

Epidemiological Analysis of Maternal Mortality from Hypertensive Diseases in Piauí between 2013 and 2022

Epidemiological analysis of maternal mortality due to hypertensive diseases in Piauí between 2013 and 2022

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SUMMARY

Introduction: Maternal mortality is a crucial public health indicator, influenced by factors such as access to health care, socioeconomic conditions, and quality of care. In Brazil, gestational hypertensive disorders (GHS) are among the leading causes of direct obstetric maternal death. Within the Northeast region, Piauí stands out for having a higher risk of maternal mortality from this cause than other states. **Objective:** To describe the epidemiological profile of maternal mortality from hypertensive diseases in Piauí from 2013 to 2022. **Methods:** This is a descriptive study with a quantitative approach that used information on live births from the Live Birth Information System and maternal deaths related to hypertensive disorders from the Mortality Information System database for the years 2013 to 2022, available in DATASUS. **Results:** Of the 406 maternal deaths, 100 (24.6%) were related to hypertensive disease. Most deaths occurred in 2019 and 2022, with eclampsia being the main cause of death (58%). The most affected age group was mothers aged 30 to 34 years (26%) with 8 to 11 years of schooling (33%). Brown women represent the majority of patients with this outcome (74%), and the period of the pregnancy-puerperal cycle with the highest number of deaths was the puerperium (57%). **Conclusions:** The research revealed an oscillatory pattern and a high incidence of maternal deaths due to hypertensive diseases in Piauí, with a higher occurrence in 2019 and 2022. Eclampsia was the main cause, affecting brown women, aged 30 to 34 years, with 8 to 11 years of schooling, especially in the puerperium. The study data can guide improvements in health policies, focusing on promoting prenatal care, early diagnosis, risk classification, and preventing complications in pregnant women in the state.

Keywords: Epidemiological Analysis. Maternal Mortality. Gestational Hypertensive Syndromes. Preeclampsia.

ABSTRACT

Introduction: Maternal mortality is a crucial public health indicator, influenced by the access to health care, socioeconomic conditions and quality of care. In Brazil, Gestational Hypertensive Syndromes (GHS) are one of the main causes of obstetric maternal death. Within the Northeast region, Piauí stands out as the state with the highest risk of maternal mortality.

Objective: Describe the epidemiological profile of maternal mortality due to hypertensive diseases in Piauí, from 2013 to 2022. **Method:** This is a descriptive study, with a quantitative approach, which provides information on live births from the Live Birth Information System and maternal deaths related to hypertensive syndromes in the Mortality Information System

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database for the years 2013 to 2022, in Piauí, available on DATASUS. **Results:** Of the 406 maternal deaths, 100 (24.6%) were related to hypertensive disease. The majority of deaths occurred in 2019 and 2022, with eclampsia as the main cause of death (58%). The most affected age group was 30 to 34 years old (26%) and within eight to eleven years of schooling. Black women represent the majority of patients in this advanced stage (74%) and the period of the pregnancy-puerperal cycle with the highest number of deaths in the postpartum period (57%).

Conclusion: The data collected can be used as a support to external public policies in order to improve prenatal services, highlighting early diagnosis, risk assessments and the implementation of preventive measures. It is essential to prioritize comprehensive assistance throughout the pregnancy-puerperal cycle, ensuring access to medical support specialized in obstetric emergencies.

Keywords: Epidemiological Analyzes. Maternal Mortality. Hypertensive Syndromes. Preeclampsia.

1. INTRODUCTION

The World Health Organization (WHO) defined maternal mortality as the death of a woman occurring during pregnancy or within a period of up to 42 days after its end, regardless of how long the pregnancy lasted or whether it was a ectopic pregnancy. The cause of death must be linked to pregnancy complications or have been intensified by it, or even be a consequence of medical procedures performed during this period. Deaths from accidental or unrelated causes to pregnancy are not considered maternal deaths (WHO, 2019).

The Maternal Mortality Ratio (MMR), expressed by the number of maternal deaths per 100,000 Live Births (LB) in a given location, is a powerful indicator of health because it is directly related to the quality of care available, access to it care or lack thereof, to the socioeconomic conditions surrounding women and their families, their health conditions previously, in addition to the impact on the State's expenses and earnings (Tintori *et al.*, 2022).

For a better analysis of this indicator, a classification was made according to the causes. It was divided if, then, maternal mortality from direct obstetric causes, which are the result of complications of pregnancy, childbirth or puerperium due to interventions, omissions, treatment incorrect or to the chain of events resulting from any of these causes; and by causes indirect obstetric, resulting from previous illness of the mother or developed during pregnancy, not due to direct obstetric causes, but aggravated by the physiological effects of pregnancy (Dias *et al.*, 2015).

In Brazil, direct obstetric maternal death is responsible for maintaining the ratio maternal mortality rates are high, while highlighting that a large part of these deaths could be avoided if assistance during pregnancy, childbirth or the postpartum period was adequate. Among the main causes within direct obstetrics, syndromes are cited hypertensive disorders, hemorrhages, puerperal infections and complications of abortion. These are responsible for 66% of maternal deaths in Brazil and hypertensive syndromes, more specifically, they are responsible for almost a quarter of them (Viana; Novaes; Calderon, 2011).

