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TEMPORAL EVOLUTION OF THE HOSPITALIZATION RATE FOR HYPERTENSIVE SYNDROMES OF PREGNANCY IN ESPÍRITO SANTO BETWEEN 2012 AND 2023

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ABSTRACT

Objective: To evaluate the temporal trend and regional variations of hypertensive syndromes of pregnancy in Espírito Santo. Method: This is an observational study of the descriptive ecological type of temporal trend, carried out in the state of Espírito Santo All hospitalization records of women who developed gestational hypertension and were diagnosed with GHS and hospitalized in the municipalities of Espírito Santo between the years 2012 and 2023 were used to evaluate determining factors, the data were stratified by the following color/race variables, age group, micro-region according to IBGE and type of service, which were later organized and coded to enable a descriptive statistical analysis. Results: The analysis of the incidence rate of GHS by age, in the period from 2012 to 2023, shows a rate of 15.6 per 10,000 for the age group of 15 to 19 years, with a β coefficient of 0.36 (95% CI: -0.27 to 1.00) and a p-value of 0.238, indicating a stationary trend. For the 20-29 age group, the rate is 28.8 per 10,000, with a β coefficient of 2.66 (95% CI: 1.35 to 3.98) and a p-value of 0.001, indicating an increasing trend. In the 30-39 age group, the rate is 23.8 per 10,000, with a β coefficient of 2.44 (95% CI: 1.2 to 3.5) and a p-value of 0.001, also indicating an increasing trend. For the 40-49 age group, the rate is 4.4 per 10,000, with a β coefficient of 0.56 (95% CI: 0.37 to 0.75) and a p-value of <0.001.

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Conclusion: It is concluded that the temporal trends of hospitalizations due to GHS vary significantly among age groups and regions of Espírito Santo. The regional and demographic variations highlighted reinforce the need for targeted public health interventions to reduce the incidence and improve the management of GHS.

Keywords: Gestational hypertension. Epidemiology. Hospitalization.

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INTRODUCTION

Although it is a physiological process that usually occurs without complications, pregnancy can be classified as high-risk in situations where there is a probability of developing pathologies triggered or exacerbated by pregnancy. As an example, you can point to Hypertensive Syndromes of Pregnancy (GHS), which are the most common clinical complications of pregnancy and represent the main cause of maternal morbidity and mortality in Brazil and worldwide, so that, in 2021, of the 2,857 maternal deaths, 313 were related to hypertension in the obstetric context (Brasil, 2022a; Brazil, 2022b).

From this perspective, according to Batista and Andrade (2021), pregnancy can trigger arterial hypertension in women who previously had normal blood pressure or exacerbate existing hypertension. This is characterized by a systolic blood pressure of 140 mmHg or more and/or a diastolic blood pressure of 90mmHg or more, which can occur during pregnancy or after delivery, and represent SHG. Adverse effects of this condition include preeclampsia (PE), superimposed preeclampsia (ESP), eclampsia (CE), HELLP syndrome, preterm birth, fetal growth restriction, and other complications that impair the health and development of the baby (Brasil, 2022a; Nakatani, 2021; Queiroz, 2018).

Thus, maternal health emerges as a central concern in the sphere of public health. Metrics such as reducing complications during pregnancy, promoting safe delivery, and preserving the health of the mother and newborn are employed to assess the quality of maternal care. Likewise, in the context of health policies, Sampaio, Oliveira and Oliveira (2022) highlight that the implementation of screening programs and early detection of GH can contribute to the reduction of associated risks and improve maternal and child outcomes, including in the case of PE. Therefore, the focus on public policies and effective health practices plays a crucial role in creating an environment conducive to maternal health, so that it is possible to maintain the commitment to the safety and quality of the care offered.

The complexity of GHS and its interrelationships with various risk factors highlight the need for an in-depth understanding of the epidemiology of this condition. This is because epidemiological analysis makes it possible to identify patterns of occurrence, associated factors, and impacts on different population groups, establishing a robust foundation for the implementation of specific actions (Sousa *et al*., 2020). Thus, the analysis of the GHS, with emphasis on public health policies and epidemiology, aims to guide the implementation of effective actions aimed at the prevention, control and treatment of the

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syndrome, with the purpose of improving maternal and fetal health and reducing associated complications.

