

Epidemiology of maternal death and the challenge of care training

Epidemiologia da morte materna e o desafio da qualificação da assistência
Epidemiología de la muerte materna y el desafío de la cualificación de la atenciónJanaina Aparecida Tintori¹  <https://orcid.org/0000-0002-0466-3720>Lise Maria Carvalho Mendes¹  <https://orcid.org/0000-0001-9325-8382>Juliana Cristina dos Santos Monteiro¹  <https://orcid.org/0000-0001-6470-673X>Flávia Gomes-Sponholz¹  <https://orcid.org/0000-0003-1540-0659>

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Abstract

Objectives: To describe reported maternal deaths, identify the epidemiological profile of women who died during their pregnancy-postpartum cycle, and analyze the variables related to prenatal and childbirth care.**Methods:** Retrospective quantitative survey. The studied population was women who died during their pregnancy-postpartum cycle and lived in one of the 26 municipalities in the area covered by the Ribeirão Preto Regional Health Department from 2011 to 2016. Secondary data obtained via the Department of Informatics of the Brazilian Unified Health System, including sociodemographic information and variables related to death, prenatal and childbirth, and the healthcare network, were treated by using descriptive statistics and univariate analysis.**Results:** Records of 36 maternal deaths were found for the period between 2011 and 2016. Most deaths occurred in women from 20 to 29 years old (63.9%). The average age of the examined women was 28.1 years, and most were single (50%), white (66.7%), primiparous (41.7%), and had an income source (30%). Access to prenatal care was perceptible because of the existence of early recruitment (72.2%) and the number of prenatal appointments. The main mode of delivery was cesarean (52.8%). Direct obstetric causes of maternal death resulted in 77.8% of the occurrences, and the main causes were hypertension, infection, and bleeding.**Conclusion:** The present study showed that most maternal deaths occurred in single, white, and primiparous women from 20 to 29 years old. Early recruitment and adequate number of prenatal appointments stood out. The classification of most deaths was direct obstetric, and hypertension, infection, and bleeding were the main causes. The present study exposed the network structure present in the healthcare sphere at issue and showed satisfactory primary healthcare and hospital coverage in childbirth care.

Resumo

Objetivo: Descrever os óbitos maternos declarados e identificar o perfil epidemiológico das mulheres que foram a óbito em seu ciclo gravídico-puerperal e analisar as variáveis relacionadas à assistência no pré-natal e parto.**Métodos:** Esta é uma pesquisa com delineamento retrospectivo com abordagem quantitativa do tipo levantamento. A população estudada foi constituída por mulheres que foram a óbito em seu período gravídico-puerperal, residentes em um dos 26 municípios da área de abrangência do Departamento Regional de Saúde de Ribeirão Preto, no período de 2011 a 2016. Foram analisados dados secundários obtidos via Departamento de Informática do Sistema Único de Saúde. Foram analisadas variáveis sociodemográficas, relativas ao óbito, ao pré-natal e parto e à rede de atenção à saúde. Os dados foram analisados de modo descritivo com a análise univariada.¹Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil.

Conflicts of interest: nothing to declare.

Resultados: Foram encontrados registros de 36 óbitos maternos no período de 2011 a 2016, a maioria dos óbitos ocorreu em mulheres na faixa etária de 20 a 29 anos (63,9%), com média de idade de 28,1 anos, sendo a maioria solteira (50%), cor branca (66,7%), primípara (41,7%), com renda (30%). O acesso ao pré-natal foi perceptível na captação precoce (72,2%) e no número de consultas durante o pré-natal. A principal via de parto foi a cesárea (52,8%). As mortes maternas obstétricas diretas resultaram em 77,8% dos óbitos, sendo as principais causas: hipertensão, infecção e hemorragia.

Conclusão: O presente estudo mostrou que a maioria dos óbitos maternos ocorreu em mulheres na faixa etária de 20 a 29 anos, solteiras, de cor branca e primigestas. Foram perceptíveis a captação precoce e o adequado número de consultas durante o pré-natal. A classificação da maioria das mortes foi obstétrica direta, sendo hipertensão, infecção e hemorragia as principais causas. Foi possível conhecer a estrutura de redes e verificar uma boa cobertura de atenção primária e de atenção hospitalar para assistência ao parto.