In this sense, reducing maternal mortality is a global priority. for many years, and is currently included in the third Sustainable Development Goal (SDGs) of the UN. Brazil, in turn, focuses investments and attention on reducing maternal mortality to a maximum of 30 deaths per 100,000 live births, which could saving more than a million lives over a decade. So, understanding what's involved the main causes of these deaths, such as hypertensive syndromes, is essential to guide effective health policies and programs, especially in the Northern and Northeastern states, where the incidence is higher (IPEA, 2018).

Within the Northeast region, some municipalities in Piauí stand out for presenting higher risk of maternal mortality. Based on data from the Ministry of Health, the high number of maternal deaths in these municipalities could be explained by deficiencies in state health services. Among the main obstacles to prenatal care, include low adherence of health professionals to the use of risk stratification guidelines, difficulties in accessing and monitoring pregnant women, especially those at high risk, and lack of training for Primary Health Care professionals working in Brazil (Oliveira *et al.*, 2023).

In view of this, this article aims to analyze the epidemiological profile of maternal deaths due to pregnancy-induced hypertensive syndromes in the state of Piauí, based on a retrospective evaluation of cases that occurred between 2013 and 2022.

2. METHODOLOGY

The study in question was descriptive, quantitative and retrospective documentary in nature, carried out through information collected through the Information System on

Mortality (SIM), through the Department of Information Technology of the Unified Health System (TabNet - DataSUS), at the electronic address (<http://www.data-sus.gov.br>). The data obtained were data on maternal deaths due to hypertensive diseases in the state of Piauí, in the section temporal from 2013 to 2022. To calculate the Maternal Mortality Ratio (MMR), considered the data on Live Births (LB) in Piauí, from 2013 to 2022, available at Live Birth Information System (SINASC).

The variables analyzed were: age group, education, race/color, and period of occurrence (in the pregnancy-puerperal cycle). The study population was selected through notification in the Death Certificate, with the cause of death defined by the Classification International Classification of Diseases in its 10th edition (ICD-10). The following codes were analyzed: O10 - Pre-existing hypertension complicating pregnancy, childbirth and the puerperium; O11 - Disorder pre-existing hypertensive with superimposed proteinuria; O13 – Gestational hypertension (induced by pregnancy) without significant proteinuria; O14 – Gestational hypertension (induced by pregnancy) with significant proteinuria; O15 – Eclampsia and O16 – Non-maternal hypertension specified.

There was no need to submit this study to the Ethics Committee for consideration. this is an analysis of a database made available on a public domain platform. However, all recommendations of Council Resolution 466/2012 were followed. National Health Agency, which defines the guidelines and regulatory standards for research involving human beings.

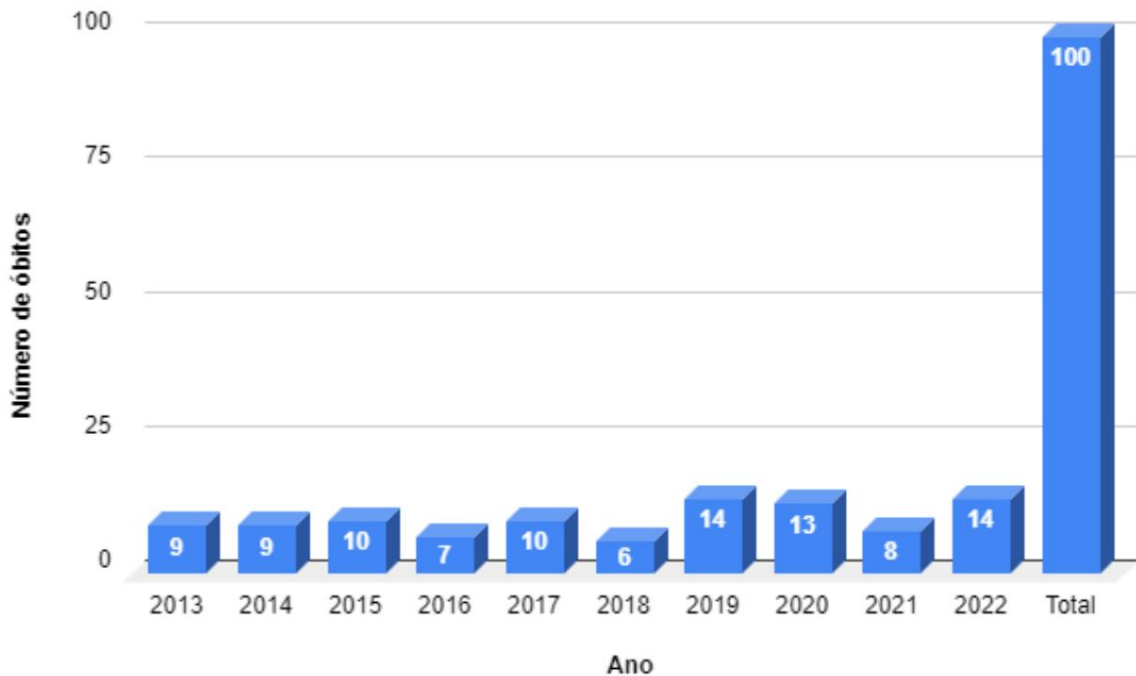
With this information, tables were created in the Microsoft Excel program to facilitate data visualization and analysis. Descriptive statistics were used with analysis of simple and absolute frequency, as well as percentage, to verify the characteristics general characteristics of the sample and the different risks.

