

REGULAR ARTICLE

The rise of multiple births in Brazil

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Abstract

Aim: The aim of this study was to assess the rise in multiple births and its influence on trends of low birth weight (LBW) rates in Porto Alegre, Brazil.

Methods: This is a registry-based study of live births from 1994 to 2005 obtained from the national live birth information system. Chi-square tests for trends were assessed for LBW and multiple birth rates. The impact of multiple births on LBW trends was assessed by sequential modelling, including year and further adjustment for multiple births. Risk factors for multiple births were assessed using the Poisson regression.

Results: A total of 263 252 live births were studied. The LBW rate increased from 9.70% to 9.88% ($p < 0.001$) and the multiple birth rate rose from 1.95% to 2.53% ($p < 0.001$). LBW rate increased among twins, from 57.14% to 63.46% ($p = 0.001$). The twin birth rate rose by 24.7%, while the rate of triplets or higher-order increased by 150%. Multiple births may be responsible for 23.9% of the increase in the LBW rate over the period. Mothers with higher levels of schooling, older mothers and mothers delivering in private hospitals were more likely to deliver multiple births.

Conclusion: It seems that both the increase in multiple births and in the LBW among multiple births contributed to this rise in overall LBW rate.

INTRODUCTION

Delayed childbearing and greater availability of infertility treatments have been associated with increasing multiple birth rates in developed countries, and this increase in multiple births, in turn, can affect the infant morbidity and mortality rates (1–3) and preterm birth rates (4). A rise or stabilization of low birth weight (LBW) and preterm birth rates have also been reported as a consequence of the increasing multiple birth rates (5–8).

Some studies have shown an increase in LBW rates in Brazil in the last 10 years, and some risk factors such as increasing caesarean section rates, preterm birth rates and noncohabitation have been implicated as possible explanations. However, none of the published studies evaluated the role of multiple births in raising LBW rates in Brazil (9–11).

Trends in multiple births and its impact on LBW rate have not been explored in Brazil because of the lack of reliable databases that would provide good-quality time-series data derived from birth certificates. The “Sistema de Informação Sobre Nascidos Vivos” (SINASC) Live Births Information System, set up in 1993 by the Brazilian Health Department, collected data on births, anthropometric measurements of the newborns, medical care and mothers’ characteristics (12).

In view of these developments, this new database was used to assess trends in multiple birth rates and its possible impact

on LBW rates in Porto Alegre, a developed area in South Brazil.

METHODS

This is a study of live births registered from 1994 to 2005 in Porto Alegre, a city of 1 440 939 inhabitants in the south of Brazil. Porto Alegre is one of the wealthiest cities of South America (9). The data for this study were obtained from the SINASC. The database is based on all-birth certificates in the city. This database provides information about hospital and home deliveries. Data about home deliveries were obtained monthly, searching all registry offices of the city. Under-registration of births has been estimated to represent only 0.1% of all live births (12).

Only variables collected since the beginning of SINASC in 1993 have been included in this analysis. All births below 500 g were excluded from the analyses because their reporting has been inconsistent over time. There were 76 births weighing less than 500 g (51 singletons, 20 twin births and 5 triplets or higher-order births).

The variables included in this analysis were: LBW (<2500 g), parity (none, 1–2, 3–4 and 5 or more), singleton or multiple births (twins and triplets or higher-order births), maternal age (less than 21, 21–30, 31–35 and >35 years), type of delivery (vaginal or caesarean), type of hospital (public, mixed [private, attending to predominantly publicly insured patients] and private hospitals), maternal education level

(0–7 years and 8 years or over) and gestational age (in intervals of 2 weeks of gestational age).

Trends of risk factors for LBW were assessed by the Chi-square test for trend. Annual relative risks (RR) for LBW comparing multiples and singletons with 95% confidence interval (CI) were calculated. A linear trend for the RR over the period was calculated by linear regression; low birth weight (RR) was used as a dependent variable and year as an independent variable. Sequential Poisson regression models were used to estimate the influence of multiple births on trends of LBW over the period and were also used to assess risk factors for multiple births and risk factors for LBW in multiple births. In these models, the RR was estimated. For the sequential modelling, a dichotomous variable was created to represent multiples (categorized as 1 for multiples and 0 for singletons). Year was included in the model as a continuous variable and the period effect was estimated as a yearly (linear) trend. A log-likelihood ratio test compared the two nested models (adjusted for year and also for multiple births). The analysis has taken into account the cluster structure of the multiple birth component. The analysis was performed using the statistical software package STATA version 9.0 (StataCorp LP, College Station, TX, USA).

