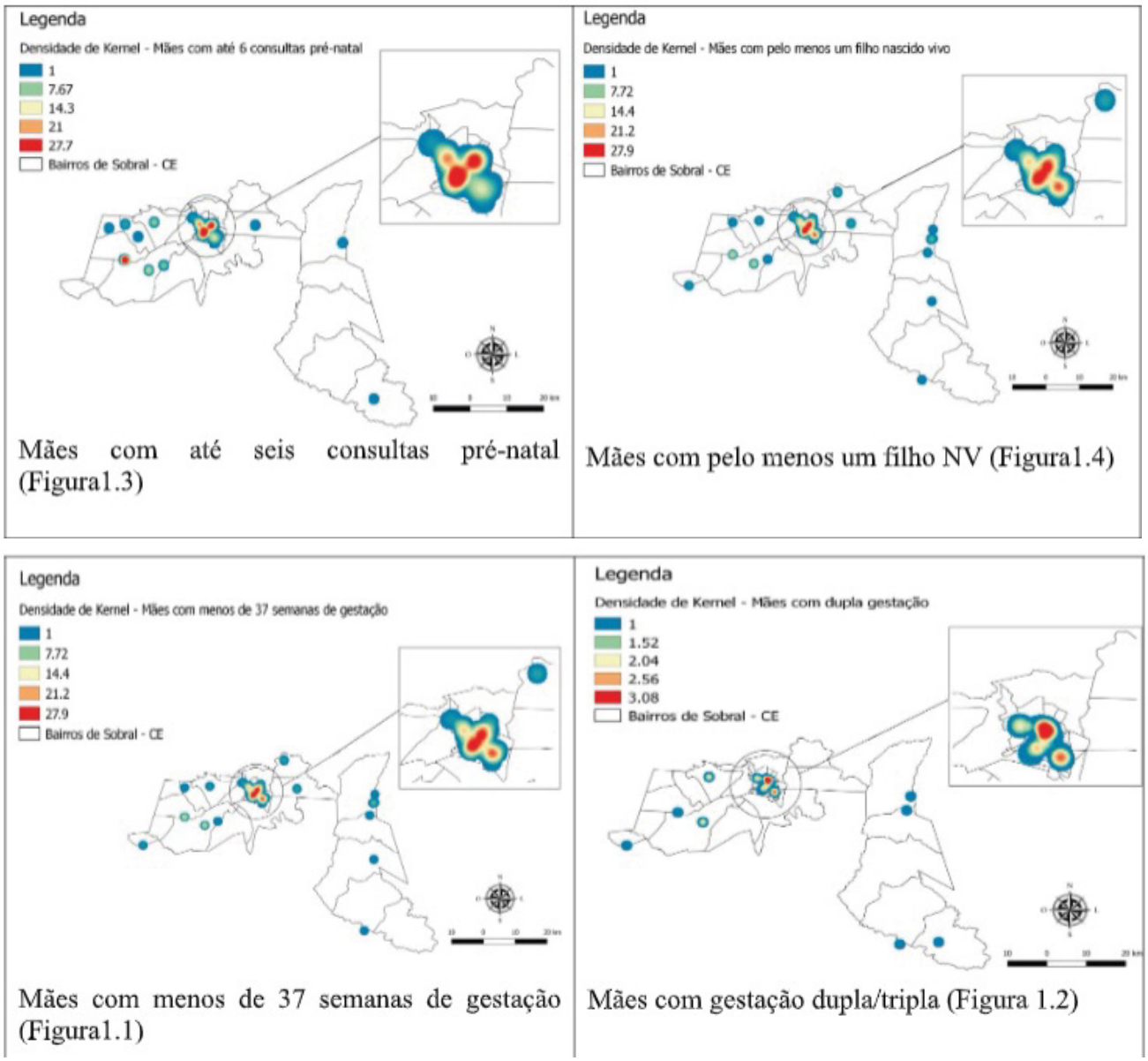

Figure 1. Kernel density estimation map applied to variables with association estatística relation to adolescents with low birth weight live-born children. Sobral, Ceará, Brazil, 2007 to 2017. **Source:** Prepared by the authors.

