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Article

Epidemiological analysis of the three main causes of maternal deaths in Brazil from 2015 to 2020

Análise epidemiológica das três principais causas de óbitos maternos no Brasil no período de 2015 a 2020

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ABSTRACT: Objective: To trace the epidemiological profile of the three main causes of maternal deaths that occurred between 2015 and 2020 in Brazil. **Methods**: Descriptive, quantitative study with data collected from the Mortality Information System (SIM) of SUS regarding maternal deaths from hypertensive syndromes, hemorrhagic syndromes, and puerperal infections between 2015-2020. The variables selected were: region, age group, race/color, level of education, place of death, year of death, and time of pregnancy or puerperium when the death occurred. **Results**: There were a total of 3819 deaths during this period, with hypertensive syndromes accounting for 54.6% of the deaths among the three syndromic groups. Overall , there were more deaths in the year of 2015, in the Northeastern region, in hospitals and during immediate and late puerperium, that is, until 42 days postpartum. When it comes to the social economic variables, brown women, between 30-39 years old and with 8-11 years of schooling were the most affected. **Conclusion**: The study identified risk groups for maternal mortality that indicate social vulnerability, such as predominant non-white race, low education and Northeast region. Thus, it becomes necessary to propose better health conditions for pregnant women, in addition to early identification of these groups most affected by the triad of maternal mortality mentioned above, i.e., hypertensive syndromes, hemorrhagic syndromes and puerperal infections, to develop awareness campaigns and reduce maternal mortality.

KEYWORDS: Maternal Mortality; Pregnancy, High-Risk; Epidemiology, Descriptive; Obstetrics.

RESUMO: Objetivo: Traçar o perfil epidemiológico das três principais causas dos óbitos maternos ocorridos entre o período de 2015 a 2020 no Brasil. **Métodos:** Estudo descritivo, quantitativo, com dados coletados no Sistema de Informações sobre Mortalidade (SIM) do SUS relativos aos óbitos maternos por síndromes hipertensivas, síndromes hemorrágicas e infecções puerperais entre 2015-2020. As variáveis selecionadas foram: região, faixa etária, raça/cor, escolaridade, local de ocorrência do óbito, ano do óbito e momento da gravidez ou puerpério em que a morte ocorreu. **Resultados:** Houve um total de 3819 óbitos durante esse período, sendo as síndromes hipertensivas responsáveis por 54,6% dos óbitos, dentre os três grupos sindrômicos. No geral, houve mais óbitos no ano de 2015, na região Nordeste, em hospitais e durante o puerpério imediato e tardio, ou seja, em até 42 dias após o parto. Em relação às variáveis socioeconômicas, as mulheres pardas, entre 30-39 anos e com escolaridade entre 8-11 anos foram as mais acometidas. **Conclusão:** O estudo identificou grupos de risco para mortalidade materna que indicam vulnerabilidade social, como raça não-branca predominante, baixa escolaridade e região Nordeste. Dessa forma, torna-se necessário propor melhores condições de saúde para gestantes, além de identificar precocemente esses grupos mais afetados pela tríade de mortalidade materna citada acima, isto é, as síndromes hipertensivas, as síndromes hemorrágicas e as infecções puerperais, para elaborar campanhas de conscientização e reduzir a mortalidade materna.

PALAVRAS-CHAVE: Mortalidade Materna; Gravidez de Alto Risco; Epidemiologia Descritiva; Obstetrícia.

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INTRODUCTION

In 1994, maternal death was defined as death during pregnancy or in 42 days after its end, by any cause related to or aggravated by pregnancy, with an exception of accidental causes. This definition, proposed by the World Health Organization (WHO), is accepted by the associations of gynecology and obstetrics, both international and national, including the International Federation of Gynecology and Obstetrics (FIGO) and the Federação Brasileira das Associações de Ginecologia e Obstetrícia (Brazilian Federation of the Gynecology and Obstetrics Associations - FEBRASGO)[1].

Maternal mortality can also be classified according to its originary causes in direct or indirect, being the maternal death by a direct cause defined as the one that occurs because of obstetric complications, during pregnancy, childbirth or puerperium, related to interventions, omissions, incorrect treatment or to a chain of events, resulting from any of these causes. Indirect obstetric maternal death is the one that results from diseases previous to the pregnancy or developed during that period, not provoked by direct obstetric causes, but aggravated by the physiological effects of pregnancy[2].

In worldwide data, among 830 women die daily for causes related to pregnancy and birth that could have been avoided. Approximately 99% of these deaths occur in developing countries, which reflects the inequality on the access to health services and demonstrates the gap between the rich and the poor[3]. When it comes to Brazil, the high morbimortality rate is incompatible with the gradual economic and social development of the country, demonstrating a reduction in the assistance to the maternal and child health quality, considering that the majority of these deaths occur by avoidable causes[4,5].

Therefore, women die as a result of the complications that occur during or after pregnancy and childbirth, and the main complications, which represent almost 75% of all deaths, are related to hypertensive and hemorrhagic syndromes and to infections. On that account, one may consider that those conditions constitute a triad responsible for most maternal deaths. Beyond that, it is a fact that other health problems may occur previously to the pregnancy, but are aggravated during the gestation, especially if they are not adequately treated[3].