RESULTS

There were 5512 (2.1%) multiple births, including 207 triplets or higher-order births (0.07%), out of a total of 263 252 newborns over a period of 12 years. There was a

small but significant increase in LBW rates from 9.70% in 1994 to 9.88% in 2005 (Chi-square for trend $p < 0.001$). This rise occurred among singletons, from 8.74% in 1994 to 9.07% in 2004, but reduced to 8.45% in 2005 (Chi-square for trend $p < 0.001$). LBW rate also increased among twins, from 57.14% to 63.49% (Chi-square for trend $p = 0.001$). LBW rate among triplets or higher-order births remained high over the whole period. The twin birth rate rose by 24.7%, while the rate of triplets or higher-order births increased by 150%. Despite a concomitant slight increase in LBW among singletons, the RR for LBW comparing multiple births to singletons increased with some seesawing during the period ($p = 0.046$) (Table S1).

Table 1 depicts sequential regressions for LBW. LBW increased by 0.76% per year. When adjusted for multiple births, the annual percentage increase in LBW decreased slightly to 0.58%, indicating that multiple births may account for 23.9% of the increase in the LBW rate over the period. We tested the difference between the two nested models and found it highly significant ($p < 0.001$).

Figure 1 shows that multiple birth rates increased significantly over the period (1.6%). After adjustment for maternal schooling, maternal age, hospital and parity, the annual percentage increase was slightly lower (1.4%), but remained significant. Mothers over 20 years of age had a higher risk for multiple births than the younger ones. Higher level of education and higher number of live births were related to multiple births in the unadjusted analysis, but these associations disappeared after adjustment. Those mothers who delivered in private hospitals were more likely to have multiple births in comparison to those delivering in public or mixed hospitals.

The unadjusted risk of LBW among multiple births increased over the period of observation, but decreased to a nonsignificant level after adjustment (Fig. 2). Nulliparity and maternal age in the 31 years or over and the fewer than 21 years age groups were associated with a higher risk for LBW, and after adjustment, the effect size remained similar. Low maternal schooling was associated with LBW among multiple births only after adjustment. Triplets or higher-order births were at a higher risk of LBW compared to twins, and the association decreased after adjustment, but remained strong. Type of delivery and type of hospital were not associated with LBW among multiple births.

Table 1 Sequential analysis for low birth weight in Porto Alegre, Brazil, from 1994 to 2005

Adjustment	RR*	95% CI†	% reduction	Log-likelihood ratio test‡
Year§	1.0076	1.0040–1.0112	–	–
For year and adjusted for all multiple births¶	1.0058	1.0024–1.0092	23.9	<0.001

*RR = relative risk, estimated by Poisson regression model.
 †CI = confidence interval. Birth weights <500 g were excluded from the analysis.
 ‡Log-likelihood ratio test comparing the two nested models.
 §Year was included as a continuous variable.
 ¶Multiple births were coded as 1 and singletons as 0.

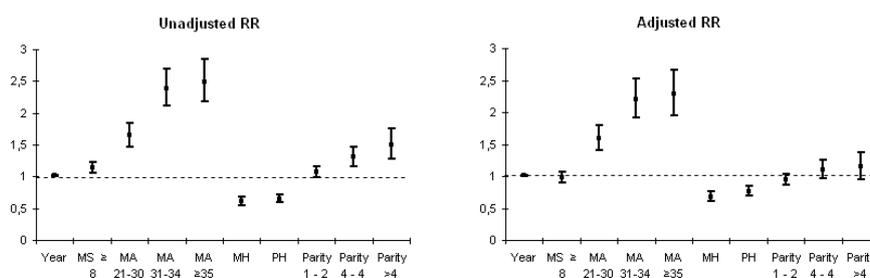


Figure 1 Unadjusted and adjusted relative risk (RR) and 95% CI for multiple births in Porto Alegre, Brazil, from 1994 to 2005. MS = maternal schooling; MA = maternal age; MH = mixed hospital; PH = public hospital.

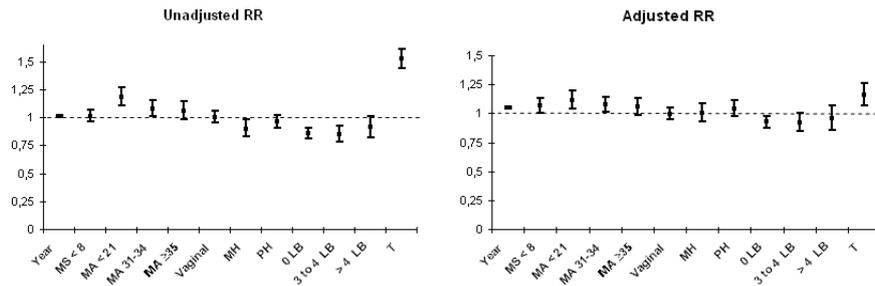


Figure 2 Unadjusted and adjusted relative risk* (RR) for low birth weight among multiple births in Porto Alegre, Brazil, from 1994 to 2005.