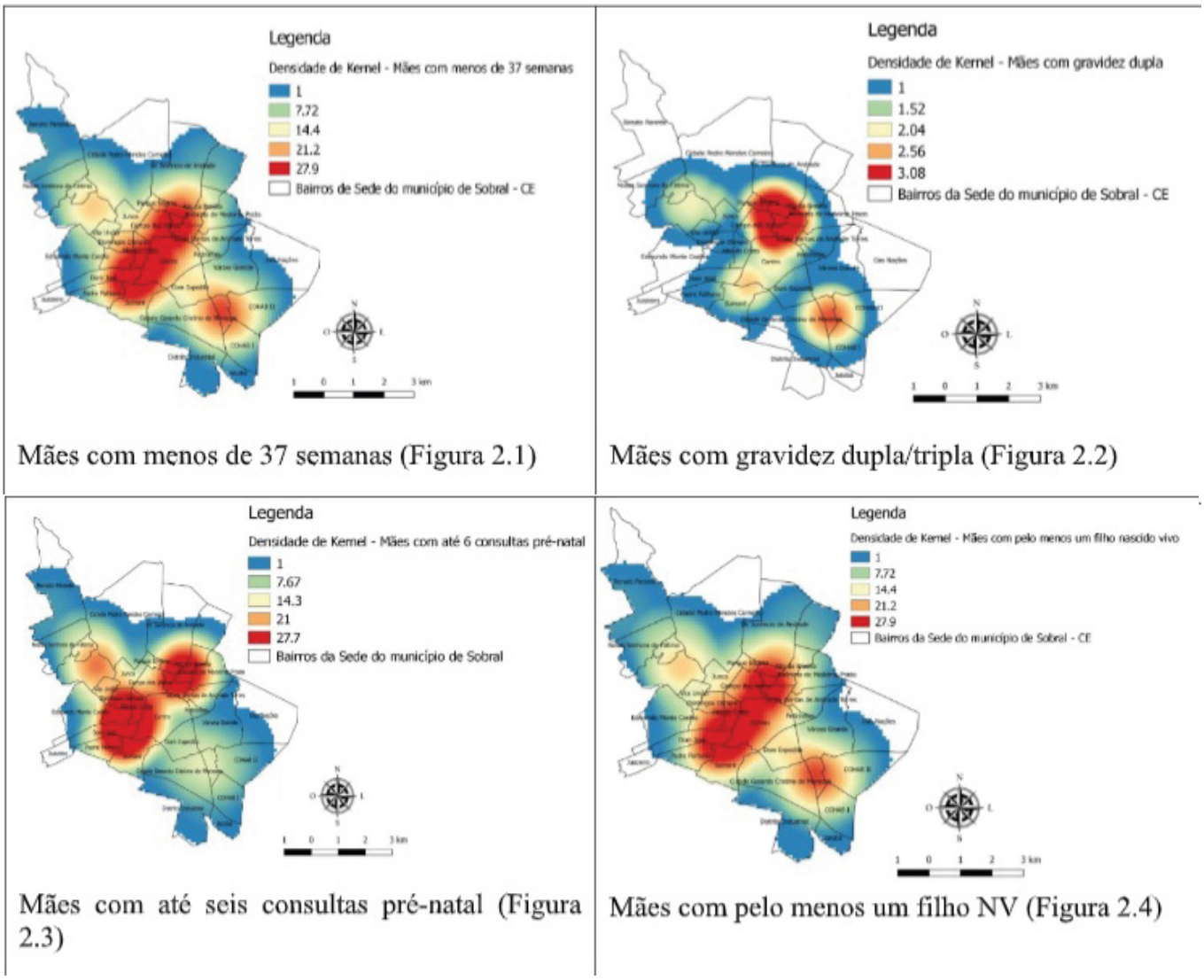

Figure 2. Maps of the county seat were generated in order to provide better visibility of the location and its intensity (measured by hot areas). Kernel density maps from headquarters showed spatial clusters in common areas and in territories with greater social demographic vulnerability

Figures 2.1 to 2.4 indicated that adolescent mothers younger than 37 weeks and those with at least one live-born child have the same Kernel density, which highlights the central region with more concentrated characteristics.

DISCUSSION

The study showed a higher frequency of LBW among new-borns of adolescents, with the main associated factor being the insufficient number of prenatal consultations. This condition is justified by the higher prevalence of LBW, with statistical significance in the multiple regression models for the group of postpartum women who attended less than six prenatal consultations. According to the Ministry of Health of Brazil, the number of appointments that should be offered to pregnant women during prenatal care must be at least six appointments, and a survey conducted in Rio de Janeiro revealed a number of less than six prenatal consultations [8], corroborating this study. In another study, in which the authors proposed to analyse how the scientific production addresses the relationship between pregnancy in adolescence and the outcome of prematurity, they identified that adolescents had fewer prenatal consultations when compared to mothers aged 20 years or more [9]. Inadequate prenatal care has been indicated as an important risk factor for pregnancy especially when related to LBW. It should be noted, however, that inadequate prenatal care can be associated with a lack and/or difficulty in accessing the service, especially in places of greater vulnerability. Furthermore, socioeconomic factors may contribute to negligence regarding the presence of prenatal consultations [8] be associated with lack of information about their importance, due to immaturity, lack of family support and/or low income. In this context, it is up to health professionals, such as nursing, to provide opportunities for Health Education based on the adequate follow-up of prenatal care, given that preventive, health-promoting, diagnostic and curative interventions are carried out in this context, in order to make viable the good outcome of the pregnancy for the binomial. It was also found that LBW is associated with gestational age, showing that new-borns, children of adolescents, were more likely to be born with less than 2, 500 grams compared to those above 37 weeks.

