Incidence of prematurity and associated risk factors among users of a health insurance company

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Abstract

Objectives: to analyze the incidence of prematurity in users of a health insurance plan; to analyze the associated risk factors.

Methods: a retrospective study was conducted in five maternity hospitals with puerperal women who were users of health insurance plans by telephone interviews guided by a semi-structured questionnaire. The variables studied were related to sociodemographic, clinical and outcome conditions. Univariate and multivariate analysis with Backward logistic regression was performed.

Results: 1,193 participants were evaluated and 116 premature births were identified. It was found that preterm birth (p<0.001; OR=4.596; CI95%=2.544-8.305), oligohydramnios (p=0.019; OR=2.697; CI95% =1.140-6.380), diabetes mellitus prior to pregnancy (p<0.001; OR=4.897; CI95%=2.147-11.169), twin pregnancy (p<0.001; OR=7.115; CI95%=3.578–14.148), autoimmune disease (p<0.001; OR=3.799; CI95%=1.987-7.260), stress during pregnancy (p=0.026; OR=1.568; CI95%=1.053-2.335), urinary infection (p=0.008; OR=1.825; CI95%=1.161-2.867), placenta previa (p=0.001; OR=3.180; CI95%=1.517–6.667), pre-eclampsia (p<0.001; OR=4.833; CI95%=2.860-8.169), gestational bleeding (p=0.001; OR=2.185; CI95%=1.340-3.564), interval between pregnancies less than six months (p=0.001; OR=3.502; CI95%=1.594-7.698), pregnancy resulting from in vitro fertilization (p<0.001; OR=2.874; CI95%=1.466-5.637) were statistically relevant as risk factors for prematurity.

Conclusion: knowledge of these factors may be important in developing strategies to improve the assistance offered to pregnant women by the health insurance providers.

Key words *Premature birth, Pregnancy high-risk, Risk factors, Insurance health*

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Introduction

Premature or preterm birth is defined as birth occurring after 20 weeks and before 37 weeks of gestation or 259 days of gestational age.[1] With regard to classification by gestational age, prematurity can be subdivided into: extreme prematurity (<28 weeks); very prematurity (28 to <32 weeks); moderate prematurity (32 to <34 completed weeks) and late prematurity (34 to <37 completed weeks).[2]

Recent data from the World Health Organization (WHO) show that, globally, the prevalence of premature births ranges from 5% to 18%, and that every year around 15 million babies are born prematurely, which represents 11.1% of live births worldwide.[3] In Brazil, around three million births occur every year, of which 279,000 are preterm births (9.3%).[4]

Prematurity can be classified as: spontaneous, resulting from spontaneous labor or premature rupture of membranes, or elective, when it is medically indicated due to complications with the fetus or the mother.[5]

The etiology of preterm birth is multifactorial and often not fully understood. Several risk factors may be involved in this process.[6] Among the situations that increase the occurrence of birth before the adquate moment, the following are: maternal age below 16 or above 35, previous preterm labor, previous abortion,[7,8] asymptomatic bacteriuria or urinary tract infection, unhealthy working conditions,[7] periodontal disease[9] gestational interval of less than six months,[10] oligohydramnios,[11] assisted reproduction,[12] gestational bleeding[8] and post-traumatic stress syndrome.[8,9]

Comparing to full-term babies, premature newborns are more prone to respiratory problems, difficulties in starting to feed and complications during hospitalization, such as hypothermia, hypoglycemia and hyperbilirubinemia. In addition, there is an increased risk of neonatal mortality and impaired neurological development in the long term.[13] The economic cost of premature birth is also high in terms of the ongoing neonatal intensive care and ongoing health care is required after its occurrence.[9] These costs are high both in the public service and as in the health insurance providers (HIP).

In this sense, it is extremely important to recognize pregnant women with risk factors and try, through adequate prenatal care, to rule out these conditions or minimize their impact during pregnancy, in order to avoid future complications for the newborn.[14] It should be stressed that in Brazil, there is still no systematically collected information, through standardized databases for recording hospital obstetric and neonatal care, with wide coverage, which includes supplementary care, as in developed countries. Therefore, it is important to carry out specific population studies with primary data collection. However, this study aimed to analyze the incidence of prematurity and the associated risk factors among users of a HIP.