It is noteworthy that the research problem seeks to understand how the epidemiology of GH relates to public health policies, in order to identify possible gaps and challenges in the implementation of effective preventive and management measures. In addition, it seeks to understand how public policies can contribute to reducing the incidence and minimizing the complications resulting from this condition. In view of these questions, the problematization of this research seeks to address the following questions: How is the temporal trend and regional variations of hypertensive syndromes of pregnancy in Espírito Santo presented? What are the risks for mothers and babies when these syndromes are diagnosed?

Thus, the objective of the study is to analyze the temporal evolution of the hospitalization rate for Hypertensive Syndromes of Pregnancy in Espírito Santo in the period 2012 and 2023.

METHODOLOGY

This is an observational study of the descriptive ecological type of temporal trend. The survey scenario was the State of Espírito Santo, located in the Southeast region of Brazil and composed of 78 municipalities, which, according to 2022 data from the Brazilian Institute of Geography and Statistics, has a Human Development Index (HDI) equal to 0.771 and a total population of approximately 3,833,712 million people, of which 1,963,649 are female (51.2%) (IBGE, 2022).

The study population is composed of all hospitalization rates diagnosed by GHS in Espírito Santo and recorded in the Hospital Information System of the Unified Health System (SIH/SUS), and the DATASUS/TABNET database, from January 1, 2012 to December 31, 2023. We selected the rates of hospitalizations whose main diagnosis was included in chapter XV regarding pregnancy, childbirth and puerperium of the International Classification of Diseases (ICD-10), specified in the list of morbidity by "Edema, proteinuria, hypertensive disorder during pregnancy, childbirth and puerperal period", referring to the codes: O10 - Gestational edema and proteinuria; O11- Gestational edema; O12- Gestational edema, proteinuria and gestational hypertension (preeclampsia); O13- Gestational hypertension with significant proteinuria; O14- Gestational hypertension

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(including preeclampsia); O15- Eclampsia; and O16- Other hypertensive disorders in pregnancy

All records of hospitalization rates of women who developed gestational hypertension and were diagnosed with GHS and hospitalized in the municipalities of Espírito Santo between 2012 and 2023 were used. In addition, to evaluate determining factors, the data were stratified by the following variables color/race (white, black, brown, yellow, indigenous), age group (10 to 14 years, 15 to 19 years, 20 to 29 years, 30 to 39 years, 40 to 49 years), micro-region according to IBGE and type of service (public or private), which were later organized and coded to enable a descriptive statistical analysis. Variables whose completeness was not reliable, characterized by a higher percentage of unknown values among the selected categories, were excluded.

Considering temporal variations, demographic characteristics, regional disparities, the epidemiological relationship with gestational hypertension, and public health policies, dependent, independent, qualitative, and quantitative variables were listed. Dependent variables (qualitative) were represented by the rate of hospitalization for GHD in relation to the female population of childbearing age (10 to 49 years) in Espírito Santo, throughout the study period. Independent Variables (quantitative) are referred to the year of observation (2014 to 2023), age group (10-14, 15-19, 20-29, 30-39, 40-49 years) and data on color/race.

The data obtained were entered and organized in an electronic spreadsheet in Excel and later the Stata 12.0 *Statistical* Software was used . Subsequently, the processing of the variables was conducted through the *Excel module* in *Microsoft Office*, allowing the creation of tables and graphs essential for the analysis and interpretation of the data according to the descriptive analysis method. This evaluation covered both quantitative and qualitative variables, dependent and independent, and the Prais-Winsten method was used to analyze temporal trends, correcting for autocorrelation in the data and providing more robust results.

The rate of hospitalization for GHS was calculated taking into account the female population of childbearing age (10 to 49 years) throughout the study period. The temporal analysis considered variations over years, months, and age groups, highlighting possible seasonal patterns or significant trends.

