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ORIGINAL ARTICLE

Influence of maternal age and hospital characteristics on the mode of delivery

Influência da idade materna e das características hospitalares nas vias de nascimento

Influencia de la edad materna y las características del hospital en la ruta de nacimiento

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ABSTRACT

Objectives: to analyze the relationship between maternal age and the source of healthcare payment with mode of delivery in public and private national hospitals between the years 2012 to 2017, and the length of hospital stay. **Methods:** cross-sectional study of 91,894 women who had children in public and private hospitals between 2012 and 2017. Data were collected from the Diagnosis-Related Groups Brazil system and a comparative analysis was performed between patients in public care and those in supplementary healthcare. **Results:** in public care, the majority were vaginal deliveries and the reverse occurred in supplementary health. The proportion of cesarean sections was higher in the age group 31 to 40 years old in both services. The hospital stay was longer among women who underwent a cesarean section. **Conclusions:** high maternal age and the source of healthcare payment influence the mode of delivery, which interfere with the length of hospital stay.
Descriptors: Maternal Age; Birth; Hospital; Cesarean Section; Normal Birth.

RESUMO

Objetivos: analisar a relação da idade materna e da fonte pagadora da assistência com as vias de nascimento em hospitais nacionais públicos e privados entre os anos de 2012 a 2017, e o tempo de permanência hospitalar. Métodos: estudo transversal com 91.894 mulheres que tiveram seus filhos em hospitais públicos e privados entre 2012 a 2017. Os dados foram coletados a partir do sistema *Diagnosis-Related Groups* Brasil e submetidos à análise comparativa entre pacientes do atendimento público e da saúde suplementar. **Resultados:** no atendimento público, a maioria dos nascimentos ocorreram por via vaginal e o inverso ocorreu na saúde suplementar. Observou-se que a proporção de cesariana foi maior na faixa etária de 31 a 40 anos, em ambos os serviços, e maior tempo de permanência hospitalar nas mulheres submetidas à cesariana. **Conclusões:** idade materna elevada e fonte de financiamento influenciam nas vias de nascimento, que interferem no tempo de permanência hospitalar.
Descritores: Idade Materna; Nascimento; Hospital; Cesárea; Parto Normal.

RESUMEN

Objetivos: analizar la relación entre la edad materna y la fuente de pago de la atención con las rutas de nacimiento en hospitales nacionales públicos y privados entre los años 2012 a 2017, y la duración de la estancia hospitalaria. Métodos: estudio transversal con 91.894 mujeres que tuvieron hijos en hospitales públicos y privados entre 2012 y 2017. Se recopilaron datos del sistema *Diagnosis-Related Groups* Brasil y se realizó un análisis comparativo entre pacientes en atención pública y aquellos en atención médica complementaria. **Resultados:** en la atención pública, la mayoría fueron partos vaginales y lo contrario ocurrió en la atención complementaria. La proporción de cesáreas fue mayor en el grupo de edad de 31 a 40 años en ambos servicios. La estadía en el hospital fue más larga entre las mujeres que se sometieron a una cesárea. **Conclusiones:** La edad materna elevada y la fuente de pago influyen en la ruta de nacimiento, lo que interfiere con la duración de la estancia hospitalaria.
Descriptores: Edad Materna; Nacimiento; Hospital; Cesárea; Parto Normal.

INTRODUCTION

Over the years, the profile of obstetric care has undergone changes driven by health technology advancements. A priori, vaginal delivery was the most frequent[1]. From the 19th century onwards, with the advancement of the biomedical model of childbirth care, the childbirth process started to be guided by an interventionist culture, and among such interventions, the cesarean delivery became frequent[1].

The vaginal delivery guarantees benefits and lower risks for the mother and the baby[1]. A cesarean delivery, in turn, can be indicated in cases of maternal comorbidities or fetal changes, and is relevant for reducing maternal and neonatal morbidity and mortality[2].