3. RESULTS AND DISCUSSION

Initially, it was observed that, between the years 2013 to 2022, 406 deaths occurred maternal deaths in the state of Piauí, of which 100 (24.6%) were caused by diseases gestational hypertension. The years with the highest incidence were 2019 and 2022, both with 14

maternal deaths due to hypertensive causes during pregnancy. The lowest occurrence was in 2018, with 6 deaths attributed to the problem in question (Graph 1).

Graph 1 - Distribution, in absolute values, of maternal deaths due to hypertensive diseases during pregnancy per year, in the state of Piauí, from 2013 to 2022.



Source: Author (2024)

Regarding the Maternal Mortality Ratio (MMR), it was observed that it was higher in year 2022, corresponding to 33.13 deaths per 100,000 live births (Table 1). The RMM corresponds to the number of maternal deaths per 100,000 live births of mothers residing in certain geographic space, in the year considered (Latin American Center of Perinatology, Women's and Reproductive Health, 2012). It is noteworthy that, in 2018, the Institute of Applied Economic Research (IPEA) defined as one of the National Goals of the Objectives of Sustainable Development to reduce the MMR to a maximum of 30 deaths per 100,000 live births (LB) in Brazil by 2030 (Institute of Applied Economic Research, 2018). Thus, the MMR for hypertensive diseases alone is higher than the established target. by IPEA considering all causes of maternal death, which demonstrates the high impact of these etiologies in women's health.

Table 1. Distribution of the Maternal Mortality Ratio (MMR), according to the year of occurrence of maternal deaths due to hypertensive diseases, Piauí, Brazil, 2013 to 2022.

Year	Live Births	Number of Deaths	RMM
2013	46,419	9	19.38
2014	47,941	9	18.77
2015	49,253	10	20.30
2016	46,986	7	14.89
2017	48,551	10	20.59
2018	49,490	6	12.12
2019	47,933	14	29.20
2020	45,229	13	28.74
2021	45,978	8	17.39
2022	42,247	14	33.13
Total (2013-2022)	470,027	100	21.27

Source: Author (2024)

A systematic review conducted by the World Health Organization (WHO) in 2014 placed hypertensive disorders in 2nd place as the cause of maternal deaths in the world, corresponding to 14% of the causes of death and second only to obstetric hemorrhage (Say *et al.*, 2014). Furthermore, a 2017 Japanese study analyzed the preventability of deaths maternal due to hypertensive diseases, noting that, although prevention is difficult in cases severe, better care can prevent deaths through early diagnosis, transportation efficient maternal care, termination of pregnancy when appropriate and antihypertensive treatment optimized (Katsuragi *et al.*, 2017). Thus, it is observed that Piauí has a percentage of deaths from SHG higher than the world average, despite being considered a preventable cause of maternal death.

Gestational hypertensive syndromes (GHS) are most commonly divided into chronic arterial hypertension, gestational hypertension, preeclampsia and superimposed preeclampsia to chronic hypertension. Chronic arterial hypertension is characterized by the presence of high blood pressure systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg reported by

pregnant or identified before 20 weeks of gestation. Pre-eclampsia occurs when the arterial hypertension is identified after the 20th week of pregnancy, accompanied or not by significant proteinuria or systemic involvement due to target organ dysfunction, such as thrombocytopenia, liver dysfunction, renal failure, acute pulmonary edema, imminent of eclampsia or eclampsia (August; Sibai, 2023).

Additionally, preeclampsia superimposed on chronic arterial hypertension is defined when proteinuria appears or worsens after 20 weeks of gestation in women with chronic high blood pressure, when more antihypertensive medications are needed or when there is target organ dysfunction. And finally, gestational hypertension is the identification of arterial hypertension in previously normotensive pregnant women, without proteinuria or other symptoms of pre-eclampsia, disappearing within 12 weeks after delivery, although develop signs or symptoms of pre-eclampsia in up to 25% of them, altering the diagnosis (August; Sibai, 2023). Among these, preeclampsia (PE), both isolated and the overlapping one, corresponds to the most serious type, representing an important cause of morbidity and mortality (Ministry of Health, 2022).

In the present study, it is demonstrated that the most prevalent cause of maternal deaths due to hypertensive diseases in Piauí, between 2013 and 2022, was eclampsia, with 58 deaths (58%) (Table 2). Next, gestational hypertension with significant proteinuria ranked 2nd place, corresponding to 31% of deaths. This group is subdivided, by ICD-10, into Pre-moderate, severe and unspecified eclampsia, with severe preeclampsia being the most common responsible, with 23 deaths recorded.