It should be noted that, for each year of the trend, the incidence rate was calculated, dividing the cases that occurred per year by the total number of women hospitalized in

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GHH, therefore, the incidence rate = (number of hospitalizations for hypertensive syndromes of pregnancy / female population of childbearing age) x 1000 was analyzed. The interpretation of the results was based on the theories and concepts presented in the theoretical framework, highlighting the relevance of health policies, the epidemiology of gestational hypertension and other related issues.

Taking into account that an investigation based on data from secondary sources, without the identification of participants and whose access is public, the present research does not require submission to the Research Ethics Committee (CEP) (Brazil, 466) and as established by Resolution No. 510, of 2016, of the National Health Council (CNS) (Brazil, 2016c).

RESULTS

Table 1 presents the sociodemographic characteristics of the cases of hospitalizations due to GHS by age group between 2012 and 2023. In the age group of 15 to 19 years, 2,753 cases were registered, representing 11.2% of the total. For the 20 to 29 age group, there were 10,962 cases, corresponding to 44.7%. Between 30 and 39 years old, 9,328 cases were observed, which is equivalent to 38.1%. In the age group of 40 to 49 years, 1,478 cases were registered, representing 6% of the total.

Table 1. Sociodemographic Characteristics of Cases of Hypertensive Syndromes of Pregnancy, Age Group

Age group	n	%
15 to 19 years old	2.753	11.2
20 to 29 years old	10.962	44.7
30 to 39 years old	9.328	38.1
40 to 49 years old	1.478	6

Source: Prepared by the author, based on data from DATASUS/TABNET, 2024.

The analysis of the incidence rate of GHS by age in the period from 2012 to 2023 shows a rate of 15.6 per 10,000 for the age group of 15 to 19 years, with a β coefficient of 0.36 (95% CI: -0.27 to 1.00) and a p-value of 0.238, indicating a stationary trend. For the 20-29 age group, the rate is 28.8 per 10,000, with a β coefficient of 2.66 (95% CI: 1.35 to 3.98) and a p-value of 0.001, indicating an increasing trend. In the 30-39 age group, the

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rate is 23.8 per 10,000, with a β coefficient of 2.44 (95% CI: 1.2 to 3.5) and a p-value of 0.001, also indicating an increasing trend. For the 40-49 age group, the rate is 4.4 per 10,000, with a β coefficient of 0.56 (95% CI: 0.37 to 0.75) and a p-value of <0.001, indicating an increasing trend. Table 2.

Table 2. Incidence Rate of Hypertensive Syndromes of Pregnancy by Age, Second Period 2012 to 2023.

Total Lost	Fee per 10,000	β (95% CI)	p	Tendency
15 to 19 years old	15.6	0.36 (-0.27; 1.00)	0.238	Stationary
20 to 29 years old	28.8	2.66 (1.35; 3.98)	0.001	Crescent
30 to 39 years old	23.8	2.44 (1.2; 3.5)	0.001	Crescent
40 to 49 years old	4.4	0.56 (0.37; 0.75)	<0.001	Crescent

Source: Prepared by the author, based on data from DATASUS/TABNET, 2024.

The data presented on GHS, distributed by race/color between 2012 and 2023, indicate that 4,106 cases were recorded among white women, representing 16.7% of the total. Among black women, 1,836 cases were recorded, equivalent to 7.5%. Brown women had 14,657 cases, corresponding to 59.8% of the total. For the yellow category, 127 cases were registered, which represents 0.5%. Among indigenous women, there were 14 cases, representing 0.1%. In addition, there are 3,781 cases without information on race/color, corresponding to 15.4% of the total. **Table 3.**

Table 3. Hypertensive Syndromes According to Race/color between 2012 and 2023

Race/ Color	n	%
White	4.106	16.7
Black	1.836	7.5
Brown	14.657	59.8
Yellow	127	0.5
Indigenous	14	0.1
No information	3.781	15.4

Source: Prepared by the author, based on data from DATASUS/TABNET, 2024.