Resumen

Objetivo: Describir las defunciones maternas declaradas, identificar el perfil epidemiológico de las mujeres que fallecieron durante el embarazo o el puerperio y analizar las variables relacionadas con la atención prenatal y el parto.

Métodos: Se trata de un estudio con diseño retrospectivo y enfoque cuantitativo tipo recopilación. La población estudiada estuvo compuesta por mujeres que fallecieron durante el embarazo o el puerperio, residentes en algunos de los 26 municipios del área de cobertura del Departamento Regional de Salud de Ribeirão Preto, en el período de 2011 a 2016. Se analizaron datos secundarios obtenidos mediante el Departamento de Informática del Sistema Único de Salud. Se analizaron variables sociodemográficas, relativas a la defunción, a la atención prenatal y parto y a la red de atención en salud. Los datos se analizaron de modo descriptivo con el análisis univariado.

Resultados: Se encontraron registros de 36 defunciones maternas en el período de 2011 a 2016, la mayoría de las defunciones ocurrió en mujeres dentro del grupo de edad de 20 a 29 años (63,9 %), con promedio de edad de 28,1 años, la mayoría soltera (50 %), blanca (66,7 %), primípara (41,7 %), con ingresos (30 %). El acceso a la atención prenatal fue detectado mediante la captación temprana (72,2 %) y el número de consultas prenatales. La principal vía de parto fue la cesárea (52,8 %). Las muertes maternas obstétricas directas representaron el 77,8 % de las defunciones, y las principales causas fueron: hipertensión, infección y hemorragia.

Conclusión: El presente estudio mostró que la mayoría de las defunciones maternas ocurrió en mujeres dentro del grupo de edad de 20 a 29 años, solteras, blancas y primíparas. Se detectó la captación temprana y un número adecuado de consultas prenatales. La clasificación de la mayoría de las muertes fue obstétricas directa, y las principales causas fueron hipertensión, infección y hemorragia. Fue posible conocer la estructura de redes y verificar una buena cobertura de atención primaria y de atención hospitalaria para asistencia al parto.

Introduction

Maternal death is defined by the International Classification of Diseases – 10th Edition (ICD10) as the death of a woman during pregnancy, childbirth or at any time in the period of 42 days after childbirth caused by any factor related to or aggravated by the characteristics of this cycle, accidents and incidents excluded.⁽¹⁾

According to the United Nations Maternal Mortality Estimation Inter-agency Group, in 2015 there was an estimative of 303,000 maternal deaths worldwide, which resulted in a maternal mortality rate (MMR) of 216 per 100,000 live births (LB). Most were preventable and happened in developing countries.⁽²⁾ Most maternal deaths would be prevented if women received adequate treatment and care, including prenatal care by well-trained health professionals, care during childbirth, and support over the first weeks that follow it.⁽³⁾

Maternal mortality is a relevant health indicator that reflects social, economic, and quality of life conditions of people living in a certain place.⁽⁴⁾ Reducing occurrence of maternal deaths has been

a global priority and is included in the targets of the Sustainable Development Goals and the United Nations 2030 Agenda. Continuous investments and attention are necessary to reach the global target of fewer than 70 maternal deaths per 100,000 LB until 2030, which could save up to one million lives over a decade.⁽³⁾ Meeting this target is a valuable measure to obtain better health indicators, but even more to reduce barriers of access to health services and inequities. An indispensable condition to making progress in the decrease of maternal deaths is understanding their causes so effective decisions about health policies and programs can be made.

The Ribeirão Preto Regional Health Department (DRS XIII, as per its abbreviation in Portuguese) is one of the 17 Regional Health Departments in the state of São Paulo and covers an area with an estimated population of around 1,327,989 people.⁽⁵⁾ It encompasses 26 municipalities and is split into three health regions: Aquífero Guarani (ten municipalities), Horizonte Verde (nine municipalities), and Vale das Cachoeiras (seven municipalities). Twenty maternity hospitals are part of DRS XIII, 13 public and seven private. Rede Cegonha was implemented

in DRS XIII, in accordance with a ministerial order, to reorganize health care to women and children. This program proposes the monitoring of some health indicators and aims to provide access to a network of care, license, and hospital bed funding.