Methods

This is a retrospective observational cohort study. It was carried out in all the maternity hospitals (n=5) served by a HIP in the city of Curitiba-PR, using interviews guided by a semi-structured questionnaire. The study participants were puerperal women who gave birth during the data collection period (September 2021 and July 2022), who were contacted by telephone and agreed to take part in the study. Those who did not want to answer the questionnaire or who could not be contacted within 30 days of giving birth were excluded.

The sample was sequential and by convenience through a single nurse who was masked to the prematurity outcome. The administrative capacity of the HIP did not allow the collection for all the puerperal women.

During one year there were a total of 6,218 deliveries at the HIP and, during the study period, there were 5,181 deliveries. A total of 1,193 puerperal women were randomly included from all the maternity hospitals served by the HIP.

The data was collected using a specific instrument, which contained sociodemographic variables (age, level of schooling), clinical variables (height, weight before pregnancy and at delivery, number of pregnancies, number of previous cesarean sections, number of previous normal deliveries, number of miscarriages and fetal deaths, previous miscarriage, previous premature birth, placenta previa, pre-eclampsia, twin pregnancies, gestation interval of less than six months, in vitro fertilization pregnancies, oligohydramnios, diabetes mellitus prior to pregnancy, gestational diabetes, bleeding during pregnancy, drug use, unhealthy conditions, COVID-19 during pregnancy, periodontal disease, kidney disease, autoimmune disease, sexually transmitted infections, urinary tract infection, procedure on the uterus or cervix during pregnancy, stress during pregnancy, history of heart and lung disease, epilepsy, COVID-19 vaccination, which vaccination and support network), and outcome (premature birth). A new variable was created called number of risk criteria, for which the number of criteria was calculated, counting one point for each criterion presented by the puerperal woman.

All data collection was carried out by a nurse trained by the research team, only by telephone within 30 days of delivery.

The data collection was transferred to the spreadsheets and processed using the Statistical Package for the Social Sciences (SPSS for Windows, version 21.0).

When describing the participants, categorical data was expressed as percentages and continuous variables as means and standard deviations. To assess any differences between the groups, the χ^2 test or Fisher's exact test were used bilaterally, with $p<0.005$ being considered. Univariate and multivariate odds ratios (OR) and 95% confidence intervals (CI) were also calculated. In order to create a predictive model, the variables with $p<0.10$ in the univariate analysis were included in a logistic regression with Backward analysis.

The variables included in step one of the logistic regression were: age; age group; height; weight before pregnancy; Body Mass Index (BMI) before delivery; weight before delivery; BMI at delivery; malnutrition; number of previous pregnancies; number of previous normal deliveries; number of previous cesarean sections; number of previous abortions or fetal deaths; age over 35; previous abortion; previous prematurity; drug use; unhealthy conditions; birth complications; Covid-19 in pregnancy; oligohydramnios; gestational diabetes; twins; diabetes mellitus prior to pregnancy; periodontal disease; kidney disease; autoimmune disease; reported stress; placenta previa; pre-eclampsia; gestational bleeding; sexually transmitted infections; pregnancy with a gestational interval of less than six months; uterine procedure during pregnancy; surgery on the cervix; uterine infection; history of heart disease; history of lung disease; epilepsy; previous eclampsia; pregnancy from in vitro fertilization; number of risk criteria; support network; vaccination against Covid-19; which vaccine performed and number of urinary tract infections.

Due to a failure to fill in the questionnaire, the analysis was carried out on the data that was available for each variable, which caused a difference in the total number of pregnant women and newborns in some data, but without compromising the statistical analysis of the work.

The study complied with the National ethics standards for research involving human beings and was approved by the *Universidade Positivo* Research Ethics Committee (CAAE: 40447620.7.0000.0093; nº 4.712.895, 14/05/2021).

Results

1,193 puerperal women were included. The prematurity rate was 9.7% in the sample studied (n=116). The mothers' age ranged from 17 to 52, with a mean of 31.91 years (±5.46). There was a predominance of patients who had completed higher education (Table 1).