The analysis of the incidence rate of GHS by region, between 2012 and 2023, reveals different trends in the municipalities. The β coefficient (Beta) represents the magnitude and direction of the relationship between an independent variable, such as time,

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and a dependent variable, such as the incidence rate of GHS. A positive β indicates that as the independent variable increases, the dependent variable also increases, while a negative β indicates that as the independent variable increases, the dependent variable decreases. The numerical value of β indicates the magnitude of the change in the dependent variable for each unit of change in the independent variable (Table 4).

Table 4. Incidence Rate of Hypertensive Syndromes of Pregnancy by Region Second Period 2012 to 2023

Total Period	β (95% CI)	p	Tendency
Barra de São Francisco	1.53 (0.42; 2.69)	0.013	Crescent
Nova Venécia	1.00 (0.09; 1.91)	0.035	Crescent
Colatina	0.20 (-1.13; 1.54)	0.730	Stationary
Mountain	-6.57 (-10.12; -3.02)	0.003	Descending
Saint Matthew	1.53 (0.64; 2.43)	0.004	Crescent
Linhares	1.41 (0.56; 2.26)	0.005	Crescent
Afonso Claúdio	1.64 (0.85; 2.43)	0.001	Crescent
Saint Teresa	1.32 (-0.39; 3.04)	0.114	Stationary
Victory	1.92 (0.76; 3.09)	0.005	Crescent
Guarapari	2.56 (1.70; 3.43)	<0.001	Crescent
Cheerful	0.66 (-1.20; 2.54)	0.435	Stationary
Cachoeiro de Itapemirim	0.29 (-3.13; 3.74)	0.846	Stationary
Itapemirim	1.57 (-0.99; 4.15)	0.195	Stationary

Source: Prepared by the author, based on data from DATASUS/TABNET, 2024.

Table 5 shows the distribution of cases and percentages of hospitalizations due to GHS, detailed by micro-regions of the IBGE, together with the respective incidence rates. In view of this, the city with the highest percentage of cases is Vitória (40.35%), followed by Cachoeiro de Itapemirim (11.32%), and with the lowest percentage of registered cases was Barra de São Francisco (2.45%).

Table 5. Distribution of Cases of Hypertensive Syndrome of Pregnancy – IBGE Microregion

	n	**%**
Barra de São Francisco	601	2.45
Nova Venécia	868	3.54
Colatina	1.771	7.22
Mountain	770	3.14
Saint Matthew	1.342	5.47
Linhares	2.063	8.41

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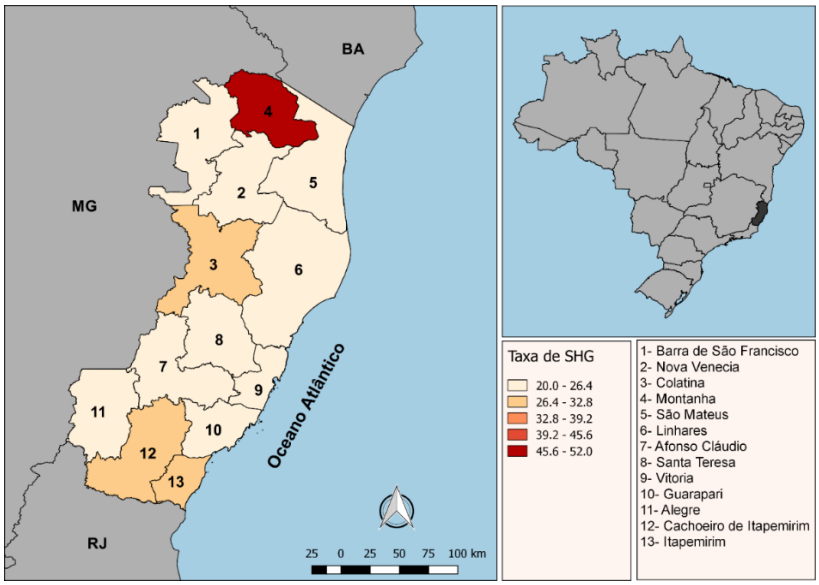
Afonso Claúdio	781	3.19
Saint Teresa	661	2.70
Victory	9.895	40.35
Guarapari	1.348	5.50
Cheerful	1.007	4.11
Cachoeiro de Itapemirim	2.776	11.32
Itapemirim	638	2.60

Source: Prepared by the author, based on IBGE data, 2024.