In that perspective, the realization of this research justifies itself since this subject constitutes a challenge to Brazilian public health, through the identification of the risk factors associated with maternal mortality. Therefore, the goal of this study is to analyze the number of maternal deaths, during the period of 2015 to 2020, caused by hypertensive syndromes, hemorrhagic syndromes and infections during pregnancy and/or puerperium, aiming to identify the epidemiological and social profile of the women affected by this triad.

METHODS

It is a quantitative approach descriptive study, that aims, by using data available on the Informations on Mortality System (Sistema de Informações de Mortalidade - SIM), available to access on the Computing Department of the Unified Health System (Departamento de Informática do Sistema Único de Saúde - DATASUS) of the Health Ministry, to trace the epidemiological profile of the maternal deaths occurred in Brazil between 2015 and 2020, for this is the last year to have data available on this system.

The research included Brazilian pregnant women that died because of the three main groups responsible for direct maternal deaths, that is, by hypertensive syndromes, hemorrhagic syndromes and puerperal infections. On the SIM, the diseases and health conditions are categorized on the Morbidity Tabulation List, which is presented on the volum I of the International Classification of Diseases (ICD-10), 10th revision, 2nd edition, big format, from pages 1225 to 1235. The diseases, health conditions and complications related to pregnancy, childbirth and puerperium are categorized on the chapter XV of the list, which corresponds to codes O00-O99 of the ICD-10, regarding the hypertensive syndromes: O10 Pre-existing hypertension complicating pregnancy, childbirth and the puerperium, O11 Pre-existing hypertension with pre-eclampsia, O12 Gestational edema and proteinuria without hypertension, O13 Gestational hypertension without significant proteinuria, O14 Pre-eclampsia, O15 Eclampsia and O16 Unspecified maternal hypertension. Regarding the chapters related to the hemorrhagic syndromes, the following were selected: O44 Placenta previa, O45 Premature separation of placenta, O46 Antepartum hemorrhage, not elsewhere classified, O67 Labor and delivery complicated by intrapartum hemorrhage, not elsewhere classified, O72 Postpartum hemorrhage. Lastly, the chapters related to puerperal infections were: O85 Puerperal sepsis, O86 Other puerperal infections. In total, there were 3.819 deaths for causes related with the ICD-10 chapters mentioned during the period of 2015-2020.

These deaths were analyzed and classified according to the following variables: region, age group, race/ethnicity, level of education, place of death, year of death and moment of pregnancy or puerperium in which the death occurred. The data obtained was organized in a table made in Google Sheets application program and presented in this research as percentages.

It should be pointed out that the present study is an analysis of secondary data that are of open access and are available on a free access online database, therefore, an ethics committee approval for research on human beings is not required.

RESULTS

According to the data collected on the SIM in 07/01/2020 and 07/02/2020, it was noted that there were a total of 3819 maternal deaths by the causes discussed in this article. In that perspective, it was possible to identify that the Hypertensive Syndromes had the most influence on the deaths selected for analysis, with up to 54,62% (2086). Following, the Hemorrhagic Syndromes constituted approximately 31,63% (1208) of the deaths chosen to study. And, lastly, the Puerperal Infections had the least participation on the triad, with 13,74% (525) of the deaths discussed in the present study (Table 1),

Table 1 - Temporal distribution of the deaths caused by the maternal mortality triad in Brazil, 2015-2020

Etiology	2015	2016	2017	2018	2019	2020	Total
	n	n	n	n	n	n	n (f%)
Hypertensive Syndromes	**359 (17,2%)**	**341 (16,35%)**	**361 (17,3%)**	**342 (16,4%)**	**343 (16,44%)**	**340 (16,3%)**	2086 (54,62%)
Hemorrhagic Syndromes	222 (18,4%)	191 (15,81%)	210 (17,38%)	211 (17,47%)	184 (15,23%)	190 (15,73%)	1208 (31,63%)
Puerperal Infections	90 (17,14%)	98 (18,67%)	86 (16,38%)	106 (20,19%)	69 (13,14%)	76 (14,48%)	525 (13,74%)
Total (f%)	671 (17,57%)	630 (16,49%)	657 (17,20%)	659 (13,25%)	596 (15,61%)	606 (15,86%)	3819 (100%)

Source: MS/SVS/CGIAE - Sistema de Informações sobre Mortalidade – SIM (2022)

In relation to the socioeconomic variables, it was observed that out of the 3819 deaths, 43,6% (1667) occurred in women of 30-39 years old, followed by women of 20-29 years old, with 34,7% (1326). In relation to the race/ethnicity, it was noted that out of the total number of deaths, 55,1% (2104) occurred in mixed race women and 28,3% (1081) occurred in white women. Therefore, it is noted that 68,9% of the pregnant women were non-white, while 28,3% of them were white. When it comes to level of education, two groups stand out: 22,9% (874) of the women had between 4-7 years of studying, and 40,8% (1558) of the women had between 8-11 years of studying. In addition, 74,51% had less than 12 years of studying, that is, did not finish high school, which is the mandatory basic education (Table 2). In summary, it was observed that there were no differences in the age group, race/ethnicity and level of education with respect to the cause of death, that is, in all variables, hypertensive syndromes were the main etiology.