This condition reveals that the biological factors of the mother Interfere with the health of the foetus, corroborating research that showed that the chance of giving birth to a baby with LBW was 72 times greater among mothers who had their children with less than 37 gestational weeks. Based on this premise, LBW can be associated with a gestational age of less than 37 weeks, due to factors such as low attendance at prenatal consultations, and/or for not having had the opportunity to complete the minimum number of appointments adequate, given the early termination of pregnancy. Children born from double or triple births were more likely to be born weighing less than 2, 500 grams, corroborating the study by Mendes [10]. on twin births. In order to identify the prevalence of LBW in the city of São Paulo, the authors found that twins and triple pregnancy or more were determining factors in the prevalence of LBW, revealed in 79.90% of cases of double pregnancy. Added to this was the study by Teixeira GA, et al. [11]. who pointed out a higher occurrence of prematurity and LBW in twin pregnancies, when compared to single foetuses, and found potential risks of gestational complications, such as arterial hypertension and premature rupture of membranes. Therefore, it is understood that twins, prematurity and low birth weight are closely associated. In fact, if single pregnancies are already likely to result in low weight, pairs or more become predisposed to preterm labor with LBW NB, considering that nutritional needs (macro and micronutrients) increase during this period.

The present study showed that mothers with at least one live-born child were more likely to have children with LBW, compared to mothers without live-born children, corroborating the research by Veiga [12] in which they had a greater chance of multiparous teenager having low birth weight child. In a divergent way, it was found a greater number of mothers who had low birth weight, arising from the first pregnancy [13]. The above findings suggest that there is greater vulnerability among adolescent mothers who had one or more children alive, due to lack of education and/or low education. It was also found in this research that most teenagers declared themselves to be a housewife, noting that they were out of the labour market, in addition to having a lower frequency of prenatal care. Such social determinants in health assume a fruitful relationship with teenage pregnancy. Among the variables that showed a significant association, in the multivariate model, it was also noticed the existence of a significant spatial association, with risk of LBW arising from teenage mothers.

It was noted that most of the cases were located in the municipality (urban area), justified by having a larger population contingent, to the detriment of districts and rural areas. The highest concentrations of cases of adolescents who were more likely to have children with LBW were more evident in the central region of the city, although, in general, the other neighbourhoods also contributed to this risk. This reinforces the idea that, in the urban environment, where most of the population and, mainly, the greatest diversification of social classes, it is inexcusable to monitor the BPN, in addition to planning public policies and Public Health actions, in order to remedy the problem in the municipality. The district regions, especially those located in rural areas, present as an obstacle the difficulty of accessing health services, which creates an increased risk for the binomial. According to Stephan [14], BPN monitoring should be used as an indicator to assess the quality of care provided in health services. It was also found that the cases are concentrated in the areas of the municipality that present greater socioeconomic vulnerability, which suggests the existence of social determinants and conditions in health in the territories related to the outcome of LBW. According to Monteiro there was evidence of an association between low use of prenatal care services and low socioeconomic status. In another study, maternal risk factors associated with low weight and prematurity are related, in particular, to lifestyle habits, prenatal care, and unfavourable clinical and socioeconomic conditions [15]. Added to this is the associative existence between teenage pregnancy and prematurity, as well as being intrinsically related to the social demographic context [16]. Assessing all the situations that could influence the low birth weight of the new born, as a result of teenage pregnancy, was a limitation of this study, especially because the analysis was carried out only on the variables available in SINASC. Furthermore, it emphasizes the importance of awareness regarding the correct filling out of live birth certificates by health professionals, so that the information is increasingly reliable and capable of reflecting the reality of the health situation in the studied territory. It is evident that the risks for LBW vary between different populations. Thus, in addition to reinforcing findings in the literature, the research contributed to the mapping of the phenomenon in the study setting. In this sense, the indicators guide the planning of actions aimed at the mother and child population, especially in the most vulnerable groups. Thus, the findings may contribute to health planning, with a focus on the development of public policies and inter sectoral actions in Collective Health, in relation to maternal and child health in the medium-sized municipality under study. Therefore, the early identification of risk factors for pregnancy in adolescence favours the feasibility of quick and effective preventive strategies to avoid adverse outcomes, such as low birth weight new-borns.

CONCLUSION

It is understood that social determinants in health, as well as guidance on reproductive planning interfere with the occurrence of LBW in children of teenage mothers. Therefore, Health Education is configured as a potentiating tool in the school environment, given that it provides opportunities for critical and significant reflections on contraceptive methods among adolescents. This shows that the lack of information about the importance of prenatal consultations, the recurrence of pregnancy, prematurity and double pregnancy make teenage pregnancy with an increased risk of having a LBW child in different regions and contexts of the country. Assessing all the situations that could influence the low birth weight of the newborn, as a result of teenage pregnancy, was a limitation of this study, mainly because the analysis was developed only in the variables available in SINASC. In addition, it emphasizes the importance of awareness regarding the correct filling out of live birth certificates by health professionals, so that the information is increasingly reliable and capable of reflecting the reality of the health situation in that territory. It is suggested

to continue discussions on the subject in subsequent studies, with different approaches and methods, in order to contribute to evidence-based practice, provide opportunities for the effectiveness of comprehensive care for the binomial in pregnancy, childbirth and puerperium and guide actions and programs of health care, to this population sphere, which aim to reduce the indicators of low birth weight newborns.

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