Figure 2 illustrates the GHG rate by IBGE micro-region in Espírito Santo. Barra de São Francisco, with a rate of 20.0 to 26.4, is in the lower range. Nova Venécia has a rate of 26.4 to 32.8, as does Colatina. Mountain, on the other hand, has a higher rate, from 39.2 to 45.6. São Mateus, Linhares, Afonso Cláudio, Santa Teresa, Vitória and Guarapari are also in the range from 26.4 to 32.8. Alegre, Cachoeiro de Itapemirim and Itapemirim have rates from 32.8 to 39.2. Vitória stands out with a higher rate, from 45.6 to 52.0, indicating the highest incidence of GHS among the micro-regions analyzed.

Figure 2. Incidence Rate of Gestational Hypertensive Syndrome According to IBGE Microregion in Espírito Santo



Source: Prepared by the author, based on data from DATASUS/TABNET, 2024.

4 DISCUSSION

GHS are the most common complications during pregnancy and affect about 10% of pregnant women. The data presented in Table 1 reveal an overview of the GHS, highlighting the distribution by age group between 20 and 29 years, in which the highest proportion of cases is concentrated, with 44.7% of the total. These numbers suggest that

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the greatest vulnerability to the development of hypertensive syndromes is among women of central reproductive age. The study by Jacob *et al*. (2020) corroborates converges with this result, since it showed percentages of 50.0% for both the 18 to 31 age group and the 32 to 46 age group.

The age group of 15 to 19 years, despite having a lower percentage, still represents a significant portion of the cases, with 11.2%. This data is worrying, as adolescents face additional risks due to biological immaturity and possible barriers in accessing adequate prenatal care (Lima *et al*., 2018). The lowest proportion of cases is observed in the 40 to 49 age group, with 6%, which can be attributed to the lower number of pregnancies at this age and the increase in preventive medical care with advancing age.

A study such as that by Nakatani (2021) points out that gestational hypertension and preeclampsia are more common in young women, mainly due to risk factors such as primiparity and less access to preventive health care, affecting about 4-5% of global pregnancies. In addition, younger women, especially adolescents, often do not plan for pregnancy and may not be prepared for the challenges of pregnancy, which can exacerbate pre-existing conditions or contribute to the development of hypertensive complications.

The high prevalence of GHS in younger age groups underlines the need for public policies aimed at improving access to and quality of prenatal care, particularly for adolescents and young adults. Early identification and appropriate management of risk factors are essential to reduce the morbidity and mortality associated with these conditions. Kerber and Melere (2017) highlight the crucial importance of high-quality prenatal care, emphasizing that maternal health is a determinant in complications and risks for both the mother and the fetus.

The data on the incidence rate of hospitalizations due to GHS by age in the period from 2012 to 2023, Table 2, reveal distinct trends between the different age groups. The incidence rate for the 15 to 19 year age group is 15.6 per 10,000, with a coefficient (β= 0.36 and a p-value of 0.238), which indicates a stationary trend and suggests a stability in the incidence rate over the period analyzed. According to the Ministry of Health, cases of teenage pregnancy have decreased, on average, by 18% since 2019 (Brasil, 2022a). But stability can be attributed to a combination of factors, such as the constant prevalence of teenage pregnancies and the maintenance of socioeconomic conditions and access to prenatal care for this group, including educational interventions and adequate health services (Da-Silva *et al*., 2019).

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For the 20 to 29 age group, the incidence rate is significantly higher, 28.8 per 10,000, with a coefficient (β= 2.66 and a p-value of 0.001), which points to an increasing trend. This age group, being the one with the highest fertility, may be experiencing an increase in the incidence of hypertensive syndromes due to several factors, such as changes in lifestyle habits, an increase in the average age of primiparous women, and a higher prevalence of chronic conditions that contribute to gestational hypertension. Studies such as the one by Moraes *et al*. (2019) indicate that factors such as obesity, diabetes, and sedentary lifestyle, which has increased in young populations, may contribute to this trend.