To compare with the Brazilian population in general, according to the National Research for Sample of Households (Pesquisa Nacional por Amostra de Domicílios - PNAD Contínua) in 2021, 43,0% of the Brazilian people declare themselves as white, versus 56,1% who declare themselves as non-white[6]. Regarding women specifically, the 2010 Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) Census indicates that the brazilian female population is composed of 51,3% of non-white women, versus 48,69% white women[7]. So, it is notable that the non-white population is larger, just like the number of deaths in this population. In relation to the level of education, still according to the 2010 Census, it was observed that women with more years of studying had a higher life expectancy, which supports the data found in this study, where the least number of deaths occurred in women with 12 or more years of studying[8].

Table 2 – Categorization of the socioeconomic variables in women that died because of the maternal mortality triad in Brazil, 2015-2020

Variables		Hypertensive Syndromes	Hemorrhagic Syndromes	Puerperal Infections	Total
		n(f%)	n(f%)	n(f%)	n (f%)
	10 to 14	**17 (56,66%) *(0,81%)**	6 (20,00%) *(0,49%)	7 (23,33%) *(1,33%)	30 (0,78%)
Age	15 to 19	**256 (57,39%) *(12,27%)**	97 (21,74%) *(8,03%)	93 (20,85%) *(17,71%)	446 (11,67%)
Group	20 to 29	**712 (53,69%) *(34,13%)**	376 (28,35%) *(31,12%)	238 (17,94%) *(45,33%)	1326 (34,72%)
	30 to 39	**898 (53,87%) *(43,05%)**	604 (36,23) *(50,00%)	165 (9,89%) *(31,43%)	1667 (43,65%)
	40 to 49	**203 (58,00%) *(9,73%)**	125 (35,71%) *(10,35%)	22 (6,28%) *(4,19%)	350 (9,16%)

continue

continuation

Variables		Hypertensive Syndromes	Hemorrhagic Syndromes	Puerperal Infections	Total
Total		**2086 (54,62%) *(100%)**	**1208 (31,63%)** *(100%)	**525 (13,74%)** *(100%)	**3819 (100%)**
	White	**540 (49,95%)** *(25,88%)	395 (36,54%) *(32,70%)	146 (13,50%) *(27,81%)	1081 (28,30%)
	Black	**286 (64,85%)** *(13,71%)	99 (22,44%) *(8,19%)	56 (12,69%) *(10,67%)	441 (11,54%)
Race/ethnicity	Yellow	**8 (57,14%)** *(0,38%)	5 (35,71%) *(0,41%)	1 (7,14%) *(0,19%)	14 (0,36%)
	Mixed race	**1154 (54,84%)** *(55,32%)	654 (31,08%) *(54,14%)	296 (14,06%) *(56,38%)	2104 (55,10%)
	Indigenous	**30 (41,09%)** *(1,44%)	29 (39,72%) *(2,40%)	14 (19,17%) *(2,66%)	73 (1,91%)
	Ignored	**68 (64,15%)** *(3,26%)	26 (24,52%) *(2,15%)	12 (11,32%) *(2,28%)	106 (2,77%)
Total		**2086 (54,62%)** *(100%)	**1208 (31,63%)** *(100%)	**525 (13,74%)** *(100%)	**3819 (100%)**
	None	**38 (50,00%)** *(1,82%)	29 (38,15%) *(2,40%)	9 (11,84%) *(1,71%)	76 (1,99%)
	1 to 3	**201 (59,46%)** *(9,63%)	96 (28,40%) *(7,94%)	41 (12,13%) *(7,81%)	338 (8,85%)
Level of education	4 to 7	**476 (54,46%)** *(22,82%)	248 (28,37%) *(20,53%)	150 (17,16%) *(28,57%)	874 (22,88%)
(years of studying)	8 to 11	**845 (54,23%)** *(40,51%)	507 (32,54%) *(41,97%)	206 (13,22%) *(39,24%)	1558 (40,79%)
	12 or +	**244 (55,83%) *(11,69%)**	154 (35,24%) *(12,75%)	39 (8,92%) *(7,42%)	437 (11,44%)
	Ignored	**282 (52,61%)** *(13,52%)	174 (32,46%) *(14,40%)	80 (15,29%) *(15,24%)	536 (14,03%)
Total		**2086 (54,62%)** *(100%)	**1208 (31,63%)** *(100%)	**525 (13,74%)** *(100%)	**3819 (100%)**

Source: MS/SVS/CGIAE - Sistema de Informações sobre Mortalidade – SIM (2022)
The percentages preceded by an asterisk (*) refer to a reading that considers primarily the information on the column and, then, the information on the lines. For example, it must be considered that, among the deaths by Hypertensive Syndromes, 0,81% occurred in women from 10 to 14 years old, 12,27% occurred in women from 15 to 19 years old and so on.