The maternal risk factors that showed statistical significance in the univariate analysis were previous prematurity ($p<0.001$; OR=4.596; CI95%=2.544-8.305), oligohydramnios ($p=0.019$; OR=2.697; CI95%=1.140-6.380), diabetes mellitus prior to pregnancy ($p<0.001$; OR=4.897; CI95%=2.147-11.169), twin pregnancy ($p<0.001$; OR=7.115; CI95%=3.578-14.148), autoimmune disease ($p<0.001$; OR=3.799; CI95%=1.987-7.260), stress during pregnancy ($p=0.026$; OR=1.568; CI95%=1.053-2.335), urinary infection ($p=0.008$; OR=1.825; CI95%=1.161-2.867), placenta previa ($p=0.001$; OR=3.180; CI95%=1.517-6.667), pre-eclampsia ($p<0.001$; OR=4.833; CI95%=2.860-8.169), gestational bleeding ($p=0.001$; OR=2.185; CI95%=1.340-3.564), interval between pregnancies of less than 6 months ($p=0.001$; OR=3.502; CI95%=1.594-7.698) and in vitro fertilization pregnancies ($p<0.001$; OR=2.874; CI95%=1.466-5.637)(Table 2).

Regarding to the variables related to the newborns, there was a predominance of normal weight (90.8%), and late preterm infants (97.9%) (Table 3).

Table 1

Sociodemographic data of puerperal women included in the study. Curitiba, 2021-2022.

Factors	Premature		Non premature		*p**
	n	%	n	%	
Level of schooling					0.773
Incomplete elementary school	0	0.0	1	0.1	
Complete elementary school	0	0.0	7	0.6	
High school incomplete	0	0.0	11	1.0	
High school complete	36	31.0	290	26.9	
High education incomplete	5	4.3	56	5.3	
High education complete	68	58.6	622	57.8	
Post-graduate complete	7	6.1	84	7.8	
Not informed	0	0.0	6	0.5	
Total within the group	116	100.0	1077	100.0	
Age group (years)					0.881
≤25	17	14.7	143	13.3	
> 26 and < 35	62	53.4	571	53.0	
≥35	37	31.9	363	33.7	
Total within the group	116	100.0	1077	100.0	

*Chi-square.

Table 2

Maternal factors related to prematurity. Curitiba, 2021-2022.

Factors	Premature		Non premature		*p**	OR (CI95%)
	n	%	n	%		
Previous prematurity	18	7.7	41	4.1	<0.001	4.596 (2.544 – 8.305)
Oligohydramnios	7	3.0	25	2.6	0.019	2.697 (1.140 – 6.380)
Diabetes mellitus prior to pregnancy	9	3.9	18	1.8	<0.001	4.897 (2.147 – 11.169)
Twin pregnancy	15	6.0	22	2.2	<0.001	7.115 (3.578 – 14.148)
Autoimmune disease	14	6.4	37	3.7	<0.001	3.799 (1.987 – 7.260)
Stress during pregnancy	44	18.9	302	30.5	0.026	1.568 (1.053 – 2.335)
Urinary tract infection	29	12.4	168	17.0	0.008	1.825 (1.161-2.867)
Placenta previa	10	4.3	31	3.1	0.001	3.180 (1.517 – 6.667)
Pre-eclampsia	24	10.3	55	5.6	<0.001	4.833 (2.860 – 8.169)
Bleeding	24	10.3	116	11.7	0.001	2.185 (1.340 – 3.564)
Pregnancy interval of less than 6 months	9	3.9	25	2.6	0.001	3.502 (1.594 – 7.698)
Pregnancy from in vitro fertilization	12	5.2	44	4.5	0.001	2.874 (1.466 – 5.637)

*Chi-square. All variables with *p*>0.05 were removed: education; age; height; weight prior to pregnancy; Body Mass Index (BMI) prior to pregnancy; weight prior to delivery; BMI at delivery; malnutrition; number of pregnancies; number of previous cesarean sections; number of previous normal deliveries; number of miscarriages and fetal deaths; previous miscarriage; drug use; unhealthy conditions; Covid-19 during pregnancy; gestational diabetes; periodontal disease; kidney disease; sexually transmitted infections; uterine procedure during pregnancy; surgery on the cervix; history of heart disease; history of lung disease; epilepsy; Covid-19 vaccination; which vaccine was given; support network. There may be more than one risk factor for each premature baby.

Table 3

Newborns' characteristics. Curitiba, 2021-2022.

Variables	n	%
Weight classification		
Normal	1083	90.8
Low weight	72	6.0
Not informed	38	3.2
Prematurity classification		
Late	102	87.9
Moderate	10	8.6
Very premature	3	2.6
Extremely premature	1	0.9

Table 4 illustrates the variables that were kept in the final logistic regression model and which made it possible to understand the risk factors that are related to the occurrence of prematurity. We highlight the existence of an association between weight before pregnancy (p=0.005), previous BMI (p=0.014), weight before delivery (p=0.005), BMI at delivery (p=0.007), number of previous cesarean sections (p=0.015), unhealthy conditions (p=0.028), pre-eclampsia (p=0.001) and cervical surgery (p=0.033) and the occurrence of prematurity.