Previously, patients with preeclampsia were classified as mild or serious, a specification similar to the classification used in ICD-10. However, it was noted that this stratification can lead to errors, since all patients with pre-eclampsia may eventually have unfavorable outcomes, in addition to being able to result in the anticipation unnecessary childbirth. Today, it is subclassified as preeclampsia without signs of severity, when there are no pressure peaks (blood pressure \leq 160/110 mmHg) or organ damage target, and in pre-eclampsia with signs of severity, when there are pressure spikes and/or lesions target organ (Peraçoli JC *et al.*, 2023).

It can be seen, then, that, although the new subdivision is more faithful to the clinical pictures presented, the divergences maintained between the SHG classifications make it difficult to analyze and more uniform management of these pathologies.

Table 2. Distribution of causes of maternal deaths due to hypertensive diseases, Piauí, Brazil, 2013 to 2022.

Causes of death	Number of deaths	%
O10 Pre-existing hypertension complicating pregnancy, childbirth and the puerperium	3	3
O11 Pre-existing hypertensive disorder with superimposed proteinuria	0	0
O13 Gestational hypertension without significant proteinuria	5	5
O14 Gestational hypertension with significant proteinuria	31	31
O15 Eclampsia	58	58
O16. Maternal hypertension NE	3	3
Total	100	100

Source: Author (2024).

Table 3. Distribution of the number of maternal deaths due to gestational hypertension with significant proteinuria, according to ICD-10 subclassifications.

O14 Gestational hypertension with significant proteinuria	Number of deaths
O14.0 Moderate preeclampsia	1
O14.1 Severe preeclampsia	23
O14.9 Preeclampsia NE	7

Source: Author (2024).

Eclampsia is a serious and potentially fatal complication of preeclampsia. It is characterized by the occurrence of generalized tonic-clonic seizures, coma, or both,

during pregnancy or the puerperium, in pregnant women with pre-eclampsia, and not related to other central nervous system conditions (Poon *et al.*, 2019).

Cerebral edema and increased intracranial pressure are related to the pathophysiology neurological symptoms and, as a result, eclampsia. Two mechanisms are proposed pathogenic: vasogenic edema and cytotoxic edema. Vasogenic edema can result from a sudden increase in blood pressure above 150 mmHg in women with poor control pressure, resulting in an increase in cerebral blood flow that causes hyperperfusion and edema. Cytotoxic edema appears to occur due to intense vasospasm resulting from an excessive cerebrovascular regulation in an attempt to correct hyperperfusion (Ives *et al.*, 2020). The recommended methods for preventing eclampsia, through the administration of sodium sulfate, magnesium in all patients with severe preeclampsia may reduce the risk of seizures up to 10 times, giving them so-called neuroprotection (Sullivan *et al.*, 2022).

A secondary analysis of a multicenter, cross-sectional study covering 27 centers from all geographic regions of Brazil, carried out between 2009 and 2010, evaluated the association between eclampsia and severe maternal outcome, which includes maternal death and *Maternal Near Miss*.

This study revealed a prevalence of severe maternal outcome for eclampsia five times higher than for other serious hypertensive diseases of pregnancy. However, despite the well-established association between the occurrence of eclampsia and maternal characteristics sociodemographic, the same patterns were not evidenced when assessing the risk of outcome severe maternal. This denotes that the clinical results after the occurrence of seizures, possibly, depend, in particular, on an effective and timely response from the care team (Giordano, 2014).

Risk factors for the occurrence of preeclampsia include a family history of disease, genetic predisposition, multiparity, Advanced Maternal Age (AMA), pregnancy by in vitro fertilization and maternal medical conditions such as pre-existing hypertension, diabetes, Chronic Kidney Disease (CKD), obesity, and lupus. Conditions associated with increased body mass placental, such as multifetal pregnancies and hydatidiform mole, are also associated with increased risk of pre-eclampsia, in addition to congenital malformations such as trisomy chromosome 13 (Phipps *et al.*, 2019).

Therefore, a detailed anamnesis, in order to recognize risk factors, from the early prenatal care is necessary to classify which women are most susceptible to

develop the syndrome, and among these, which have an indication for prophylaxis use. To this screening, primary care plays an indispensable role in promoting the search active care of pregnant women, in addition to specialized training of nurses and doctors to manage these cases. However, there is still a lack of comprehensive, multicenter studies that define which risk factors that contribute to fatal outcome among women who develop hypertensive syndromes during pregnancy.

When evaluating the variables of registered deaths, it was found that the oldest age group affected corresponded to those aged 30 to 34 (26%), followed by the age group of 25 to 29 years, corresponding to 22% of maternal deaths due to hypertensive diseases (Table 4).

Table 4 - Distribution of age groups of maternal deaths due to hypertensive diseases, Piauí, Brazil, 2013 to 2022.

Age range	n	%
10 to 14 years old	2	2
15 to 19 years old	9	9
20 to 24 years old	19	19
25 to 29 years old	22	22
30 to 34 years old	26	26
35 to 39 years old	18	18
40 to 44 years old	4	4

Source: Author (2024)

In comparison with other Brazilian states, it was found that a survey carried out in the state of São Paulo, evaluating the period from 2017 to 2021, showed that the majority of deaths from eclampsia occurred between 30 and 39 years of age, corresponding to 51.3% of deaths (Araújo *et al.*, 2024). In addition, an epidemiological profile drawn up in the State of Alagoas, analyzing the years 2004 to 2013, concluded that the maternal death rate due to diseases gestational hypertensives was higher in the age group of 30-39 years (Pereira *et al.*, 2017).