When it comes to the spatial distribution of deaths by the maternal mortality triad, Table 3 shows data related to the distribution by place of death. There was emphasis on deaths occurring in the hospital environment, representing 92.77% (3543) of the total number of deaths selected for analysis, with deaths at home accounting for only 2.72% (103) (Table 3), this being, however, a data justified by the 2009 IBGE Census, which revealed that the rate of home births in Brazil is approximately only 1.25%[9].

Still on the spatial distribution, regarding the regions of Brazil, out of the 3819 deaths, 34.35% (1312) occurred in the Northeast region, with hypertensive syndromes being the main cause; the second most affected region was the Southeast, with 33.31% (1272) deaths, mainly due to hemorrhagic syndromes and puerperal infections. (Table 4). By way of comparison, according to the DATASUS Information System on Live Births (Sistema de Informações sobre Nascidos Vivos - SINASC), between 2015 and 2020 the highest number of live births was also in the Southeast and Northeast regions, recording, respectively, 39.14% and 28,14% of the total. Therefore, it is important to highlight that the Northeast is the region with the highest risk for maternal deaths, as it had a greater share in the total number of deaths than it did in the total number of live births.

Considering each group of causes individually among those selected in this study, it was observed that among the deaths caused by hypertensive syndromes, the most affected women were those aged between 30 and 39 years (43.05%), mixed race (55.32%) and with 8 to 11 years of studying (40.51%). Among the deaths by hemorrhagic syndromes, women aged between 30 and 39 years old (50.00%), mixed race (54.14%) and with 8 to 11 years of studying (41.97%) were also more affected. Though, when it comes to puerperal infections, there is a difference in this pattern. Among deaths from this cause, the majority occurred in women aged 20 to 29 years (45.33%), unlike what was observed in deaths due to hypertensive syndromes and hemorrhagic syndromes. Regarding race/ethnicity and level of education, the pattern was also maintained in deaths due to puerperal infections, with more mixed race women (56.38%) and those with 8 to 11 years of education (39.24%) affected.

Table 3 – Distribution of the number of deaths by the maternal mortality triad in Brazil, 2015-2020, by place of death

Etiology	Hospital	Other health establishment	Home	Public streets	Others	Ignored	Total
	n	n	n	n	n	n	n (f%)
Hypertensive Syndromes	**1895**	55	77	24	34	1	2086 (54,62%)
Hemorrhagic Syndromes	**1139**	18	21	6	23	1	1208 (31,63%)
Puerperal Infections	**509**	7	5	1	3	0	525 (13,74%)
Total (f%)	**3543 (92,77%)**	80 (2,09%)	103 (2,72%)	31 (0,81%)	60 (1,57%)	2 (0,05%)	3819 (100%)

Source: MS/SVS/CGIAE - Sistema de Informações sobre Mortalidade – SIM (2022)

Table 4 - Distribution of the deaths because of the maternal mortality triad in Brazil, 2015-2020, by region

Etiology	North	Northeast	Southeast	South	Middle West	Total
	n	n	n	n	n	n (f%)
Hypertensive Syndromes	319	**793**	648	155	171	2086 (54,62%)
Hemorrhagic Syndromes	189	349	**441**	121	108	1208 (31,63%)
Puerperal Infections	91	170	**183**	43	38	525 (13,74%)
Total (f%)	599 (15,68%)	1312 (34,35%)	1272 (33,31%)	319 (8,35%)	317 (8,30%)	3819 (100%)

Source: MS/SVS/CGIAE - Sistema de Informações sobre Mortalidade – SIM (2022)

Regarding the moment of the gestational period, it was observed that 65.61% (2506) of deaths occurred during the immediate and late puerperium period, that is, within 42 days after birth; 22.57% (862) occurred during pregnancy or childbirth or due to an abortion; and, finally, 2.41% (92) of deaths occurred during the remote puerperium period, that is, from 43 days to less than 1 year after birth (Table 5).

Finally, it was found that deaths remained stable over the years, with 17.57% (671) of deaths occurring in 2015, 17.25% (659) in 2018, 17.20% (657) in 2017, 16.49% (630) in 2016, 15.86% (606) in 2020 and, finally, 15.61% (596) occurred in 2019 (Table 1). It is important, though, to highlight that, in 2020, the world faced the Covid-19 pandemic, which directly influenced the increase in maternal mortality, according to the most recent epidemiological bulletin from the Surveillance Secretariat of the Ministry of Health[10].

According to the bulletin, the Maternal Mortality Ratio (MMR), an indicator used to measure maternal mortality, increased from 57.9 maternal deaths for every 100,000 live births in 2019 to 74.7 in 2020 in all regions of Brazil, with emphasis on the North and Northeast regions, where greater social vulnerability is found and, consequently, greater access

barriers to high-risk prenatal and postpartum care. Nonetheless, it is worth highlighting that, between 2019 and 2020, there was an increase in deaths predominantly due to indirect obstetric causes (from 479 to 843 deaths), with deaths resulting from direct obstetric causes accounting for an increase of just 0.67% (from 1034 to 1014), mainly due to hypertension, hemorrhage and puerperal infection, which supports the data collected and analyzed in the present study[10].