However, there is a significant increase in births through this route. According to the World Health Organization (WHO), surgical birth rates above 10.0% are not related to the reduction of maternal and neonatal morbidity and mortality; the maximum acceptable is 15.0% for pregnant women at usual risk and 25.0% for those considered at high risk[3]. Through ordinance 306/2016, the Ministry of Health updated these rates according to specific characteristics of the Brazilian population, and established cesarean rates between 25% and 30% as the maximum acceptable[4].

Even with the increase in acceptable values, the rate of cesarean deliveries in Brazil remains extremely high, at 56%[4]. This figure stands out among countries that provide less interventionist care, such as the Netherlands and the Czech Republic (14.0%) or even among countries such as Canada and the United States of America (USA) that have rates of 23.0% and 25.0%, respectively[5].

The woman's choice of mode of delivery is related to different variables, such as age, education, income, childbirth experience and color/race. Women over 30 years of age have higher rates of cesarean deliveries, as well as those with higher education and income[5-6]. There is a gradient in the relationship between color/race and the mode of delivery, so that the lighter the skin color, the higher the rate of cesarean deliveries[1,5-6].

Previous positive experiences also lead pregnant women to choose the same mode of delivery[6]. The type of institution (public or private) and the quality of care provided during prenatal care can also influence this choice[5]. Although most women start prenatal care with a preference for vaginal delivery[6], there are higher rates of birth by cesarean delivery. Hence the questioning of pregnant women's autonomy in choosing the mode of delivery[1,5-6].

A recent study[7] showed that 52.7% of pregnant women were treated in public services and 47.3% in supplementary health care, and cesarean delivery rates among these women were 55.5% and 93.8%, respectively[7]. Most pregnant women understand a cesarean delivery as a painless, convenient and best assisted way of giving birth[8]. However, when performed without clinical indications, it can lead to a higher risk of puerperal infection, prematurity and neonatal mortality, and higher length of hospital stay[3,9].

Thus, there is a failure in preconception and prenatal consultations that results in the lack of information about childbirth and birth and unpreparedness of pregnant women[8]. These aspects can contribute to doubts and fears regarding childbirth and directly influence the choice of the mode of delivery[8].

Given the above and the considerable increase in cesarean delivery rates from the 1990s in public and private health services in Brazil, the maternal and health institution factors that can influence the mode of delivery must be identified. This way, effective strategies can be proposed for reducing unnecessary cesarean deliveries and consequently, the length of stay and health costs.

OBJECTIVES

To analyze the relationship between maternal age and the source of healthcare payment with the mode of delivery in public and private national hospitals between the years 2012 and 2017, as well as the length of hospital stay.

METHODS

Ethical aspects

This study was approved by the Research Ethics Committee of the *Universidade Federal de Minas Gerais*.

Study design, period and location

This is an epidemiological, cross-sectional study. It was conducted from June 2012 to December 2017 in private hospitals that provide services to supplementary health operators in Brazil and to the National Health System (Brazilian SUS), distributed in the Midwest, North, Southeast and South of the country with use of the Diagnosis-Related Groups system (DRG *Brasil*® version 9).

Population; inclusion and exclusion criteria

The study was conducted with 91,894 women who underwent cesarean delivery and vaginal delivery, aged 15 years and over. All postpartum women who were discharged to go home and did not present adverse events related to the care provided during the parturition process were considered. Women who had abortions were excluded.

Study protocol

The data presented were collected using the DRG *Brasil*®, version 9.04. The DRG or Diagnostic-Related Groups is a methodology for categorizing patients into homogeneous groups according to their characteristics and care complexity. It was developed in 1960 by the Yale University of the United States of America (USA) with the purpose of monitoring the quality of care and the use of hospital services. This system was adapted for Brazil in the early 2000s, but as the methodology is still recent, implementation is not widespread in all hospitals, and more present in the private network. It is applicable to patients admitted to hospitals that treat acute cases, that is, those in which patients' average length of stay does not exceed 30 days[10].

Data collection was performed from hospital discharge information of national public and private health institutions of short stay, that is, those who attend acute hospitalizations in which the average length of stay of patients is less than 30 days.