In studying this variable, it is known that advanced maternal age is established as pregnancy in women 35 years of age or older. According to the International Federation of Gynecology and Obstetrics (FIGO), IMA is associated with a 1.2 to 3 times greater risk of

develop preeclampsia (Poon LC *et al.*, 2019). At the same time, in Brazil, there was a significant increase in the percentage of births to women over 35, doubling from proportion from 1994 to 2018 (Ministry of Health, 2022).

It is therefore noted that Piauí is in agreement with other Brazilian states regarding the age group most susceptible to death from hypertensive causes, incorporating 44 deaths between 30 and 39 years old. However, it differs from other studies that reveal an increased risk of present pre-eclampsia from the age of 35.

This divergence may be related to the number of pregnancies in each age group, since, in Piauí, pregnancies are still concentrated in the 20 to 24 age group, followed by range of 25 to 29 years, estimated through the number of live births (Table 5). Thus, it is not possible to conclude that there is a direct relationship between age group and maternal mortality due to hypertensive diseases through this research.

Table 5 - Distribution of the number of live births by mother's age group, Piauí, Brazil, 2013 to 2022.

Mother's age	Number of Live Births
10 to 14 years old	4,765
15 to 19 years old	87,058
20 to 24 years old	123,495
25 to 29 years old	113,714
30 to 34 years old	87,139
35 to 39 years old	43,078
40 to 44 years old	10,113
45 to 49 years old	609
50 to 54 years old	39
55 to 59 years old	7
60 to 64 years old	7
65 to 69 years old	2
Age unknown	1
Total	470,027

Source: Author (2024)

Subsequently, when evaluating data related to color and race, it was found that deaths of mothers due to hypertensive syndromes in Piauí, between 2013 and 2022, were more frequent in brown women (74%) (Table 5).

Table 6 - Color/race distribution of maternal deaths due to hypertensive diseases, Piauí, Brazil, 2013 a 2022.

Color/race	n	%
White	13	13
Black	10	10
Yellow	2	2
Brown	74	74
Ignored	1	1

Source: Author (2024)

Studies focusing on the role of ethnicity in preeclampsia disparities suffer limitations, such as the fact that race is a self-declared characteristic, which can make this subjective assessment (Dimitriadis *et al.*, 2023). An example of this is the definition of the term “pardo” in Brazil. While the IBGE defines pardo as an individual who identifies as a mixture of two or more color or race options (Osório, 2013), authors such as Munanga (2019) conceptualize brown people, along with black people, as part of the black group. In this way, it is difficult a valid scientific analysis regarding this variable.

At the same time, data released in 2022 shows that the majority of the population Piauienses self-declare as being of mixed race or color (64.83%), while blacks represent 12.25% of the population (IBGE, 2022). This demonstrates, then, a bias in the present research, since that as it is the majority group, it is expected that more brown women will be subject to severe outcomes due to hypertensive syndromes during pregnancy.

In the literature, it is recognized that black pregnant women with pre-eclampsia have a higher prevalence of negative outcomes (Dimitriadis *et al.*, 2023). As an example, a study carried out in the United States, on maternal mortality due to hypertensive diseases,

from 1979 to 2018, which showed that the mortality rate was 4 times higher in black women compared to white women (Ananth *et al.*, 2021).

In contrast, a Brazilian study carried out in 2017, which assessed the risk of maternal complications according to ethnic groups, did not show a distribution significantly different between the different ethnic groups considered, contrary to the expectations, which can be attributed to the high level of miscegenation present in Brazil (Fernandes; Sousa; Cecatti, 2017). Therefore, applying data from other countries to reality Brazilian may be mistaken, since the national ethnic and racial profile is different, being it is necessary to further analyze the influence of color and race on women's health.

Continuing the present study, it was observed that deaths were more frequent in women with 8 to 11 years (33%) of schooling (Table 6).

Table 7 - Distribution of maternal deaths due to hypertensive diseases, according to years of study, Piauí, Brazil, 2013 to 2022.

Education	n	%
None	5	5
1 to 3 years	9	9
4 to 7 years old	31	31
8 to 11 years old	33	33
12 years and over	8	8
Ignored	14	14

Source: Author (2024)

A comprehensive search using databases such as Ovid MEDLINE, CINAHL, Popline, Scopus and ClinicalTrials.gov (from 1990 to 2018), which examined the correlation between maternal morbidity and mortality and the social determinants of health in the United States, revealed that failure to complete high school can negatively influence health status before, during and after pregnancy. This factor is then used as an indicator of the status socioeconomic, in addition to associating it with aspects that affect the beginning of prenatal care, health literacy and health outcomes (Wang *et al.*, 2020).

Additionally, in a study conducted in Brazil with primary care users health, it was found that adults with elementary and secondary education demonstrated, respectively, 22.06 and 4.20 times more likely to present health literacy inadequate when compared to those with higher education (Marques; Lemos; 2018). According to Weiss *et al.* (2005), health literacy (HL) is the ability to obtain, process and understand basic health information and services needed to make decisions pertinent information about your own health and medical care.