Table 5 – Distribution of deaths because of the maternal mortality triad in Brazil, 2015-2020, by gestational period

Etiology	During pregnancy, childbirth or abortion	During puerperium, within 42 days	During puerperium, from 43 days to less than a year	Not during pregnancy or puerperium	Inconsistent period informed	Not informed or ignored	Total
	n	n	n	n	n	n	n (f%)
Hypertensive Syndromes	535	**1277**	50	32	2	190	2086 (54,62%)
Hemorrhagic Syndromes	316	**776**	17	19	0	80	1208 (31,63%)
Puerperal Infections	11	**453**	25	11	0	25	525 (13,74%)
Total (f%)	862 (22,57%)	**2506 (65,61%)**	92 (2,41%)	62 (1,62%)	2 (0,05%)	295 (7,72%)	3819 (100%)

Source: MS/SVS/CGIAE - Sistema de Informações sobre Mortalidade – SIM (2022)

DISCUSSION

This research identified the following risk groups associated with maternal mortality: the majority of pregnant women who died were between 30 and 39 years old, of mixed race and with 8 to 11 years of education. It was also noticed that over 90% of deaths occurred in a hospital environment, the majority of deaths occurred in the Northeast region and the time when the most deaths occurred was during the immediate and late postpartum period, that is, within 42 days after childbirth.

Currently, the Brazilian Ministry of Health declares that the main causes of maternal mortality are hypertension, hemorrhages, puerperal infections and abortions[11]. In addition, hypertensive syndromes occupy the first place in the ranking of causes of maternal deaths in developing countries, as well as being responsible for around 14.0% of all maternal deaths in the world[12]. Furthermore, according to data from the Pan American Health Organization (PAHO), puerperal infection is one of the main causes of maternal morbidity and mortality, constituting an important public health issue, representing the third main cause of maternal death in Brazil in recent years, which correlates with the data obtained in DATASUS[3].

Regarding the socioeconomic variables, as a result of greater female participation in the labor market and improvements in contraceptive methods, women are choosing to become pregnant after the age of 30, which contributes to the understanding of the fact that the age group between 30 and 49 years old was most affected by the maternal mortality triad[13]. The Brazilian Institute of Geography and Statistics (IBGE) confirms this fact, since, between 2010 and 2020, there was an increase of 27.5% in the number of women who gave birth between the ages of 30 and 34 and 63.6% in women between 35 and 39 years old[14]. Besides, the Ministry of Health considers maternal age over 35 years old to be a pre-existing pregnancy risk factor, which requires special attention during prenatal care, with the pregnancy being considered high risk[5].

In relation to race/ethnicity, the IBGE points out that non-white women (mixed race or black) attend prenatal appointments less frequently than white women. In addition, the institute states that, in 2014, in Brazil, around 53.6% of people declared themselves to be black or mixed race, while 45.5% declared themselves to be white[15]. However, according to the data found, 66.6% of women who died from 2015-2020 due to hypertensive syndromes, hemorrhagic syndromes and puerperal infections in Brazil were mixed race or black, while 28.3% were white. It can be seen that the difference between the proportion of black and mixed race people and the proportion of white people in the population, in 2014, was not that large, nevertheless, the difference between the proportion of deaths of black and mixed race pregnant women and deaths of white pregnant women is significant. This data highlights the inequality in access to women's health care for these pregnant women[15]. When it comes to scholarity, a woman's low level of education can be a limiting factor in access to information, supplies and services that are necessary for a healthy pregnancy. Thus, unfavorable socioeconomic conditions, such as low education and low family income, have led women to high-risk pregnancies, as these situations are generally associated with stress, worse nutritional conditions, late detection of complications and a delay in the use of appropriate interventions and services available for care[16].

Regarding the place of death, maternal deaths occurred predominantly in the hospital, where, according to the National Demographic Survey of Child and Women's Health, 98.4% of births occur in Brazil[17], mainly because pregnant women also opt for labor and birth assistance in this establishment. However, it is noted that despite 98.4% of births taking place in hospitals, the percentage of deaths in these places was lower (92.7%). This can be explained by births in other health establishments and at home, which together accounted for almost 3% of deaths, as well as the difficulty or lack of access to medical services, the social, economic and demographic conditions that impact the risk of developing complications during and after pregnancy[18].

According to the Ministry of Health, home birth is associated with twice the risk of maternal and fetal death. The parturient must have the right to have her choices respected, plus there might be a general feeling of dissatisfaction with the current hospital obstetric model, which is one of the main reasons for choosing a planned home birth, still, it is necessary to bring awareness to the possible risks of a home birth, such as the lack of organization and qualification of the physical structure of the Brazilian maternal and child care network, in order to guarantee better outcomes for the families[18,19].