The DRG methodology is a classification system that considers the main diagnosis, comorbidities and complications present at admission, procedures performed, age, and other patient variables.

Through each DRG, are grouped patients with similar consumption of institutional resources (including length of stay) and clinical and economic information. DRGs are organized according to the physiological system into large diagnostic groups called Major Diagnostic Categories (MDC). All clinical diagnoses, both primary and secondary, including complications and comorbidities, are classified according to the International Classification of Diseases (ICD). The procedures performed were coded according to the tables used in SUS and in supplementary health (in this case, the Unified Terminology of Supplementary Health).

In addition to maternal age and the source of healthcare payment (public care or supplementary health), this study included DRG that make up the MDC 14 related to pregnancy, childbirth and the puerperium, namely: cesarean section with additional complications or comorbidities to the initial diagnosis (DRG 765), cesarean section without complications or associated comorbidities (DRG 766) , vaginal delivery with sterilization or dilation and curettage (DRG 767), vaginal delivery in the operating room, except sterilization or dilation and curettage (DRG 768), vaginal delivery with complicating diagnoses (DRG 774) and vaginal delivery without complicating diagnoses (DRG 775).

Data were collected from medical records after hospital discharge registered in the DRG *Brasil*® system by coding nurses dedicated to this function.

Analysis of results and statistics

The sample was described using absolute and relative frequencies. Regarding length of stay, the mean, standard deviation (SD) and median were presented. In this study, the results were presented considering the mode of delivery and the source of healthcare payment (public care – SUS; supplementary health).

The comparative analysis between two patient groups (supplementary health and public care) regarding length of stay for each DRG was performed using the Student's t test for independent samples. When the analysis indicated a significant difference ($p < 0.05$), the effect size was assessed. Since these are large samples, there is a higher probability of type I error, thus, the evaluation of the effect size by means of Cohen's D statistic allows the assessment of clinical relevance. Cohen's D statistic is interpreted by using the Cohen's D coefficient, which considers a small effect (Cohen's $D < 0.40$), medium effect (Cohen's D between 0.40 and 0.60) and large effect (Cohen's $D \geq 0.60$). Data were processed and analyzed using the free R statistical software.

RESULTS

Of the pregnant women participating in this study, 14.0% were from the Midwest, 0.2% from the North, 71.7% from the Southeast and 14.1% from the South of Brazil (data not shown).

Regarding the mode of delivery, 70.7% had their children by cesarean delivery. Regarding the source of healthcare payment, of the total deliveries performed in public care, 54.3% were vaginal deliveries and in supplementary health, 74.1% of births occurred by cesarean delivery (Table 1).

Table 1 – Mode of delivery according to source of healthcare payment, Brazil, 2012-2017

Source of healthcare payment	Total births	Mode of delivery			
		Vaginal		Cesarean	
		n	%	n	%
Public care	10.921	5.936	54.3	4.985	45.7
Supplementary health	80.973	20.979	25.9	59.994	74.1
Total	91.894	26.915	29.3	64.979	70.7

In public care, 52.0% of pregnant women who had their children by cesarean delivery were aged between 18 and 30 years, while in supplementary health, 54.3% were between 31 and 40 years old (Table 2). Results showed that despite significant differences between the group of mothers served by supplementary health and the group served by public care, the effect size was small (Cohen's D = 0.29). Therefore, the length of stay was similar between the two health systems (Table 2).

In relation to vaginal deliveries, in public care and in supplementary health, most pregnant women were between 18 and 30 years old (66.4% and 52.4%, respectively). Despite the significant differences between the group served by supplementary health and public care, the effect size was also small (Cohen's D=0.11) (Table 3).