In view of this, it is noted that the importance of schooling in public health issues is undeniable, although in the present research it is not possible to visualize any similar relationship to the aforementioned studies with the problem under analysis. At the same time, the scarcity of works qualified individuals who relate this variable to maternal mortality due to hypertensive diseases makes it difficult for this issue to be addressed in public measures to tackle this problem.

Ultimately, the period of occurrence of death that stood out most, within the pregnancy-puerperal cycle, was the puerperium, which represents 57% of the deaths analyzed in this study (Table 7). However, in the classification of eclampsia, which is the main cause of death in this study, the highest number of deaths was during pregnancy with 18 cases (Table 8).

Table 8 - Distribution of periods of occurrence of maternal deaths, according to the pregnancy cycle. puerperal, due to hypertensive diseases, Piauí, Brazil, 2013 to 2022.

Period of death	n	%
During pregnancy, childbirth or abortion	36	36
During the puerperium, up to 42 days	57	57
Not during pregnancy or postpartum period	1	1
Not informed or ignored	6	6

Source: Author (2024)

Table 9. Distribution of the number of maternal deaths due to Eclampsia, according to ICD-10 subclassifications.

O15 Eclampsia	Number of deaths
O15.0 Eclampsia in pregnancy	18

O15.1 Eclampsia in labor	9
O15.2 Eclampsia in the puerperium	14
O15.9 Eclampsia NE as to period	17

Source: Author (2024)

High blood pressure in the postpartum period is more commonly seen in women with disorders hypertensive in prenatal care, but it can also occur initially in the postpartum period, with possibility of manifesting with neurological symptoms, such as headache and eclampsia (Hauspurg; Jeyabalan; 2022). In these cases, blood pressure peaks in three to six days after childbirth and has several causes (August, 2024).

New-onset transient postpartum hypertension may be related to a combination of factors, including the administration of a large volume of intravenous fluids to patients who had a cesarean section or spinal anesthesia for labor, loss of vasodilation associated with pregnancy after delivery, mobilization of extravascular fluid after childbirth, administration of ergot derivatives for the prevention or treatment of postpartum hemorrhage childbirth and/or prolonged administration of high doses of nonsteroidal anti-inflammatory drugs (NSAIDs) for postpartum analgesia. Thus, postpartum monitoring, which is often neglected, should be done by measuring blood pressure daily for 72 hours after delivery and again no later than 7 to 10 days after delivery. Adjunctive blood pressure monitoring arterial at home is also useful, if feasible (August, 2024).

A comprehensive search conducted in the databases African Journals Online, Google Scholar, HINARI, PubMed and MEDLINE and in the Cochrane library in 2015 showed that the proportion of antepartum, intrapartum and postpartum eclampsia was 59%, 20% and 21%, respectively (Berhan; Berhan, 2015). Similarly, the present study had the highest part of deaths due to eclampsia in the pre-partum period.

On the other hand, it is shown that the number of deaths designated as “Eclampsia not specified as to the period” was quite significant. This may have happened as a failure to complete the death certificate, since many professionals do not have sufficient familiarity with ICD-10 and do not care too much about the code that will be placed. However, this prevents studies from presenting more reliable data and analyses with greater scientific weight.

At the same time, it is demonstrated that the prevention and treatment of eclampsia require an immediate, interdisciplinary and staggered approach, given the severity of this emergency and the risks associated with the mother and fetus. Therefore, it is crucial to maintain therapy at the maintenance dose in a hospital environment, with monitoring of vital parameters. At this stage, the treatment with magnesium sulfate (MgSO₄) is indicated in the face of signs of imminent eclampsia, eclampsia, HELLP syndrome (hemolysis, elevated liver enzyme levels and low blood count) platelet count) and severe hypertension. Early and timely recognition, followed by treatment with MgSO₄ significantly reduces the risk of eclampsia and maternal mortality, without causing harm to the fetus (Clinical Guide, 2023).

4. CONCLUSION

The study showed an oscillatory pattern and a high prevalence in the number of deaths maternal deaths due to hypertensive diseases in Piauí, with the highest occurrence in 10 years in the years 2019 and 2022 with 14 deaths in each and the highest RMM in 2022 (33.13 deaths per 100,000 live births). Eclampsia was the main cause of death. The epidemiological profile found is of brown women, aged 30 to 34, with 8 to 11 years of schooling. In addition, it was observed It is known that the puerperium was the period most affected by deaths.

This data can contribute to the improvement of local public policies aimed at improving prenatal services throughout the state, especially in early diagnosis, risk classification and prevention measures. Thus, ensuring a assistance throughout the pregnancy-puerperal cycle should be a priority in health care women, through full access to qualified teams in obstetric emergencies.

REFERENCES

ANANTH, CV *et al.* Historical and Recent Changes in Maternal Mortality Due to Hypertensive Disorders in the United States, 1979 to 2018. **Hypertension**, v. 78, no. 5, p. 1414-1422, nov. 2021. DOI: 10.1161/HYPERTENSIONAHA.121.17661. PMID: 34510912; PMCID: PMC9218546.