Still on the topic of spatial distribution, data on maternal deaths highlight the high mortality rates in the Northeast and Southeast regions. Such numbers can be justified by the fact that, according to IBGE, the Brazilian population is distributed as follows: Southeast 41.9%, Northeast 27.6%, South 14.3%, North 8.6% and Middle-West 7.6%[20]. Following this line of reasoning, according to data from SINASC, in the period of 2015 to 2020, there were 17,323,226 births per occurrence in Brazil. Out of these births, around 10.8% occurred in the North region, 28.1% occurred in the Northeast region, 39.1% occurred in the Southeast region, 13.6% occurred in the South region and 8.3% occurred in the Middle-West region, numbers that are proportional to the distribution of the Brazilian population. It is noticed that, despite not being the region with the highest percentage of live births, the Northeast region leads in the percentage of maternal deaths. This can be explained by factors such as a higher percentage of illiteracy and socioeconomic vulnerability that are relevant as they lead to difficulties in accessing and using health services[21].

Regarding the gestational period, the period in which maternal deaths due to hypertensive syndromes, hemorrhagic syndromes and puerperal infections were concentrated was during the puerperium up to 42 days postpartum. Some studies describe that the majority of maternal deaths occur in the puerperal period, highlighting the importance of postpartum monitoring, as, during this period, risk factors remain and complications may occur, causing the deaths of these women[22,23]. It is known that the postpartum period is a period that requires qualified professionals to provide adequate assistance, with precise interventions, especially related to complications resulting from childbirth.

Therefore, qualified assistance with trained professionals is of utmost importance to prevent infections, hemorrhages and hypertensive syndromes in addition to early detection and reduction of worsening cases[24]. Thus, the need to implement appropriate interventions is reinforced, such as a thorough gynecological examination and solicitation of basic laboratory tests, in addition to quality birth and postpartum care, humanized professional training and good prenatal care that is capable of early recognition of vulnerable groups and risk factors for morbidity, through early detection and treatment of diseases[25].

Moreover, despite prenatal care being practically universal in Brazil, the adequacy is still low, as women start prenatal care out of the indicated period, in addition to not having the minimum number of appointments required. When analyzing other parameters, such as routine exams and guidance on breastfeeding and childbirth, less than 10% of pregnant women are adequately advised. Social and demographic factors explain these data, such as less access for mixed race and black women to health services and lower education levels and residents of the North and Northeast regions[26-28].

Regarding the articulation of prenatal care with other services in the health network, some problems were highlighted such as the difficult communication between prenatal care and childbirth assistance services, with a low proportion of pregnant women receiving guidance on the reference maternity hospital for hospitalization and childbirth[29]. This finding reflects the deficiency in the hospital referral system for childbirth care, causing risks to the health of the woman and the baby. In this sense, a 2012 study analyzed the relationship between morbidity and mortality and the theory proposed by Thaddeus and Maine in 1990, which consisted of the concept of "delays", which occur between the establishment of an obstetric complication and its appropriate treatment and outcome. The "delays" are, respectively: delay in making a decision to seek help by the woman and/or her family, delay in reaching the appropriate place to receive such help and delay in receiving the necessary care when in the appropriate place. These "delays" are influenced by the most diverse factors, such as socioeconomic and geographic factors, accessibility and inadequate treatment[30].

With this in mind, the need for adequate guidance regarding the reference maternity hospital for hospitalization for childbirth can be recognized and seriously considered, aiming to mitigate the "delays" that can increase maternal morbidity and mortality. It is important to highlight the relationship between these "delays" and some characteristics of pregnant women. A study found that women living in the North and Northeast regions, adolescent women, particularly those between 10 and 14 years of age, and those who had recently given birth with less education were those who least reported having received proper guidance regarding a reference maternity hospital, while white women and first-time pregnant women were the ones who received the most orientation[26]. Knowing the importance of this guidance and its impact on maternal deaths, adequate and effective coordination between primary, secondary and tertiary care and, consequently, between prevention, early identification of risk factors and timely treatment is essential.

Therefore, as preventive measures, preeclampsia must be detected and adequately treated before its worsening (eclampsia) and other potentially fatal complications. Administering drugs such as magnesium sulfate to patients with preeclampsia may decrease the risk of eclampsia. Besides, severe bleeding after birth can lead to the death of a healthy woman within a few hours, if she is not assisted immediately, which can occur in cases such as home births and in hospitals that do not provide the necessary support, such as a blood bank. The use of oxytocin immediately after birth is an effective measure that prevents up to 60% of cases of puerperal hemorrhage[3].

Furthermore, infections during pregnancy, especially urinary tract infection (UTI), predispose to premature rupture of membranes (PROM), which constitutes an important risk factor for maternal-fetal mortality. A review study identified that PROM was associated with UTI in 17% of cases, with this correlation being explained by an inflammatory response generated by the host due to bacterial stimulation, favoring premature amniorrhexis. Therefore, good prenatal monitoring is extremely important, with urine cultures performed in each trimester of pregnancy, in order to avoid compromising maternal and fetal prognosis[31].

In this way, postpartum infection can be eliminated if good hygiene is practiced, if surgical deliveries are performed only under medical indications and with properly sterilized instruments and if its first signs are recognized and treated in a timely manner[3]. It is emphasized that cesarean section causes five to thirty times greater risks of infection than vaginal birth[18]. Furthermore, among the factors associated with puerperal infections, prolonged labor also stands out. According to the World Health Organization, monitoring the progress of labor must be done carefully and accurately as its prolongation is related to maternal and fetal complications[32].

