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CLINICAL ARTICLE

The increasing trend in preterm birth in public hospitals in northern Argentina

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ABSTRACT

Objective: To identify factors associated with the increasing incidence of preterm birth in northern Argentina. *Methods:* In an observational study, data were reviewed from a prospective, population-based registry of pregnancy outcomes in six cities in 2009–2012. The primary outcome was preterm birth (at 20–37 weeks). Bivariate tests and generalized estimating equations were used within a conceptual hierarchical framework to estimate the cluster-corrected annual trend in odds of preterm birth. *Results:* The study reviewed data from 11 433 live births. There were 484 (4.2%) preterm births. The incidence of preterm births increased by 38% between 2009 and 2012, from 37.5 to 51.7 per 1000 live births. Unadjusted risk factors for preterm birth included young or advanced maternal age, normal body mass index, nulliparity, no prenatal care, no vitamins or supplements during pregnancy, multiple gestation, and maternal hypertension or prepartum hemorrhage. The prevalence of many risk factors increased over the study period, but variations in these factors explained less than 1% of the increasing trend in preterm birth. *Conclusion:* The incidence of preterm births in six small cities in northern Argentina increased greatly between 2009 and 2012. This trend was unexplained by the risk factors measured. Other factors should be assessed in future studies.

1. Introduction

Improving birth outcomes has been a global priority for many years, with a focus on decreasing neonatal morbidity and mortality by increasing access to skilled healthcare providers. Preterm birth is the leading direct cause of neonatal mortality, resulting in 1 million newborn deaths annually [1]. Historically, preterm birth rates have been highest in low- and middle-income countries [2]. In the past three decades, however, the rate of preterm births has been rising in some middle- and high-income countries despite a high level of access to health services [2,3].

Spontaneous preterm labor and subsequent preterm birth are thought to be caused by a small number of mostly asymptomatic pathologies that might be influenced by internal and external maternal factors, including genetic, environmental, behavioral, and socioeconomic factors. Preterm elective induction or cesarean delivery could also be influenced by maternal or fetal risk factors and indications, the healthcare system, provider preferences, or imprecise estimates of gestational age [3–6]. Thus, research on the role of health systems and sociodemographic factors related to preterm birth might provide insight into the prevention of preterm births [7].

A rise in the prevalence of preterm birth is concerning not only because prematurity accounts for an average of 35%, and up to 65%, of deaths in the first 4 weeks of life [8], but also because surviving preterm neonates often require costly intensive care and are at increased risk of medium- and long-term health and developmental problems [2]. Thus, identifying factors associated with an increasing rate of preterm birth is crucial for both developing policies and implementing targeted and contextually appropriate interventions to reverse the trends [4,7]. Northern Argentina is one region where preterm birth rates have been rising despite universal access to maternity care even among disadvantaged populations [9].

The aim of the present study was to identify factors associated with the increasing trend in preterm birth in six small cities in Argentina.

2. Materials and methods

The present observational study reviewed secondary survey data from a prospective population-based registry of maternal and neonatal health outcomes in the Corrientes and Santiago del Estero provinces of Argentina between January 1, 2009, and December 31, 2012 [10,11]. This registry was compiled by the NICHD Global Network for Women's and Children's Health Research in Argentina (henceforth, Global Network) to identify all pregnant women and record pregnancy outcomes up to 6 weeks after delivery. Women provided informed consent for

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inclusion at the time of delivery. Detailed information about study design and ethics procedures have been described elsewhere [10,11].

The present study used data from six Global Network study clusters, which were randomly selected from two provinces in Argentina. Each cluster comprised a small city in the interior of the country with approximately 500 deliveries per year. Information was collected in public hospitals at the time of delivery from women and their hospital records. Self-reported information on prenatal care was collected retrospectively at the time of enrollment. For the present analysis, data from the partial years 2008 and 2013 and pregnancies that ended in spontaneous abortion, were medically terminated, or had missing data were excluded.

The primary study outcome was preterm birth, which was defined as any singleton or multiple live birth occurring at a gestational age of 20–37 weeks [1]. All study hospitals used either date of last menstrual period or ultrasonography for gestational age assessment, recording the best obstetric estimate on the basis of the information available. Time trends were assessed by calendar year of birth.

Because preterm birth is determined by multiple factors, some of which directly influence this outcome (e.g. genetics and maternal health) and some of which have a more complex effect (e.g. socioeconomic influences), preterm birth was modeled via a conceptual hierarchical framework first adapted from Victora et al. [12]. This framework was used to identify and depict the multiple levels of influence on preterm birth, and to consider the different levels of potential intervention.