ARAUJO, Raphaela *et al.* Epidemiological profile of mortality of women with eclampsia in the state of São Paulo from 2017 to 2021. **Journal of Epidemiology and Public Health-RESP**, v. 2, n. 1, 2024.



BERHAN, Y.; BERHAN, A. Should magnesium sulfate be administered to women with mild pre-eclampsia? A systematic review of published reports on eclampsia. **Journal of Obstetrics and Gynecology Research**, vol. 41, no. 6, p. 831-842, jun. 2015. DOI: 10.1111/jog.12697. PMID: 25833188.

BEZERRA, Kevia; DE ANDRADE, Mirley. **Maternal mortality**: a challenge for global public health. Gov.br, 2022. Available at: <https://www.gov.br/ebserh/pt-br/hospitais-universitarios/regiao-nordeste/hujb-ufcg/comunicacao/noticias/parto-seguro#:~:text=Em%201994%2C%20a%20Organiza%C3%A7%C3%A3o%20Mundial,agravada%20pela%20pregnancy%20or%20por>. Accessed on: November 24, 2023.

Latin American Center for Perinatology, Women's and Reproductive Health. **Action plan to accelerate the reduction of maternal mortality and severe maternal morbidity**: Monitoring and evaluation strategy. Montevideo: CLAP/SMR; 2012.

CLÍNICO, G. **Clinical guideline for the prevention, diagnosis, and management of hypertensive syndromes during pregnancy**. Available at: <https://www.einstein.br/DocumentosAcessoLivre/DIRETRIZ-CLINICA-PARA-PREVENCAO-DIAGNOSTICO-E-MANEJO-DE-SINDROMES-HIPERTENSIVAS-NA-GESTACAO-TMI.pdf>. Accessed on: February 25, 2024.

DIAS, Júlia Maria Gonçalves *et al.* Maternal mortality. **Medical Journal of Minas Gerais**, v. 25, n. 2, 2015. Available at: <https://doi.org/10.5935/2238-3182.20150034>.

DIMITRIADIS, E. *et al.* Pre-eclampsia. **Nature Reviews Disease Primers**, vol. 9, no. 1, p. 8, Feb. 2023. DOI: 10.1038/s41572-023-00417-6. PMID: 36797292.

FERNANDES, KG; SOUSA, MH; CECATTI, JG Skin color and maternal near miss: Exploring a demographic and health survey in Brazil. **Brazilian journal of gynecology and obstetrics**, v. 39, n. 05, p. 209–216, 2017.

FISHEL BARTAL, M.; SIBAI, BM. Eclampsia in the 21st century. **American journal of obstetrics and gynecology**, vol. 226, no. 2S, p. S1237-S1253, Feb. 2022. DOI: 10.1016/j.ajog.2020.09.037. PMID: 32980358.

GIORDANO, JC *et al.* The burden of eclampsia: results from a multicenter study on surveillance of severe maternal morbidity in Brazil. **PLOS ONE**, vol. 9, no. 5, p. e97401, May 2014. DOI: 10.1371/journal.pone.0097401. PMID: 24825164; PMCID: PMC4019598.

HAUSPURG, A.; JEYABALAN, A. Postpartum preeclampsia or eclampsia: defining its place and management among the hypertensive disorders of pregnancy. **American journal of obstetrics and gynecology**, vol. 226, no. 2S, p. S1211-S1221, Feb. 2022. DOI: 10.1016/j.ajog.2020.10.027. PMID: 35177218; PMCID: PMC8857508.

IBGE. **2022 Demographic Census: Population by color or race - Universe results**.

Rio de Janeiro: IBGE, 2022. Available at: [https://censo2022.ibge.gov.br/panorama/indicadores.html?localidade=N2\[2\]](https://censo2022.ibge.gov.br/panorama/indicadores.html?localidade=N2[2]). Accessed on: February 25, 2024.

IVES, CW *et al.* Preeclampsia-Pathophysiology and Clinical Presentations: JACC State-of-the-Art Review. **Journal of the American College of Cardiology**, vol. 76, no. 14, p. 1690-1702, Oct. 2020. DOI: 10.1016/j.jacc.2020.08.014. PMID: 33004135.



KATSURAGI, S. *et al.* Analysis of preventability of hypertensive disorder in pregnancy-related maternal deaths using the nationwide registration system of maternal deaths in Japan.

The journal of maternal-fetal & neonatal medicine, vol. 32, no. 20, p. 3420–3426, 2019.

LIMA, Camila Rodrigues Pinto *et al.* Epidemiological analysis of maternal mortality in Brazil. **Brazilian Journal of Development**, v. 9, n. 8, p. 24241-24258, 2023.

MARQUES, Suzana Raquel Lopes; LEMOS, Stela Maris Aguiar. Health literacy and associated factors in adult primary care users. **Work, Education and Health**, v. 16, n. 2, p. 535–559, 2018.

MINISTRY OF HEALTH. Secretariat of Primary Health Care. Department of Programmatic Actions. **High-Risk Pregnancy Manual**. 2022.