Finally, the present study set out to analyze maternal deaths caused by hypertensive syndromes, hemorrhagic syndromes and puerperal infections, between 2015-2020 in Brazil. Only these three causes were selected for analysis, as they are established as the most prevalent in the country and in the world[3]. In this sense, the study was effective in finding reliable data, obtained by the Ministry of Health, and correlating this data with information relating to the Brazilian population and births that occur in the national territory as a whole.

Moreover, some disproportionalities were found, suggesting that certain groups are more affected by the unfavorable outcomes that were analyzed, which indicates the need to propose structural changes and public policies, aiming to universalize access to a safe pregnancy and postpartum period in Brazil. Yet, there were some limitations in carrying out this study, such as the non-availability of data for the years 2021 and 2022 by the Mortality Information System (SIM), in addition to the fact that much important information is ignored when filling out medical records, harming its analysis and causing there to be a "shadowed area" of information, which could even have a significant impact on some results.

In conclusion, given that there is an inherent vulnerability to certain social and demographic characteristics regarding maternal deaths, developing better health care conditions, through the strengthening of public policies in Brazil, is, without a doubt, a decisive way of mitigating the number of deaths by the maternal death triad. Furthermore, the principle of integrality proposed by the Unified Health System must be emphasized and pregnant women should be guided in looking for hospitals and maternity wards at any sign of complication, with greater care for socioeconomic and cultural vulnerabilities, thus strengthening the interface between primary-secondary-tertiary care. Providing favorable reproductive health conditions is a challenge, and this reality requires an active search and quality in the care provided from prenatal care to childbirth and the postpartum period, thus aiming to reduce preventable maternal deaths to the minimum amount possible.