The average MMR in DRS XIII from 2010 to 2016 was 30.59 per 100,000 LB. The rates for 2015 and 2016, 63.37 and 51.95 per 100,000 LB, respectively, stood out for being considerably higher than that mean.⁽⁶⁾ The development of the present study was justified by the confirmation of an increase in the number of this type of death in DRS XIII. Describing the causes of maternal deaths and evaluating delivered care are seen as important measures. Additionally, the need for intervention in a population in which most maternal deaths are preventable must be emphasized to avoid a negative family and social impact.

The objectives of the present study were describing maternal deaths that were reported in the municipalities included in the area of coverage of DRS XIII, identifying the epidemiological profile of women who died during their pregnancy-postpartum cycle, and analyzing the variables related to prenatal and childbirth care.

Methods

This was a retrospective quantitative survey. The studied population was women who died during their pregnancy-postpartum period and lived in one of the 26 municipalities of the area of coverage of DRS XIII from 2011 to 2016.

Secondary data were obtained by consulting the Department of Informatics of the Brazilian Unified Health System (SUS, as per its acronym in Portuguese) by means of the Live Birth Information System and the Mortality Information System. Network structure data were obtained by searching the Brazilian National Health Facility Database and referred to both SUS and non-SUS facilities.⁽⁷⁾

The following variables were analyzed: sociodemographic information (age group, marital status, skin color, level of education, occupation, and origin); death-related ones (place of death, stage of the

pregnancy-postpartum in which death occurred, health care received during the manifestation of the disease that caused death, confirmation of diagnosis by means of necropsy, and cause of obstetric maternal death); prenatal- and childbirth-related (place of prenatal appointments, number of pregnancies, early recruitment, number of prenatal appointments, mode of delivery, professional who assisted childbirth); and healthcare network-related (identification of the percentage of primary health care and supplementary health coverage by health regions of DRS XIII, identification of maternities, number of usual obstetric risk and high obstetric risk hospital beds, and total number of adult intensive care unit hospital beds).

After authorization by the Center of Strategic Health Information (CIEVS, as per its acronym in Portuguese) at the Disease Control Coordinating Office at the São Paulo Health Secretariat, data were extracted from death certificates and summarized investigation forms, which belong to the domain of the Mortality Information System.

Data were treated by using descriptive statistics and univariate analysis. Qualitative variables were shown as distribution of absolute (n) and relative (%) frequencies. For quantitative analysis, means, medians, standard deviations, and maximum and minimum values were calculated.

The proposal was approved by the research ethics committee as per Certificate of Presentation for Ethical Evaluation no. 79532617.0.0000.5393 and sent to CIEVS as a procedure to meet the recommendations listed in the Brazilian National Health Council Resolution no. 466/12 and its regulatory guidelines and norms for human research.

Results

Records of 36 maternal deaths were found for the period between 2011 and 2016 for the municipalities that make up the area of coverage of DRS XIII. The rates of maternal death in DRS XIII in the examined period were: 27.44 per 100,000 LB in 2011, 16.54 per 100,000 LB in 2012, 16.74 per 100,000 LB in 2013, 21.43 per 100,000 LB in

2014, 63.37 per 100,000 LB in 2015, and 51.95 per 100,000 LB in 2016.

Maternal mortality according to epidemiological profile

The age group with the highest number of deaths was 20 to 29 years, with 23 deaths (63.9%), followed by 30 to 39 years, with 11 deaths (30.6%) and under 20 years, with two deaths (5.6%). No death was recorded for women over 40 years old, with the minimum and maximum ages of women who died equal to 18 and 39 years, respectively. The average age was 28.1 years. Eighteen women (50%) were single, and 12 (33.4%) were married or were in a common-law marriage. Twenty-four women (66.7%) were white, followed by five (13.9%) brown and five (13.9%) black. Nineteen women (52.8%) had eight or more years of formal education, and five (13.9%) had a college degree. Eleven women (30%) had a source of income, given that this field was filled in with a Brazilian Occupation Classification code in the death certificate. This field was filled in as “ignored” in 20 records (55.6%) and was not filled in in five records (13.9%).