In addition, Da-Silva's (2023) analysis points out that stress can play a significant role in increasing the incidence of hypertensive syndromes. Women in this age group often balance multiple responsibilities, which can contribute to high stress levels and, consequently, increase the risk of hypertensive complications.

The age group of 30 to 39 years has an incidence rate of 23.8 per 10,000, with a coefficient (β= 2.44 and a p-value of 0.001), which also indicates an increasing trend, which can be explained by several factors related to the health and reproductive behavior of women in this age group. According to the Ministry of Health, pregnant women aged 35 years or older are considered late or at an advanced age, and are more susceptible to developing complications during pregnancy, which makes pregnancy high-risk (Brasil, 2012).

In view of this, Bittelbrunn, Petri, and Martins (2023) highlight that as women postpone motherhood, often to focus on their careers and education, they may accumulate additional risk factors, such as chronic hypertension and diabetes, which are known to increase the likelihood of GHS. These preexisting risk factors make this population more susceptible to complications during pregnancy, including gestational hypertension and preeclampsia.

In the 40 to 49 age group, the incidence rate is 4.4 per 10,000, with a coefficient (β= 0.56 and a p-value of <0.001), with an increasing trend. Although the absolute rate is lower, the upward trend is worrisome, given that pregnancies in this age group are less common and generally associated with a higher risk of complications. Da-Rocha, Silva and Morais (2018) show that women who become pregnant after the age of 40 face a significantly higher risk of hypertensive complications due to the physiological changes that occur with aging. These changes may include increased arterial stiffness and a reduced ability to

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adapt to cardiovascular disease during pregnancy, which may lead to the development of gestational hypertension and preeclampsia.

The results underscore the importance of public health strategies that address the specific needs of each age group, with a focus on the prevention and management of conditions that contribute to gestational hypertension. The increasing incidence in the 20-39 age groups highlights the need for interventions targeting healthy lifestyle habits and early management of chronic conditions. Therefore, understanding these trends is crucial to developing clinical policies and practices that can mitigate risks and improve maternal and fetal outcomes.

The distribution of GHS cases by race/color Table 3 reveals important demographic and social aspects. The group with the highest incidence of hospitalizations due to GHS is brown women, with 14,657 cases, representing 59.8% of the total, compared to other racial categories. This data is significant and can be reflected in studies that associate socioeconomic conditions and unequal access to health services with higher prevalence of adverse gestational conditions. According to Amorim *et al*. (2023), there is a trend toward a higher incidence of preeclampsia in underrepresented communities and among pregnant women who face barriers in accessing effective antenatal care.

Authors such as Pacheco *et al*. (2018) emphasize that color/race does not act as a genetic or biological marker, but rather as a social construct, exerting influence on health conditions as a social determinant. Although it is recognized that color/race is not intrinsically an element of risk, it is essential to ponder on the disadvantageous social insertion of the brown, black population, which represents an aggravating factor in relation to their vulnerability in the face of health conditions.

De-Oliveira *et al*. (2016) highlight the justification for conducting research with self-declared black individuals, especially in the context of preeclampsia, based on the observation of the prevalence of this color. This selection is based not only on biological reasons, but also on sociocultural factors associated with the incidence of diseases. In addition, the consideration of the possibility of a hereditary trait in individuals of this color, which affects the cellular uptake of sodium and calcium, contributes to the understanding of this phenomenon. This genetic peculiarity can, therefore, influence the development of arterial hypertension, giving importance to the investigation of these aspects in the context of research on preeclampsia.

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The group of yellow women has 127 cases, representing 0.6% of the total. This relatively low number can be partially explained by the lower representation of this population in the total number of pregnant women. Likewise, the number of cases among indigenous women is even lower, with only 14 cases, corresponding to 0.06%. This low incidence may also be influenced by underreporting and difficulties in accessing health services in indigenous communities, and may also reflect both a lower demographic of these groups in the state and specific barriers in accessing health services. In addition, the reduction in cases without information over the years may indicate improvements in data collection, as pointed out by Queiroz (2014).