Potential risk factors associated with the trend in preterm birth were controlled for via a four-level framework (Fig. 1): level 1 was maternal characteristics, including maternal age, education, and pre-pregnancy body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters); level 2 was reproductive history, including parity and last delivery outcome; level 3 was current or index pregnancy characteristics, including receipt of prenatal care, prenatal vitamins or iron supplements, multiple pregnancy, any evidence of hypertensive disease in pregnancy (e.g. severe pre-eclampsia or eclampsia), and prepartum hemorrhage; and level 4 was delivery characteristics represented by mode of delivery. Maternal characteristics, the highest level in the framework, included factors that might directly influence preterm birth or act through a number of other, more proximate risk factors in levels 2, 3, and 4 to influence preterm birth. Similarly, risk factors in level 2 might also influence preterm birth directly or through risk factors in levels 3 and 4, and so on. This conceptual hierarchical framework was constructed using knowledge of the demographic and biological determinants of preterm birth.

Data analysis was carried out using Stata version 13 (StataCorp, College Station, TX, USA). Overall descriptive statistics were generated for factors associated with preterm birth, and the incidence of preterm birth within subgroups was tabulated. The bivariate relationship between each risk factor and preterm birth was assessed by estimating the unadjusted odds ratio of preterm birth for each high-risk subgroup as compared with the low-risk reference group. Descriptive statistics were then generated by year, and Royston χ^2 test for linear trend of categorical variables was used to identify trends.

The odds of preterm birth was adjusted by modeling preterm birth on time and one risk factor at a time, and then the percentage difference in the annual mean odds of preterm birth was calculated for each model versus the time-only adjusted model to gauge the contribution of each factor independent of time. Lastly, by using factors associated with preterm birth, the fully adjusted change in odds of preterm birth per year was estimated via a generalized estimating equation that facilitated within-cluster correlation of the error terms.

The results were generated in a multistep process, beginning with the time-adjusted annual change in odds of preterm birth and then sequentially adding risk factors within each level of the hierarchical model to evaluate how factors at each level might have accounted for the trend in preterm birth. A threshold of a 10% change in odds was predetermined as a meaningful change in the adjusted odds of preterm birth versus the time-only adjusted trend. Because many birth records had missing information on maternal pre-pregnancy BMI and last pregnancy outcome (owing to nulliparity), these indicators were omitted from the final generalized estimating equation analyses. $P < 0.05$ and 95% confidence intervals (CIs) were used to assign statistical significance.

3. Results

During the study period, there were 11 433 live births that met the inclusion criteria, with 484 (4.2%) preterm births. The final generalized estimating equation analyses included 10 759 live births; there were 425 (4.0%) preterm births with complete data. Fig. 2 shows the trends in delivery outcomes in the study sample between 2009 and 2012. The incidence of preterm birth increased from 37.5 to 51.7 per 1000 live births. The rate of stillbirths and neonatal deaths also increased over time; however, the sample size did not facilitate an analysis of these trends. The incidence of multiple pregnancies did not change over the study period.

Table 1 presents descriptive statistics by level of the hierarchical model, in addition to the prevalence of preterm birth and its relationship with each factor. The sample comprised women who were mainly 20 years or older, had completed primary school, and mostly had other children. Prenatal care was almost universal and rates of pregnancy

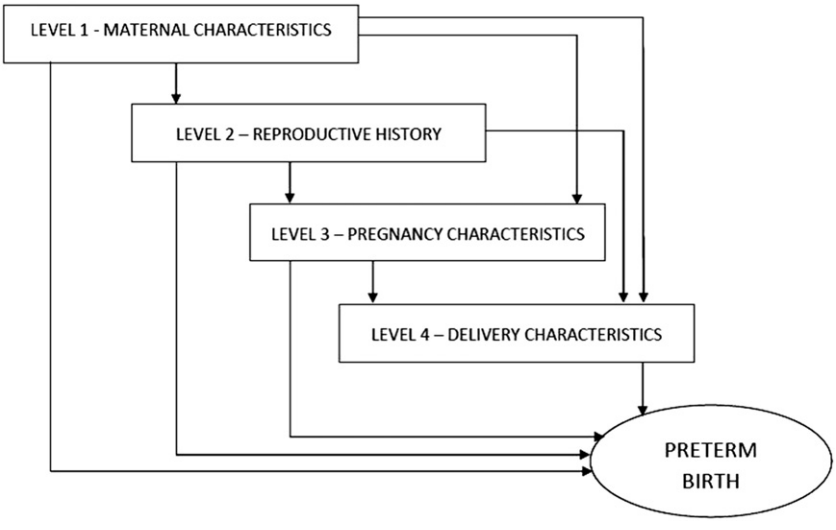

Fig. 1. Hierarchical model showing the factors associated with preterm birth by level.