Overview of the mortality from external causes of reproductive-age women in Brazil

Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa* ⓘ, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade

Abstract
Studies have shown that a new demographic and epidemiological profile has been emerging in women of childbearing age, mainly due to the increase in life expectancy, reduction in infant mortality, higher survival in old age, and the drop in fertility rate.

To evaluate the external (violence) causes of mortality among women in Brazil from 2007 to 2016.

This is a quantitative, ecological study of temporal trends and correlations of the main causes of mortality of women of childbearing age and their association with age, from 2007 to 2016 in Brazil. The collected data were extracted from the Departamento de Informática do Sistema Único de Saúde database called the Mortality Information System.

It was possible to identify a considerable increase among the Brazilian states, with the highest coefficient of mortality from external causes, especially the northern regions. The highest coefficient identified among the evaluated states was 3.57 per 10,000, and in the northeast and southeast, external causes mainly affected young women aged 10 to 29 years.

It is necessary for managers and health professionals to be more aware of the diseases that affect this population.

Abbreviations: DATASUS = Departamento de Informática do Sistema Único de Saúde, ICD-10 = international classification of diseases, LISA = local spatial association indexes, MGI = Moran global index, NCD = noncommunicable diseases, PNAD = continuous national household sample survey, SDG = sustainable development goal, RIAU = intermediate urban articulation regions, SIM = mortality information system, SPSS = statistical package for social sciences, WCA = women of childbearing age.

Keywords: cause of death, violence against women, women's health

1. Introduction

The female population has undergone a number of changes in recent decades, allowing professional and social growth among women.[1] These changes have caused an increase in mortality among women due to smoking, alcohol, and drug use, unprotected sex, occupational exposure, inadequate nutrition, and other factors.[2]

Studies have shown that a new demographic and epidemiological profile has been emerging among women of childbearing age (WCA), mainly due to the increase in life expectancy, reduction in infant mortality, higher survival in old age, and the drop in fertility rate.[3] The worldview regarding this pattern is directly associated with the socioeconomic situation of each country or region.[4]

In Brazil, the main causes of death in the female population are external causes such as accidents and assaults, with a higher incidence among women aged 10 to 29 years.[5] From this perspective, external causes are a serious public health problem, and among the causes that impose a heavy burden on health services are those that correspond to binomial accidents and violence.[6]

Considering the magnitude of this public health problem, this study aimed to evaluate the external (violence) causes of mortality among WCA, as well as their spatial association, in Brazil from 2007 to 2016.

2. Methods

This was a quantitative, ecological study of temporal trends and correlations of the main causes of mortality of WCA and their association with age, from 2007 to 2016. Brazil was used as the base for this study. We used the 161 regions called Intermediate Urban Articulation Regions.

As the main study variable, the coefficient of mortality from external causes was adopted in women aged 10 to 49 years (WCA) according to Chapter XX of the 10th International Classification of Diseases. For the purpose of calculating this variable, the following method was adopted: deaths of WCA by external causes (year by year), divided by the population of women in the same age group and multiplied by 10,000.

Table 1

Distribution of the 5 leading causes of mortality among women aged 10 to 49 by age group; Brazil, 2019.

Chapters CID-10	Mean*	Median	SD	CI		P
				Minimum	Maximum	
Chapter II- Neoplasms (Tumors)						
10 to 14 yrs	0,057	0,46	0,045	0,00	0,30	<.001
15 to 19 yrs	0,067	0,059	0,046	0,00	0,30	
20 to 29 yrs	0,23	0,19	0,16	0,00	1,08	
30 to 39 yrs	0,65	0,54	0,47	0,01	3,23	
40 to 49 yrs	1,54	1,28	1,11	0,03	7,84	
Chapter IX - Circulatory Diseases						
10 to 14 yrs	0,02	0,02	0,02	0,00	0,17	<.001
15 to 19 yrs	0,05	0,04	0,04	0,00	0,26	
20 to 29 yrs	0,19	0,15	0,13	0,00	0,99	
30 to 39 yrs	0,50	0,43	0,32	0,01	2,47	
40 to 49 yrs	1,38	1,20	0,94	0,01	7,26	
Chapter XX - External Causes						
10 to 14 yrs	0,11	0,09	0,09	0,00	0,52	<.001
15 to 19 yrs	0,30	0,25	0,20	0,00	1,11	
20 to 29 yrs	0,72	0,62	0,48	0,01	3,72	
30 to 39 yrs	0,61	0,54	0,41	0,01	3,44	
40 to 49 yrs	0,48	0,42	0,31	0,01	2,81	
Chapter I- Infectious and Parasitic Diseases						
10 to 14 yrs	0,02	0,01	0,02	0,00	0,14	<.001
15 to 19 yrs	0,04	0,03	0,04	0,00	0,28	
20 to 29 yrs	0,17	0,12	0,16	0,00	1,01	
30 to 39 yrs	0,33	0,24	0,30	0,00	1,98	
40 to 49 yrs	0,38	0,28	0,34	0,00	2,85	
Chapter IV - Endocrine, Nutritional, and Metabolic Diseases						
10 to 14 yrs	0,01	0,00	0,01	0,00	0,08	<.001
15 to 19 yrs	0,01	0,01	0,01	0,00	0,12	
20 to 29 yrs	0,06	0,05	0,4	0,00	0,42	
30 to 39 yrs	0,12	0,11	0,08	0,00	0,63	
40 to 49 yrs	0,32	0,28	0,22	0,00	1,88	