Maternal mortality according to prenatal and childbirth care

Thirteen women (36.1%) had their pregnancies monitored in primary health care, followed by nine (19.4%) who belonged to the high-risk follow-up group and five (13.9%) who received prenatal care in supplementary care. Of the 36 women that died, 15 (41.7%) were having or had their first pregnancy, ten (27.8%) were having or had their second pregnancy, and 11 (30.6%) were multigravida. Twenty-six women (72.2%) initiated prenatal care before the 12th week of pregnancy, and 18 women (50%) had seven or more appointments, followed by seven (19.4%) with four to six appointments and five (13.9%) with one to three appointments. The main pregnancy conclusion mode was cesarean, with 19 women (52.8%) submitted to this surgical procedure.

Thirty-three women (91.7%) died in a hospital setting, 28 (77.8%) received reported medical care at the moment they were dying, and 20 (55.6%) were sent to necropsy (Table 1).

Table 1. Characterization of the reported maternal deaths by place of occurrence and care condition

Variable	Frequency(%)
Place of death	
Hospital	33(91.7)
Another health facility	1(2.8)
Home	2(5.6)
Received medical care?	
Yes	28(77.8)
No	3(8.3)
Ignored	5(13.9)
Sent to necropsy?	
Yes	20(55.6)
No	15(41.7)
Ignored	1(2.8)

Source: São Paulo Health Secretariat/Disease Control Coordinating Office/CIEVS, 2018.

Maternal mortality according to classification, obstetric cause, and phase in which death occurred

The three-character list of ICD10, present in Chapter XV and originates groups and codes, was used to analyze the causes of the recorded deaths. For the group direct maternal death, the codes Hypertension O11, O13, O14, O15, and O16, Hemorrhage O45 and O72, Infection O23, O85, and O86, and causes O43, O73, O75, and O90 were used. For indirect obstetric causes, the following codes were considered: Human immunodeficiency virus (HIV)-related disease B20, Complications in postpartum O98 and O99, and Pre-existing hypertension O10. Twenty-eight women (77.7%) died of direct obstetric causes. The distribution of deaths over the pregnancy-postpartum cycle indicated that the period with the highest risk was postpartum, with 25 deaths (69.5%), followed by eight (22.2%) during pregnancy, two (5.5%) during childbirth, 24 (66.7%) during immediate postpartum (up to ten days after childbirth), one (2.8%) during late postpartum (ten days after childbirth onwards), and one (2.8%) caused by miscarriage (Table 2).

Discussion

According to the present study, 36 deaths of women who were in their pregnancy-postpartum cycle were reported and declared, from 2011 to 2016, in DRS XIII. These numbers draw attention because of the increase in death occurrence in 2015, which re-

Table 2. Distribution of maternal deaths according to classification, obstetric cause, and phase in which death occurred

Basic cause of death - ICD10	Phase in which death occurred				n(%)
	Pregnancy	Childbirth	Immediate postpartum	Late postpartum	
Indirect obstetric maternal death					7(19.5)
Pre-existing hypertension (O10)			1		1(2.8)
Postpartum complications (O98-O99)	2		3		5(13.9)
HIV-related disease (B20) - miscarriage	1				1(2.8)
Direct obstetric maternal death					28(77.7)
Hypertension disorders during pregnancy, childbirth, and postpartum (O11-O16)	4		3		7(19.4)
Infection during pregnancy and postpartum (O23-O85-O86)	1		6		7(19.4)
Hemorrhage (O45-O72)		2	5		7(19.4)
Other causes (O43-O73-O75-O90)	1		6		7(19.4)
Nonspecified obstetric maternal death					1(2.8)
Nonspecified obstetric death* (O95)				1	1(2.8)
Total	9	2	24	1	36(100)

mained in 2016, indicating a tendency of growth in MMR. Analysis of the examined time series showed that MMR in DRS XIII from 2011 to 2014 was lower than the state rate. However, the number of maternal deaths in DRS XIII triplicated in 2015, making MMR reach 63.37 per 100,000 LB, a number 25% higher than the state's (47.53 per 100,000 LB).⁽⁸⁾ This information is worrying because, in the two years that followed the examined period, 2017 and 2018, this plateau that emerged in DRS XIII was kept, with an MMR of 55.56 per 100,000 LB and 60.69 per 100,000 LB, respectively, with no perspective of a drop.⁽⁶⁾ The World Health Organization has warned about the parameters of high MMR (over 50 per 100,000 LB), and the results found for DRS XIII make the area be classified as showing a high and worrying rate.