Table 2 – Characterization of pregnant women undergoing cesarean delivery according to maternal characteristics and length of hospital stay, considering the health system, Brazil, 2012-2017

	Total		Public Care		Supplementary Health		*p* value	Cohen's D
	n	%	n	%	n	%		
Age group (years)								
15-17	647	1.0	179	3.6	468	0.8		
18-30	27.530	42.4	2.594	52.0	24.936	41.6		
31-40	34.655	53.3	2.058	41.3	32.597	54.3		
>40	2.147	3.3	154	3.1	1.993	3.3		
Length of hospital stay (days)							<0.001	0.29
Mean ± S.D.	2.5 ± 2.8		3.4 ± 3.5		2.4 ± 2.8			
Median	2.1		2.9		2.1			

Note: S.D. - Standard Deviation.

Table 3 – Characterization of pregnant women undergoing vaginal delivery according to maternal characteristics and length of hospital stay, considering the health system, Brazil, 2012-2017

	Total		Public Care		Supplementary Health		*p* value	Cohen's D
	n	%	n	%	n	%		
Age group (years)								
15-17	989	3.7	575	9.7	414	2.0		
18-30	14.941	55.5	3.944	66.4	10.997	52.4		
31-40	10.540	39.2	1.332	22.5	9.208	43.9		
>40	445	1.6	85	1.4	360	1.7		
Length of hospital stay (days)							<0.001	0.11
Mean ± S.D.	2.2 ± 1.6		2.0 ± 2.9		2.0 ± 2.7			
Median	1.9		1.8		1.8			

Note: S.D. - Standard Deviation.

The percentage of pregnant women without comorbidities who underwent cesarean delivery was higher in the group served by supplementary health (56.4%) compared to the group served by public care (43.6%) (data not shown).

Of the percentage of pregnant women with comorbidities, the main ones presented by pregnant women in the public system were disorders of the membrane and amniotic fluid (8.2%), gestational hypertension with significant proteinuria (4.1%), gestational diabetes mellitus (3.6%), care provided to the mother due to known or suspected abnormality of maternal pelvic organs (3.2%) and premature rupture of membranes (3.2%) (data not shown).

Regarding comorbidities present in pregnant women undergoing cesarean delivery in the private sector, the following were observed: personal history of allergy to drugs, medication and biological substances (4.7%), other disorders of the membranes and amniotic fluid (4.7%), gestational diabetes mellitus (4.6%), premature rupture of membranes (4.0%) and care provided to the mother due to known or suspected abnormality of maternal pelvic organs (3.7%) (data not shown).

The results showed that most pregnant women undergoing vaginal delivery both in public and supplementary health care did not present comorbidities, representing 65.2% and 71.7%, respectively. Among the main comorbidities present in women served in public care, the following stand out: laceration of the perineum during delivery (10.8%), disorders of membranes and amniotic fluid (4.5%), premature rupture of membranes (4.1%), abdominal and pelvic pain (3.1%) and problems related to lifestyle (2.4%) (data not shown).

In relation to the main comorbidities presented by pregnant women undergoing vaginal delivery attended in supplementary health, the following were observed: premature rupture of membranes (6.2%), personal history of allergies to drugs, medicines and biological substances (4.4%), other maternal diseases classified elsewhere, which complicate pregnancy, childbirth and the puerperium (3.9%), gestational diabetes mellitus (2.8%) and laceration of the perineum during delivery (2.3%) (data not shown).

DISCUSSION

The present study revealed that most births in this sample occurred in supplementary health, women aged between 31 and 40 years old, and the cesarean delivery predominated. In relation to births in public care, there was a prevalence of vaginal delivery in the age group between 18 and 30 years.

Cesarean deliveries were mostly present in the age group between 18 and 30 years in public care and between 31 and 40 years in supplementary health. This result corroborates with studies that bring maternal age as one of the main contributing factors to the choice of cesarean section as the mode of delivery. Associated with this, in Brazil, more and more, women have had their children later[11]. Later pregnancies can be explained by different reasons, such as greater dedication to study and profession, the higher purchasing power of women, high availability of contraceptive methods, in addition to late marriages and choice of "ideal" partners[12]. Consequently, there will be sufficient financial resources to pay for this assistance and for the medical decision in view of the possible comorbidities presented by the pregnant woman[1,13].