CI = confidence interval, ICD-10 = International Classification of Diseases, SD = standard deviation.

* Sum of the 10- to 49-yr-old mortality rate for every 10,000 women in the same age group.

Source: Departamento de Informática do Sistema Único de Saúde/Mortality Information System.

In order to identify the profile of the main causes of mortality in WCA, the mortality coefficient of the 5 leading causes of death in WCA was also included. The collected data were extracted from the Departamento de Informática do Sistema Único de Saúde database called the Mortality Information System.

For the statistical analysis, the data were entered into the Statistical Package for Social Sciences software version 22.2, a software that transforms data into important information for spatial and statistical analysis. For the spatial analysis, Terra View 4.2.2, a Brazilian software and was used to construct thematic maps, with analysis of spatial correlations, which can monitor the population of a given urban space, as well as the Moran Global Index, a coefficient that measures the spatial correlation for finding patterns in data sets, and significance (P). The GeoDa program was used, where the local spatial association indexes were applied.

The Local Moran Index is a statistical tool that provides an indication of the extent of significance of a "cluster" of equal values. Local Spatial Association Indexes is a statistical parameter that shows the proportional values and analyzes the similarity or difference of each event with respect to the closest events.[7]

Approval from a research ethics committee was not required for appropriating the public domain data used in this study.

3. Results

Table 1 gives an overview of WCA mortality based on the analysis of the mean, median, and standard deviations of the 5 International Classification of Diseases chapters that presented the highest WCA mortality coefficients per 10,000 women in the 161 Intermediate Urban Articulation Regions in Brazil. For the women aged 10 to 49 years, in the period 2007 to 2016 - namely for Chapter II - Neoplasms (tumors); Chapter IX - Diseases of the circulatory system; Chapter XX - External Causes; Chapter I - Some infectious and parasitic diseases; and Chapter IV - Endocrine, nutritional, and metabolic diseases - the averages increased upwards in line with the age group.

In this study, the significant increase in the average from the age of 15 years onwards deserves to be highlighted, but with special emphasis on the period from 20 to 29 years old, considered as young adult. Additionally, it is noteworthy that women aged 40 to 49 had significant means in all causes of death, except in Chapter XX, where in the 20 to 29 years old population had a more relevant mean. These data give cause for concern and reveal the need to define exogenous variables and control social factors.

In order to better understand the external causes of this significant problem in the WCA population, Table 2 shows the mortality rate from external causes in the Brazilian states; it is possible to observe that, over the years, there was a significant

External cause mortality coefficient in women aged 10 to 49 yrs in the Brazilian states, from 2007 to 2016, Brazil, 2019.