In addition, there is a significant number of cases of hospitalization for GHS "without information" on race/color, totaling 3,781 (15.42%). The absence of this information can limit the accuracy of analyses and prevents a more complete understanding of racial disparities in maternal health. Therefore, it is important to emphasize that the notification method also covers the appropriate documentation of the data. When there are failures or absences of information in the registry, this leads to underreporting of cases, negatively affecting initiatives for the prevention and management of diseases and health problems (Regional Council of Medicine of Paraná, 2011).

Overall, the distribution of GHS cases by race/color not only reflects the differences in the prevalence of these conditions between different groups, but also highlights inequalities in access to and quality of health care. Understanding these disparities is essential for developing targeted interventions that can reduce the incidence of these syndromes and improve maternal health equitably. It is imperative that future health policies consider these social and racial variables to more effectively address the needs of pregnant women, improving maternal and neonatal outcomes and reducing health disparities.

The analysis of the incidence rate of GHS hospitalization by region , Table 4, reveals significant variations in regional trends. Barra de São Francisco, with a β coefficient of 1.53 and a p-value of 0.013, indicates an increasing trend, suggesting that the incidence of hypertensive syndromes is increasing in this region. This trend is also reflected in Nova Venécia, São Mateus, Linhares, Afonso Cláudio, Vitória and Guarapari. These increases may be associated with specific regional factors, including demographic and socioeconomic changes, as highlighted by studies such as those by Araújo *et al*. (2017), which correlate the increase in obesity and other risk conditions with the incidence of hypertensive

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syndromes. Similarly, urbanization, unequal access to health care, and the rise in chronic conditions may be contributing to these growing trends

On the other hand, the municipality of Colatina has a stationary rate, with a β coefficient of 0.20 and a p-value of 0.730, indicating that there were no significant changes in incidence over the study period. The municipality of Montanha, in contrast, shows a significant downward trend, with a β coefficient of -6.57 and a p-value of 0.003. This reduction may reflect improvements in prenatal care or changes in the pregnant population, as suggested by the studies by Olegário (2019), which emphasize the importance of early interventions and effective control of risk factors to reduce the incidence of hypertensive syndromes.

In contrast, the municipalities of Santa Teresa, Alegre, Cachoeiro de Itapemirim and Itapemirim showed stationary rates, with β coefficients of 1.32, 0.66, 0.29 and 1.57, respectively, and non-significant p-values. Stability in these areas may indicate a continued effectiveness of health services or an absence of significant changes in the health conditions of pregnant women, as discussed in studies by Jacob *et al*. (2020) on the stability of health conditions in populations well served by robust health systems.

The detailed analysis of regional trends in the incidence of GHS hospitalizations in the State of Espírito Santo underlines the need for targeted interventions that consider the specificities of each region, since it provides a broader view of GHS trends in large geographic areas, identifying general patterns and comparing large regions with each other. These variations highlight the influence of specific demographic and socioeconomic factors, as well as the quality of prenatal care, underlining the need for region-specific health policies. Understanding the underlying causes of these variations is necessary to develop effective policies and improve maternal health in an equitable manner.

The data presented in Table 5 reveal a varied distribution of cases of hospitalizations due to GHS according to the micro-regions of the IBGE, reflecting the socioeconomic and demographic characteristics of these areas. Vitória stands out with the highest number of cases, totaling 9,895, which represents 40.3% of the total. This high number can be attributed to the higher population density and better case notification capacity, typical characteristics of large urban centers.

Cachoeiro de Itapemirim (2,776 cases), Linhares (2,063 cases), Colatina (1,771) and Guarapari (1,348 cases) also have significant numbers, although substantially lower than Vitória. These micro-regions, although smaller, are economically relevant and have a more

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developed health infrastructure, facilitating the identification and registration of cases. Smaller micro-regions, such as Barra de São Francisco (601 cases, 2.45%), Afonso Cláudio (781 cases, 3.2%) and Itapemirim (638 cases, 2.6%), have significantly lower numbers. These results may be a reflection of a lower population density and possibly a less robust health infrastructure, which may impact reporting and recording capacity.