Most maternal deaths examined in the present study occurred in young (from 20 to 29 years old) women who were single, white, and had eight or more years of formal education. Characterization of the deaths corroborated the results described in other studies regarding age group, marital status, occupation, and level of education.⁽⁹⁻¹¹⁾ However, other pieces of evidence have indicated that maternal mortality was more frequent in black women, a situation explained by the association of difficult control of hypertension-related diseases in this population, difficult access to health services, and low quality of care.^(10,12) An American retrospective study concluded that Afro-American women showed a MMR four times higher than that found for white American women.⁽¹³⁾ Regarding marital

status, the presence of the partner was interpreted as a possibility of getting greater emotional support during pregnancy and childbirth.⁽¹⁴⁾

Another aspect identified in the present study was the guaranteed access of pregnant women to prenatal care, whether by means of primary health care or supplementary health. Despite the unfavorable outcome, most women had their first prenatal appointment still in the first trimester of pregnancy and went through six or more appointments, in accordance with the guidelines of Rede Cegonha. This finding emphasized the fact that even when the targets of the quantitative indicators proposed by the Brazilian Ministry of Health, including early recruitment, number of appointments, and access, are fulfilled, quality goes untracked by these data in obstetric care.

According to the study *Nascer no Brasil*, 98.7% of the analyzed women had high coverage of prenatal care, with 75.8% of them beginning prenatal care early and 73.1% attending six or more appointments.⁽¹⁵⁾ The study also stressed that prenatal care must be welcoming so trust and a bond and developed between pregnant women and health services.⁽¹⁵⁾

Regarding outcome, nearly all 36 women died in a hospital setting, received medical care during death, and were sent to necropsy. Carrying out necropsy in women who die under these circumstances is crucial, because it contributes to the identification of the possible causes and provides resources to the adoption of measures that can prevent a similar problem from occurring again.

The method used in the present study did not allow access to the results of necropsies to confirm the basic cause of death. However, all maternal deaths that occur in the municipalities in the area covered by DRS XIII are presented and discussed by the Maternal, Child, and Fetal Death Surveillance Regional Committee. This group, like other commissions or committees formed to prevent and fight maternal death, has an educational nature, is responsible for identifying the magnitude of maternal death, its causes, and factors that determine it, and evaluates the results of care delivered to pregnant and postpartum women. After analyzing the investigations of the deaths, the Committee sends recommendations, when necessary, to managers at all healthcare levels, so they become aware and make the due arrangements.

The period in which the risk was higher was postpartum, followed by pregnancy. This finding corroborated a study carried out in India that warned about high MMR on the first and second days after childbirth.⁽¹⁶⁾ In this context, it is essential to qualify health teams so professionals can recognize emergencies and the need for immediate interventions when complications set up.^(17,18)

Analysis of mode of delivery showed that most women were submitted to a cesarean. A recent meta-analysis concluded that women who underwent this type of surgery had 3.1 more chances of dying than those who had natural childbirth.⁽¹⁸⁾ Cesarean can contribute to increasing the number of maternal deaths and severe maternal morbidity because of the exposure of women to the risks inherent in surgeries, such as bleeding, infections, reactions to anesthesia, and embolism, to mention a few, which justifies its indication only in cases of proved obstetric morbidity and fetal risks.⁽¹⁹⁾

Deaths were more frequent among primiparous women. Most deaths in women with this characteristic did not show a connection with what is reported in the literature. It has been pointed out that multiparity is a risk factor, especially because it increases the chances of bleeding, whereas the increase in deaths in primiparous women can be associated with comorbidities.^(20,21)

Analysis of the causes of maternal deaths indicated that most had a direct obstetric cause, distrib-

uted over complications related to hypertension, bleeding, infection, and other factors that originate problems during pregnancy, childbirth, and/or postpartum. A study carried out in the Brazilian state of São Paulo showed a transition in the main cause of maternal deaths between 2010 and 2015 from complications related to hypertension to those related to bleeding. These causes drew the attention of the researchers, because they could have been prevented by means of integration of healthcare networks with primarily organized and ready-for-use hospital settings with qualified employees.⁽¹¹⁾ Deaths caused by hypertension-related disorders also deserve to be analyzed carefully, especially when the most serious problems, such as eclampsia and the HELLP syndrome, manifest.