Table 4

Variables maintained in the final logistic regression model. Curitiba, 2021-2022.

Variables	B	S.E.	Wald	*p*	Exp(B)	CI95% for Exp (B)
Age	0.108	0.060	3.239	0.072	1.114	0.990-1.252
Pre-pregnancy weight	-2.276	0.890	6.533	0.011	0.103	0.018-0.588
Previous BMI	6.000	2.433	6.081	0.014	403.328	3.435-4795.153
Weight before childbirth	2.272	-0.816	7.749	0.005	9.700	1.959-48.029
BMI at delivery	-6.077	2.255	7.264	0.007	0.002	0.000-191
Number of previous cesarean	1.220	0.500	5.947	0.015	3.387	1.271-9.030
Unhealthy conditions	2.491	1.132	4.846	0.028	12.075	1.314-110.947
Diabetes mellitus prior to pregnancy	5.531	4.739	1.362	0.243	252.345	0.23-272687.307
Kidney disease	-24.022	12905.931	0.000	0.999	0.000	0.000
Autoimmune disease	2.605	1.520	2.936	0.087	13.526	0.687-266.150
Pre-eclampsia	4.260	1.312	10.549	0.001	70.793	5.415-925.488
Cervical surgery	3.840	1.798	4.563	0.033	46.526	1.373-1576.959
Number of risk criteria			4.318	0.742		
One risk criterion	-20.921	7217.268	0.000	0.998	0.000	0.000
Two risk criteria	-1.647	1.858	0.786	0.375	0.193	0.005-7.351
Three risk criteria	-0.586	1.807	0.105	0.746	0.557	0.016-19.212
Four risk criteria	-1.230	1.789	0.473	0.492	0.292	0.009-9.735
Five risk criteria	-3.125	1.973	2.508	0.113	0.044	0.001-2.101
Six risk criteria	-1.401	2.111	0.440	0.507	0.246	0.004-15.438
Seven risk criteria	-24.039	526.987	0.000	0.999	0.000	0.000
Constant	-5.391	3.967	1.847	0.174		

B= regression coefficient; S.E.= standard error; Wald= importance of each variable in the model; Exp(B)= exponentiated logistic coefficients; CI95%= confidence interval; BMI= body mass index.

Discussion

The incidence of prematurity in this study was 9.7%. It should be noted that in Brazil, the prematurity rate between 2011 and 2021 was 11.1%[15] and has been showing a stable trend. In relation to current options for prevention, these are still limited.[16] In this study, 87.9% of premature babies were classified as late preterm. This condition is considered a risk given the metabolic and neurological immaturity of this group of premature.[16]

Regard to the age and prematurity variable, many authors agree that women who are 35 or older are more likely to suffer from gestational complications and have greater implications for gestational outcomes and neonatal results.[17] However, this study did not show statistical significance when evaluating this variable in a univariate and multivariate analysis, perhaps because most of the puerperal women included did not fall into the extreme age group.

According to the literature, a previous premature birth increases the risk of having another premature birth by three to four times. The number of recurrence is also associated with a five to six-fold increase in the chance of having a new preterm birth. However, a limitation of this risk marker is that it cannot be applied to nulliparous women.[6] In this study, this risk factor showed statistical significance for the occurrence of prematurity with an OR= 4.596 (CI95%=2.544 - 8.305).

Urinary tract infection (UTI) during pregnancy is common and its prevalence is estimated at 20%.[18] In the sample studied, the rate found was 16.52%. Most UTIs evolve from asymptomatic bacteriuria and can lead to adverse maternal and fetal events.[19] Pregnant women with UTIs can develop preterm labor as a complication, which is related to the increased incidence of prematurity.[20] This risk factor has shown statistical significance for the occurrence of prematurity. It is therefore essential that it is always investigated and treated appropriately.