DISCUSSION

The rate of multiple births increased significantly over the period. The increases in twin birth rates were lower than in most developed countries during the 1980s and 1990s, but the triplet and higher-order birth rates were of similar magnitude (2). The twin birth rate rose by 24.7%, while the rate of triplets or higher-order births increased by 150%. Increase in twin birth rate in France was 45% and slightly higher than in England-Wales, with an increase of 41% in the same period (2). In the United States, the increase in twins was 39% and in triplets, 358% (2,3).

It seems that in Porto Alegre, both the increase, mainly, in the multiple birth rates and, in small proportion, in the LBW rate among multiple births contributed to this rise in the overall LBW rate. Multiple birth rates explained about 23.9% of the increase in the LBW rate during the period. Some studies have shown that most of the contribution of multiple births in increasing LBW rates came from twins (13,14).

The rise of LBW among multiple births had less influence on the LBW rate in Porto Alegre, possibly because LBW rate among singletons is much higher. The increasing trend of LBW rate among multiple births was nonsignificant after adjustment for maternal schooling, maternal age, number of live births and whether births were twins or triplets or higher-order ones, indicating that these variables explained most of the increasing trend in LBW among multiple births.

In developed countries, assisted reproductive technologies (ART) and delayed childbearing, especially in more privileged social strata, have been associated with an increasing trend in multiple births rate (10,15,16). In this study, mothers with higher levels of schooling, older mothers and mothers delivering in private hospitals were more likely to deliver multiple births. Our results have confirmed a previous study in Brazil, showing that delivery in private hospitals can be associated with ART in high socioeconomic strata (17). This technology has been available in Brazil since the beginning of the 1980s in private and public health services. The Federal Medical Council has attempted to regulate ART, but the norms currently available are minimal. In terms of number of transferred embryos, there is a recommendation for transferring no more than four embryos (18).

In the multiple births group, the risk factors for LBW are similar to those shown for singletons in previous studies in Brazil (19,20). The results show that teenage mothers and

nuliparity are risk factors for LBW in multiple birth pregnancies. In Brazil, pregnancy in young women has been associated with lower access to intensive prenatal care (21), whereas delayed childbearing is related to easier access to intensive prenatal care (17). In young mothers, prenatal care could lead to an early detection of gestational problems such as intrauterine growth restriction (22).

The increase in triplets was an important factor related to LBW during the period. In developed countries, the majority of triplets have been conceived by ART: 86% in Israel, 77% in Belgium and approximately 43% in United States (23–26). These findings suggested that the increase in triplets or higher-order births in our study might also be linked to ART. The significant relationship between triplets and excess mortality and morbidity in these countries creates concern about the impact of *in vitro* fertilization on pregnancy outcome in Porto Alegre (27).

This is the first population study in South America that has evaluated the impact of multiple births on LBW rates. The strengths of this study are the completeness of the data set of births in Porto Alegre and the reliance on well-defined variables. Its weakness is the limited number of variables available on the birth certificate. Information on maternal smoking during the gestational period, usually related to LBW, was unavailable on birth certificates (8). This variable may explain, at least partially, the high LBW rates in Porto Alegre, but it is unlikely, on current evidence, that smoking behaviours would have influenced the multiple birth rates. The rate of maternal smoking has decreased during the last 30 years in Brazil; thus, its effect on LBW may have had a limited impact in our study (6). Moreover, we were able to include in our study many of the factors associated with maternal smoking such as socioeconomic background and higher access to medical care (1,2). Unfortunately, we were unable to assess the direct impact of obstetric interventions such as the number of prenatal care visits, the use of ultrasound, induction of labors and the availability and use of ART. Thus, inclusion of these variables could have explained the residual risk for LBW on multiple births that remained after adjustment for the studied variables. An underestimation of the impact of multiple births on LWB due to the exclusion of infants with birth weight less than 500 g from the analysis is unlikely because the number of exclusions was too small and inclusion of those weighing less than 500 g did not change the results significantly.

In conclusion, the increase in multiple birth rates could be explained by sociocultural and demographic factors that impinge on reproductive behaviours in some regions of Brazil. Delayed childbearing and increasing use of obstetric interventions may play a significant role in the increasing multiple birth and LBW rates. These characteristics have become a fact of life in developed countries and are also developing in middle industrial countries such as Brazil.

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Supplementary material

The following supplementary material is available for this article:

Table S1 Number of births, low birth weight (LBW) rates, percentage distribution of births and LBW rates among singletons, twins and triplets or higher-order births, and relative risk for LBW comparing multiple and singletons births, in Porto Alegre, Brazil, from 1994 to 2005

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