Regarding indirect obstetric deaths, the present study found the following causes: other diseases classified elsewhere in ICD10 (which may be related to anemia or problems in the circulatory, immunologic, or respiratory system), followed by chronic hypertension, infectious and parasitic diseases, and HIV-related diseases. In the literature, the number of deaths by indirect causes is higher in hospitals that offer reference services for high-risk pregnancy.⁽²²⁾

Indirect obstetric deaths could be prevented with high-quality family and reproductive planning. Health professionals play an important role in the early recognition of signs and symptoms of complications over the pregnancy-postpartum cycle. Using women's obstetric history can be a predictive risk tool in the process of reducing the number of maternal deaths.⁽¹³⁾ Other researchers reinforced this warning and highlighted previous pathologies that deserve attention when delivering care during pregnancy and childbirth, including eclampsia, diabetes, obesity, and multiple pregnancy, since these factors show greater association with indirect maternal deaths.⁽²³⁾

Several studies have proved that maternal mortality is directly associated with the quality of medical and obstetric care offered during pregnancy, childbirth, and postpartum. Regardless of other factors, it is indispensable to guarantee humanized and specialized obstetric care, provided by a trained team that is ready to identify and manage emergen-

cies. All these actions must be combined with an administration plan focused on reducing maternal morbimortality.^(24,25)

In the context of care networks as set-ups that organize health actions and services and by taking into account that regionalization is a SUS guideline, care offered to women must be comprehensive, universal, resolute, and decentralized.⁽²⁶⁾ Therefore, based on the recommendations of Rede Cegonha, DRS XIII created the Regional Maternal Network, agreed in collegiate instances and putting together health managers and technicians by means of Regional Technical Chambers and Work Technical Groups to evaluate and form it. The creation of collegiates, which are collective spaces of management and mobilization, has been one of the main contributions of Rede Cegonha to technical and political discussions guided by women's health.

The Ribeirão Preto Regional Health Department has information on the network structure in the area and shows good coverage of primary health care in the three health regions. It was reported that primary health care is a guarantee of implementation of strategies to promote reproductive and sexual health, educational activities related to prenatal and postpartum care, and family planning. Any care failure in this structure can lead to the emergence of complications, contributing to the increase of maternal morbimortality.⁽²⁵⁾

The Ribeirão Preto Regional Health Department has a hospital network with 20 maternity hospitals to offer care to pregnant women and encompasses two public maternity hospitals oriented toward high-complexity treatment. A study carried out in the Brazilian state of Paraná that examined the childbirth care hospital network, which offers services to the region and has state coverage, showed a high rate of preventable maternal deaths, which allowed to infer that probable failures originated in lack of adequate structure, training of professionals, and adoption of evidence-based practices advocated by international and Brazilian organizations.⁽⁹⁾

Researchers assessed expectations and perceptions of women living in the interior of the Brazilian state of Minas Gerais regarding childbirth. According to this study, pregnant women hoped for

high-quality services, with human and welcoming professionals.⁽²⁷⁾ These expectations reinforced the points discussed in the present study, since women understand that the more specialized and qualified the service, the lower the chances of unfavorable outcomes.

The results reported in the present study demonstrated that maternal death remains a challenge for obstetric care in the region covered by DRS XIII. It is fundamental that professionals and institutions be properly prepared, show commitment, and develop their activities according to scientific evidence. It is necessary and urgent to change the model of care delivered to these women and their families.

Conclusion

The present study showed that most recorded maternal deaths occurred in women in the age group ranging from 20 to 29 years, who were also single, white, and primiparous. Early recruitment and adequate number of prenatal appointments were perceptible. Most deaths were classified as direct obstetric, with hypertension, infection, and bleeding being the main causes. The data allowed to know the network structure of the facilities and verify the existence of satisfactory childbirth care coverage in primary health care and hospital settings in DRS XIII.

Collaborations

Tintori JA, Mendes LM, Monteiro JC, and Gomes-Sponholz F contributed to study conception, data analysis and interpretation, article writing, relevant critical review of the intellectual content, and approval of the final version to be published.

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