It is not possible to dissociate cesarean delivery from maternal age, that is, older women tend to have more complications, which reflects in the choice of the cesarean mode of delivery[14-15]. However, the decision is still largely based on professional information, often without real clinical indications for performing a cesarean section[16].

In general, the indication for cesarean delivery occurs differently among the financing systems addressed. A study[16] demonstrated that cesarean deliveries have acquired greater representativeness both in public care and in supplementary health. The high rate of births by this route can also be demonstrated in our results, with figures of 45.7% in public care and 74.1% in supplementary health, values well above those recommended by the WHO, which can have direct or indirect influence on maternal and child outcomes[16].

The increase in cesarean delivery rates is not only a Brazilian reality[9]. Data from the nationwide study "Being born in Brazil: survey on childbirth and birth" from 2011–2012, demonstrated a difference between the rates of cesarean deliveries according to the source of healthcare payment of childbirth: 87.9 % in the private sector, higher than the 42.9% found in the public sector[17]. To explain this difference, authors demonstrated several factors favoring the increase, mainly in the private sector[17-20]. The most marking are related to the remuneration model offered by Brazilian supplementary health insurances, the qualification of professionals and cultural factors. Therefore the inference that these cesarean deliveries are not predominantly related to the actual presence of obstetric risk[17]. In public care, cesarean deliveries occur predominantly through the diagnosis of comorbidities and complications in the prenatal period and labor.

Another finding of this study was that 56.4% of cesarean deliveries in supplementary health and 43.6% in public care were performed in pregnant women without comorbidities. Women undergoing cesarean deliveries without clinical or obstetric indications have higher chances of acute maternal complications[21]. Women undergoing cesarean deliveries have a threefold higher chance of infection compared to those undergoing vaginal births and a greater chance of admission to the intensive care unit[21], in addition to resulting in greater susceptibility to infections and adverse events for puerperal women and newborns. Furthermore, elective cesarean deliveries result in higher hospital costs, expenses that could be used for another purpose, especially in public health[22].

The presence of comorbidities and a history of obstetric risk are contributing factors to the physician's decision for a cesarean delivery in both sectors[8]. However, it should be questioned if these are real indications for a cesarean delivery, as in this study, some pregnant women (28.3% in supplementary health and 34.8% in public care) had comorbidities and still had the outcome of vaginal delivery.

Finally, despite the hospital-centered healthcare model, there is a worldwide movement towards the spread of information on safe delivery. There are several initiatives to change the current obstetric scenario. The Adequate Childbirth Project by the National Supplementary Health Agency (Portuguese acronym: ANSS) was created with support from the Ministry of Health with the main objective of proposing encouraging actions of normal childbirth for reducing cesarean deliveries without clinical indications[11]. In 2016, associated with this project, the Federal Council of Medicine established criteria for performing elective cesarean deliveries based on women's choice in Brazil. Thus, in situations of habitual risk, cesarean sections could be performed only after the 39th

week of pregnancy[23]. Although there have been advances, it is still necessary to think and rethink strategies, especially institutional and for the organization of healthcare networks, so that the birth process is thought in a more physiological way[5,24-25].

Study limitations

The limitation of this study was the non-representativeness of the sample, because of the greater participation of supplementary health, which is justified by the greater implementation of the DRG methodology in hospitals with this type of financing. Nonetheless, data could be compared between the sources of healthcare payment, since results were presented in relative frequency.

Contributions to the Area

We highlight the potential of results presented to support the performance of managers and health professionals in the sense of planning the care of pregnant women and mothers in Brazil.

CONCLUSIONS

High maternal age associated with the care provided by supplementary health influences the mode of delivery. Thus, the group effect of health services and individual maternal factors can interfere with hospital stay and consequently, with costs of the institution.

The results of this study can contribute to the development of actions for the identification and management of risk factors, in order to minimize the unnecessary indications for cesarean delivery and provide support for the development and implementation of other projects related to safe delivery, such as the *Projeto Parto Adequado* (Adequate Childbirth Project).

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