MUNANGA, Kabengele. **Re-discussing miscegenation in Brazil: national identity versus black identity**. Belo Horizonte: Autêntica, 2019.

INSTITUTE OF APPLIED ECONOMIC RESEARCH (IPEA). **SDGs - National Targets for Sustainable Development Goals**. Brasília: Ipea; 2018. Available at: http://www.ipea.gov.br/portal/images/stories/PDFs/livros/livros/180801_ods_metas_nac_dos_obj_de_desenv_susten_propos_de_adequa.pdf. Accessed on: January 29, 2024.

IPEA. **SDG 3 - Health and Well-being - Ipea - Sustainable Development Goals**. 2018. Available at: <https://www.ipea.gov.br/ods/ods3.html>. Accessed on: February 25, 2024.

OLIVEIRA, IVG *et al.* Maternal mortality in Northeast Brazil 2009-2019: spatial distribution, trends and associated factors. **Epidemiology and Health Services**, v. 32, no. 3, e2022973, Oct. 2023. DOI: 10.1590/S2237-96222023000300009.EN. PMID: 37909520; PMCID: PMC10615180.

OSORIO, Rafael Guerreiro; PETRUCCELLI, Jose Luis; SABOIA, Ana Lucia.

Characteristics. Ethnic-Racial Characteristics of the Population – Classification and Identities – IBGE, Studies and Analyses Demographic and Socioeconomic Information No. 2. Rio de Janeiro: IBGE, 2013. Available at: <http://biblioteca.ibge.gov.br/visualizacao/livros/liv63405.pdf>. Accessed on: January 1, 2024.

PERAÇOLI, JC *et al.* **Preeclampsia – Protocol 2023**. Brazilian Network for Studies on Hypertension in Pregnancy (RBEHG), 2023.

PEREIRA, GT *et al.* Epidemiological profile of maternal mortality due to hypertension: situational analysis of a northeastern state between 2004 and 2013. **Revista de Pesquisa Cuidado é Fundamental Online**, Rio de Janeiro, Brazil, v. 9, n. 3, p. 653–658, 2017. DOI: 10.9789/2175-5361.2017.v9i3.653-658. Available at: <https://seer.unirio.br/cuidadofundamental/article/view/5526>. Accessed on: September 8, 2025.

PHIPPS, EA *et al.* Pre-eclampsia: pathogenesis, novel diagnoses and therapies. **Nature reviews. Nephrology**, vol. 15, no. 5, p. 275-289, May 2019. DOI: 10.1038/s41581-019-0119-6. PMID: 30792480; PMCID: PMC6472952.

PHYLLIS, August, MD, MPH, Baha M Sibai, MD. **Hypertensive disorders in pregnancy: Approach to differential diagnosis.** *In:* UpToDate. February 2023. Available at: <https://www.uptodate.com/contents/126975>. Accessed on: December 29, 2023.

PHYLLIS, August, MD, MPH. **Treatment of hypertension in pregnant and postpartum patients.** *In:* UptoDate. February, 2024. Available at: https://www.uptodate.com/contents/treatment-of-hypertension-in-pregnant-and-postpartum-patients?search=maternal%20mortality%20hypertensive%20disorders%20postpartum&source=e=search_result&selectedTitle=4%7E150&usage_type=default&display_rank=4#H1551103579. Accessed on: February 5, 2024.

POON, LC *et al.* The International Federation of Gynecology and Obstetrics (FIGO) initiative on pre-eclampsia: A pragmatic guide for first-trimester screening and prevention. **International Journal of Gynecology & Obstetrics**, vol. 145, n. Suppl 1, p. 1-33, May 2019. DOI: 10.1002/ijgo.12802. PMID: 31111484; PMCID: PMC6944283.

SAY, Lale *et al.* Global causes of maternal death: a WHO systematic analysis. **The Lancet. Global health.** 2014 Jun;2(6):e323-33. doi: 10.1016/S2214-109X(14)70227-X. Epub 2014 May 5. PMID: 25103301.

SULLIVAN, M *et al.* Duration of postpartum magnesium sulfate for seizure prophylaxis in women with preeclampsia: A systematic review and meta-analysis. **The journal of maternal-fetal & neonatal medicine.** 35 (25), 2022. p. 7188-7193. doi:10.1080/14767058.2021.1946505

TINTORI, JA *et al.* Epidemiology of maternal death and the challenge of qualifying care. **Acta Paulista de Enfermagem**, v. 35, 2022.

Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: World Health Organization, 2019.

VIANA, Rosane da Costa; NOVAES, Maria Rita Carvalho Garbi; CALDERON, Iracema de Mattos Paranhos. Maternal mortality: an updated approach. **Communication in Health Sciences**, p. 141-152, 2011.

WANG, E *et al.* Social Determinants of Pregnancy-Related Mortality and Morbidity in the United States: A Systematic Review. **Obstetrics and gynecology**, vol. 135, no. 4, p. 896-915, apr. 2020. DOI: 10.1097/ AOG.0000000000003762. PMID: 32168209; PMCID: PMC7104722.

WEISS, BD *et al.* Quick assessment of literacy in primary care: the newest vital sign. **Annals of family medicine**, vol. 3, p. 514-22, 2005.