This study found that oligohydramnios was statistically significant as a risk factor for preterm birth, corroborating another published study.[11] Oligohydramnios can be conceptualized as a marked reduction in the amount of amniotic fluid. This condition has significant consequences for the pregnant woman and her newborn, and the earlier oligohydramnios sets in, the worse the prognosis is.[11]

Pre-eclampsia was also statistically significant as a risk factor for preterm delivery, corroborating with other authors.[21] Arterial hypertension during pregnancy is defined as systolic pressure ≥140 mmHg or diastolic pressure ≥90 mmHg and can be classified into different syndromes. It is known that hypertensive syndromes in pregnancy can lead to spontaneous labor due to increased uterine contractility. Pre-eclampsia occurs in 2% to 8% of all pregnancies and is the leading cause of maternal death in Brazil, especially when it takes on its severe forms, such as eclampsia and HELLP syndrome.[22]

The literature mentions that among the many causes that lead to premature birth, special care must be taken with those related to the female genital tract and placental alterations, such as placenta previa.[23] This risk factor showed statistical significance for the occurrence of prematurity in this study.

Corroborating the findings of this study, the short interval between pregnancies (<6 months) should be assessed in every pregnancy, as it is considered a risk factor for prematurity,[10] as well as assisted reproduction,[12] autoimmune disease[25] and Diabetes Mellitus (DM),[23] which are also cited in the literature as risk factors for prematurity.

With regard to assisted reproduction techniques, multiple pregnancy is the most common and most serious iatrogenic complication in this type of procedure. The relation between multiple pregnancies and prematurity is universally recognized, leading to an increase in both maternal and fetal mortality and morbidity.[12]

Twin pregnancies, stressful situations during pregnancy and gestational bleeding were statistically significant risk factors for preterm birth in this study, corroborating other studies.[8,9,24] Fetal or maternal stress can trigger and release hypothalamic hormones (corticotropin-releasing hormone, oxytocin) and adrenal hormones (cortisol, adrenaline). Bleeding, with the production of thrombin, increases uterine contractility. Uterine hyperdistension is a cause of increased uterine contractility, which occurs in polyhydramnios and twin pregnancies.[1]

Pregnant women with diabetes have an increased risk of preterm birth due to conditions such as hypertension, infections, increased risk of bleeding, which may be more common in this population, which may lead to the decision to terminate the pregnancy early.[23]

It should be noted that some studies have shown an association between periodontal disease,[9] previous abortion,[7,8] drug use,[7] Covid-19,[26] kidney disease,[27] sexually transmitted infections[28] and heart disease[8] and premature birth.However, this study did not show statistical significance for the occurrence of prematurity when evaluating these variables.

We reiterate the fact that there were almost 30% of cases of Covid-19 in the sample, but they were not associated with prematurity, perhaps due to the 95.6% vaccination coverage.A retrospective study carried out in China concluded that compared pregnant women without Covid-19, pregnant women with a confirmed diagnosis had an increased risk of premature birth (OR= 3.34; CI95%= 1.60-7.00).[29]

It should be noted that despite recent technological and scientific developments, with a better understanding of the variables related to prematurity and the definition of new biomarkers associated with preterm birth, the ability of risk scores to predict prematurity still remains weak in most situations, which compromises the integration of a single score for use in clinical practice. The development of new risk scores, the identification of new variables and the development of a large set of reference data from various centers could be a future step towards solving this problem.[30] The regression model presented in this article should be validated in the future within the HIP and in other centers.

This study has some limitations, but these do not restrict its conclusions.The data collection was retrospective and was carried out during the Covid-19 pandemic, which prevented any face-to-face contact; puerperal women attending private maternity hospitals in a single city were included, and it is possible that women giving birth in other maternity hospitals and in the public network have different risks of prematurity; the inability of theHIP to collect data on all deliveries during the study period, which may be due to the lack of contact with many puerperal women, registration errors and, above all, non-response to our telephone calls.

In this study, the risk factors associated with preterm birth were previous prematurity, oligohydramnios, diabetes mellitus prior to pregnancy, twin pregnancy, autoimmune disease, stress during pregnancy, urinary infection, placenta previa, pre-eclampsia, gestational bleeding, interval between pregnancies of less than six months and in vitro fertilization.

Knowing these factors in a given community, as well as comparing them with data from other places, can be important in developing strategies to improve care for the pregnant population.For the HIP, the identification of these factors will enable the implementation of initiatives such as home monitoring and the inclusion of diagnostic laboratory methods in its pregnant women's program.

Authors' contributions

The authors also contributed to the revision of the article. Author Lind J wrote the initial version of the manuscript. Author Rocha JLL helped with the statistical analysis.All the authors have approved the final version of the article and declare no conflicts of interest.

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