The relevance of the data from Vitória and the other micro-regions with the highest number of cases underlines the importance of considering both population density and health infrastructure when analyzing the distribution of cases. Studies such as those by Jacob *et al*. (2020) emphasize that socioeconomic and infrastructure factors play a crucial role in population health. They suggest that areas with better health infrastructure, such as large urban centers, tend to register more SHG cases due to greater diagnostic and reporting capacity. On the other hand, smaller and less developed micro-regions may be underreported, influencing the total data.

The data in reference to Figure 2 show the variation in the incidence rates of hospitalizations due to GHS among the micro-regions of Espírito Santo, revealing notable differences in the incidence of these conditions. The municipalities of Barra de São Francisco and Nova Venécia, with rates between 20.0 and 26.4 and 26.4 to 32.8, respectively, are in the lowest ranges, suggesting a lower incidence compared to other regions. These data may reflect a combination of factors such as lower population density, different levels of access to antenatal care, and variations in socioeconomic conditions as discussed by Soares *et al*. (2015).

Mountain, with a rate of 39.2 to 45.6, has one of the highest rates, making it stand out significantly. This high incidence may be associated with specific challenges faced by the local population, including barriers in accessing health services and a higher prevalence of risk factors such as obesity and diabetes, as discussed by Jacob *et al*. (2020). The concentration of cases in Montanha may also indicate the need for targeted interventions to improve the quality and accessibility of antenatal care.

Regions such as São Mateus, Linhares, Afonso Cláudio, Santa Teresa, and Guarapari, all with rates between 26.4 and 32.8, demonstrate a moderate incidence of GHS. These regions, although not having the highest rates, still show a significant presence of hypertensive syndromes, possibly due to demographic and socioeconomic factors that influence maternal health. Study by De-Oliveira *et al*. (2016) suggests that health disparities

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are often exacerbated by differences in access to health care, a factor that may be reflected in these data.

Alegre, Cachoeiro de Itapemirim and Itapemirim, with rates from 32.8 to 39.2, are located at an intermediate-high level. The incidence in these regions may be linked to a combination of urbanization and challenges in the local health system, as pointed out by Kerber and Melere (2017) who discuss how population and socioeconomic changes can impact maternal health in an adverse way.

Vitória, with a rate of 45.6 to 52.0, has the highest incidence of GHS among the micro-regions analyzed. As the state capital, Vitória has a higher population density and a more complex health system, which can contribute both to better notification of cases and to a higher prevalence of risk factors. Rapid urbanization and the stress associated with urban life are factors that may influence these high rates, as suggested by studies by Lima *et al*. (2018).

The results underline the need for public health policies that consider microregional specificities, which offers a more granular and specific understanding of local variations, allowing the identification of specific factors that contribute to differences in GHS incidence rates. Targeted interventions that address the social determinants of health and improve access to antenatal care are crucial to reducing the incidence of GHS. Understanding both regional and microregional approaches is necessary to develop effective strategies that mitigate risks and improve maternal health outcomes across Espírito Santo.

5 FINAL CONSIDERATIONS

It is concluded that the temporal trends of hospitalizations for GHS vary significantly among age groups and regions of Espírito Santo, the analysis of the risks associated with the diagnosis of these syndromes emphasizes the importance of rigorous monitoring and effective prevention policies to protect the health of mothers and babies. The importance of targeted and equitable public health interventions to reduce the incidence and improve the management of GHS is also highlighted. In addition, the need for effective prevention policies and strict monitoring to protect the health of mothers and babies is highlighted. As practical implications, the findings highlight the urgent need to improve access to and quality of antenatal care, especially in the regions and among the most affected demographic groups.

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Among the limitations of this study, the dependence on secondary data, which may have restrictions in terms of precision and completeness. In addition, factors such as unequal access to health services and variations in hospital records may have influenced the results. It is recommended that future research explore more deeply the social and economic determinants of SHG and its regional variations.

Finally, the importance of continuous monitoring and targeted interventions to control and reduce the incidence of GHS in Espírito Santo is highlighted. Understanding temporal trends and regional variations is crucial for effective and equitable policymaking, ensuring better health outcomes for mothers and babies.

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