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REFERENCES

1. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Ações Programáticas Estratégicas. Estudo da mortalidade de mulheres de 10 a 49 anos, com ênfase na mortalidade materna [Internet]. 2006. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/cd11_03estudo_mortalidade_mulher.pdf
2. Viana RC, Novaes MRCG, Calderon IMP. Mortalidade materna - uma abordagem atualizada. Comun Ciênc Saúde. 2011;22(1):141–52.
3. Saúde materna - OPAS/OMS | Organização Pan-Americana da Saúde [Internet]. [citado em 11 de outubro de 2022]. https://www.paho.org/pt/node/63100
4. Lopes FBT, Moares MS, Bezerra APF, Rodrigues APRA, Santos NRS, Oliveira JS. Mortalidade Materna por Síndromes Hipertensivas e Hemorrágicas em uma Maternidade- Escola Referência de Alagoas. Cad Grad Biológicas e da Saúde-UNIT-ALAGOAS. 2017;4(2):149–62. https://periodicos.set.edu.br/fitsbiosaude/article/view/4493
5. Saúde M da. Gestação de Alto Risco Manual Técnico [Internet]. Gestação de Alto Risco Manual Técnico. 2012. 370–3 p. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/gestacao_alto_risco.pdf
6. Instituto Brasileiro de Geografia e Estatística - Educa | Jovens [Internet]. Conheça o Brasil – População. [citado em 15 de junho de 2023]. https://educa.ibge.gov.br/jovens/conheca-o-brasil/populacao/18319-cor-ou-raca.html
7. Federal S. População Brasileira – 2010 (Censo IBGE) [Internet]. Portal Institucional do Senado Federal. [citado em 15 de junho de 2023]. https://www12.senado.leg.br/institucional/responsabilidade-social/oel/panorama-nacional/populacao-brasileira
8. Da Silva LE, Freire FHMA, Pereira, RHM. Diferenciais de mortalidade por escolaridade da população adulta brasileira, em 2010. Cad Saúde Pública. 2016;32(4):1–12. Doi: 10.1590/0102-311X00019815
9. Chaves WB, Da Mota CP, Silva JLL da, Mouta RJ de O, Silva T da C, Dias Filho JC, et al. Perfil sociodemográfico de mulheres que tiveram partos domiciliares do município do Rio de Janeiro, no período de 2010 a 2017. Res Soc Dev. 2022;11(3):e22011326382. Doi: 10.33448/rsd-v11i3.26382
10. BRASIL. Ministério da Saúde. Monitoramento dos casos de arboviroses até a semana epidemiológica 18 de 2022. Vol. 53, Ministério da Saúde - Boletim Epidemiológico. 2022. 1–37 p.
11. Martins ACS, Silva LS. Epidemiological profile of maternal mortality. Rev Bras Enferm. 2018;71:677–83. Doi: 10.1590/0034-7167-2017-0624
12. Al-Rubaie ZTA, Askie LM, Ray JG, Hudson HM, Lord SJ. The performance of risk prediction models for pre-eclampsia using routinely collected maternal characteristics and comparison with models that include specialised tests and with clinical guideline decision rules: a systematic review. BJOG An Int J Obstet Gynaecol. 2016;123(9):1441–52. Doi: 10.1111/1471-0528.14029
13. Aldrighi JD, Wall ML, Souza SRRK. Experience of pregnant women at an advanced age. Rev Gauch Enferm [Internet]. 2018;39:e20170112. DOI: 10.1590/1983-1447.2018.2017-0112
14. Em dez anos, cai 26% o número de mães com menos de 15 anos no Brasil, aponta IBGE | Economia | G1 [Internet]. [citado em 11 de outubro de 2022]. https://g1.globo.com/economia/noticia/2020/12/09/em-dez-anos-cai-26percent-o-numero-de-maes-com-menos-de-15-anos-no-brasil-aponta-ibge.ghtml
15. IBGE. Síntese de indicadores sociais. Vol. 39, I. 2016. 1–63 p.
16. Pícoli RP, Cazola LH de O, Lemos EF. Maternal mortality according to race/skin color in Mato Grosso do Sul, Brazil, from 2010 to 2015. Rev Bras Saúde Matern Infant. 2017;17(4):729–37. Doi: 10.1590/1806-93042017000400007
17. BRASIL. Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher PNDS 2006. Dimensões do Processo Reprodutivo e da Saúde da Criança. Vol. 1. 2009. 1–301 p.
18. Pascoto GS, Tanaka EZ, Fernandes LCR, Shimo AKK, Sanfelice CFO. Difficulties in home birth care from the perspective of obstetric nurses. Rev Baiana Enferm. 2020;34:1–10. Doi: 10.18471/rbe.v34.36633
19. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Ministério da Saúde não recomenda o parto domiciliar no Brasil [citado em 16 de junho de 2023]. https://aps.saude.gov.br/noticia/15016
20. Chaim SRP, De Oliveira SMJV, Kimura AF. Hipertensão arterial na gestação e condições neonatais ao nascimento. ACTA Paul Enferm. 2008;21(1):53–8. Doi: 10.1590/S0103-21002008000100008
21. Instituto Brasileiro de Geografia e Estatística (2013). Síntese de Indicadores Sociais - Uma análise das condições de vida da população brasileira. Estudos e Pesquisas - Informação Demográfica e Socioeconômica. 2013;32:266. https://biblioteca.ibge.gov.br/visualizacao/livros/liv64436.pdf
22. Herculano MMS, Veloso LS, Teles LMR, Oriá MOB, de Almeida PC, Damasceno AK de C. Óbitos maternos em uma Maternidade Pública de Fortaleza: Um estudo epidemiológico. Rev Esc Enferm. 2012;46(2):295–301. Doi: 10.1590/S0080-62342012000200005
23. Menezes MLN, Bezerra J de FO, Bezerra J de FO. Epidemiological profile of maternal deaths in a referral hospital for high-risk pregnancy. Rev Rede Enferm Nord. 2015;16(5):714. Doi: 10.15253/2175-6783.2015000500013
24. Lima MRG de, Coelho ASF, Salge AKM, Guimarães JV, Costa PS, Sousa TCC de, et al. Alterações maternas e desfecho gravídico-puerperal na ocorrência de óbito materno. Cad Saúde Coletiva. 2017;25(3):324–31. Doi: 10.1590/1414-462X201700030057
25. Fernandes BB, Nunes FBB, Prudêncio PS, Mamede FV. Epidemiological research of the maternal deaths and compliance with the fifth millennium development goal. Rev Gaucha Enferm. 2015;36:192–9. Doi: 10.1590/1983-1447.2015.esp.56792
26. Coutinho T, Monteiro MFG, Sayd JD, Teixeira MTB, Coutinho CM, Coutinho LM. Monitoramento do processo de assistência pré-natal entre as usuárias do sistema único de saúde em município do Sudeste brasileiro. Rev Bras Ginecol e Obstet. 2010;32(11):565–9. Doi: 10.1590/S0100-72032010001100008
27. Domingues RMSM, Hartz ZMA, Dias ABM, Leal MC. Avaliação da adequação da assistência pré-natal na rede SUS do Município do Rio de Janeiro, Brasil. Cad Saude Publica. 2012;28(3):425–37. Doi: 10.1590/S0102-311X2012000300003
28. Andreucci CB, Cecatti JG. Desempenho de indicadores de processo do programa de humanização do pré-natal e nascimento no Brasil: Uma revisão sistemática. Cad Saude Publica. 2011;27(6):1053–64. Doi: 10.1590/S0102-311X2011000600003
29. Leal M do C. Prenatal care in Brazil. Cad Saude Publica. 2014;30:S1–15. Doi: 10.1590/0102-311X00126013
30. Pacagnella RC, Cecatti JG, Osis MJ, Souza JP. The role of delays in severe maternal morbidity and mortality: expanding the conceptual framework. Reproductive Health Matters. 2012;20(39):155-63. Doi: 10.1016/S0968-8080(12)39601-8
31. Portela FM, Marcolan LB, Reis AA, de Lucca DPP, Filho JKP, Rosas LEFCL, Nascimento FC. Infecção urinária como fator de risco para amniorrexe prematura. Rev Cad Medicina. 2019;02:85–93. https://revista.unifeso.edu.br/index.php/cadernosdemedicinaunifeso/article/view/1644
32. Organização Mundial de Saúde. Maternidade Segura. Assistência ao parto normal: um guia prático. Brasília (DF): OMS/SRF/MSM; 1996.

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