STATE	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Acre	1.62	1.33	1.95	1.95	2.20	1.95	2.45	2.12	1.54	2.29
Alagoas	1.96	1.56	1.95	2.44	2.46	2.31	2.11	2.37	1.77	1.79
Amapá	1.45	1.76	1.49	1.49	2.59	2.07	2.11	1.71	1.80	1.63
Amazonas	1.34	1.59	1.47	1.60	1.74	1.87	1.92	1.96	2.30	2.08
Bahia	1.66	1.72	1.78	2.05	2.00	2.19	1.97	1.92	1.77	1.90
Ceará	1.55	1.58	1.64	1.86	1.94	2.04	2.25	2.30	2.04	2.02
Distrito Federal	1.89	1.85	1.96	1.80	2.10	1.93	2.20	1.81	1.68	1.59
Espírito Santo	2.87	3.16	3.27	3.07	2.84	2.94	2.98	2.88	2.90	2.14
Goiás	2.02	2.25	2.31	2.59	2.80	2.93	2.95	3.27	2.86	2.56
Maranhão	1.26	1.45	1.49	1.75	1.64	2.04	1.82	2.04	1.88	2.04
Mato Grosso	2.58	2.65	2.68	2.81	2.77	2.93	2.79	3.03	2.54	2.56
Mato Grosso do Sul	2.57	2.33	2.48	2.91	2.78	2.67	3.02	2.92	2.55	2.68
Minas Gerais	1.85	1.86	1.97	1.97	2.16	2.04	1.85	1.95	1.84	1.77
Pará	1.47	1.49	1.55	1.88	1.83	2.17	2.13	2.04	2.11	2.22
Paraíba	1.53	1.67	1.66	1.80	2.16	2.32	2.06	1.85	2.09	1.83
Paraná	2.20	2.39	2.47	2.61	2.38	2.74	2.28	2.35	2.12	2.04
Pernambuco	2.05	2.25	2.23	2.16	2.14	1.98	1.97	1.91	1.89	2.02
Piauí	1.46	1.87	1.70	1.79	1.60	2.10	1.82	2.19	2.21	2.00
Rio de Janeiro	1.95	1.81	1.72	1.88	2.11	1.77	1.74	1.83	1.66	1.76
Rio Grande do Norte	1.47	1.49	1.57	1.87	1.82	1.58	1.83	1.93	1.81	1.92
Rio Grande do Sul	1.94	1.84	1.92	2.00	1.87	1.98	2.20	1.97	1.88	1.93
Rondônia	2.02	2.25	2.73	2.53	2.96	2.84	2.76	2.51	2.96	2.46
Roraima	2.76	2.29	2.69	3.43	2.62	3.03	3.97	2.15	3.16	3.57
Santa Catarina	2.10	2.24	1.86	2.27	2.08	2.24	1.96	2.26	1.99	2.15
São Paulo	1.47	1.49	1.50	1.55	1.55	1.55	1.45	1.50	1.34	1.32
Sergipe	1.54	1.74	1.70	2.21	2.31	2.01	2.20	2.17	2.11	1.89

Source: Departamento de Informática do Sistema Único de Saúde/Mortality Information System.

increase across the states, especially in Roraima in the north, which in 2016 had the highest coefficient at 3.57 per 10,000 WCA among those evaluated. Espírito Santo in the southeast and Mato Grosso and Mato Grosso do Sul in the mid-west of the country also deserve to be highlighted, as their coefficients remained high in most of the evaluated years.

Figure 1A displays the spatialization of the mortality coefficient in WCA from external causes. As seen in the previous table, it is possible to identify that the worst coefficients are concentrated in the northern regions, especially the states of Amazonas, Amapá, Rondônia, Roraima, and a part of Tocantins. In the Midwest, the biggest highlights are the states of Brasilia and a small portion of Mato Grosso do Sul.

Continuing, Figure 1B shows the spatial analysis of the external cause mortality coefficient. Positive autocorrelation and significant spatial dependence were observed, expressed by the Moran Global Index values of 0.11 and $P = .05$, respectively. BoxMap, in turn, presented high correlations for the mortality coefficient due to external causes throughout the north and northeast, especially in the states of Pernambuco and Maranhão. It is still possible to observe that, in the southeast region, states, such as Rio de Janeiro, Espírito Santo, and São Paulo expressed autocorrelation, and in the south, Rio Grande do Sul presented the same pattern.

In the significance analysis, MoranMap (Fig. 1C) showed a strong cluster formation in the state of Amapá, in the northern region, as well as in southeastern states, showing high means of the external cause mortality in WCA.

Given the importance of mortality due to external causes, a correlation was made between mortality due to such causes and the stratification of age groups, as shown in Figure 2: 10 to

14 years; 15 to 19 years; 20 to 29 years; 30 to 39 years; and 40 to 49 years.

It was observed that in all age groups studied, the correlations were positive, and the highest coefficients were observed in the north region, especially the states of Amazonas and Roraima. Moreover, it was possible to identify that the population of young women (10 to 39 years old) was the most affected by this problem, as represented in the Alto-Alto legend on the map.

4. Discussion

Table 1 shows that the main factors affecting the female population are neoplasms and diseases of the circulatory system, which mainly affect women from 30 years of age onwards. Meanwhile, external causes, the third largest cause identified, are found in the younger population, from 15 to 39 years old.

Noncommunicable diseases accounted for 71% of the overall total of 57 million deaths. The major ones were cardiovascular disease, cancer, chronic respiratory disease, and diabetes. Further, it was estimated that low- and middle-income countries face the highest risks, at 21% and 23%, respectively, almost double the rate of high-income countries.[7]

Regarding cardiovascular diseases, Table 1 identifies that the coefficients for this cause of mortality in WCA increase with age. Factors, such as social inequality, poor education, and insufficient access to adequate health systems, are considered conditions that can lead to an increase in mortality.[8]

The strategies for implementing various cancer control policies depend primarily on the country's development and its territorial, sociocultural, and economic particularities. In addition, the

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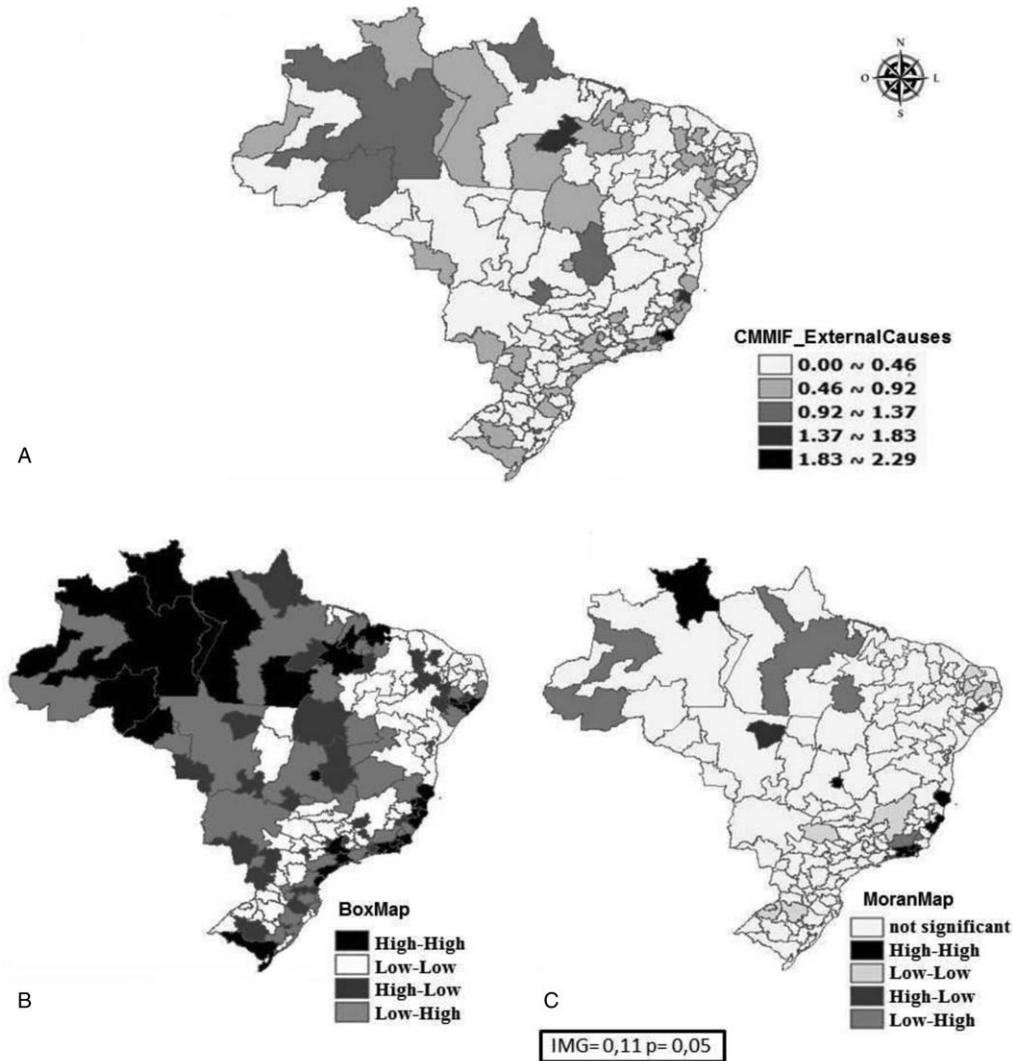
Figure 1. Spatialization of the external cause mortality coefficient in women of childbearing age from 2007 to 2016 (A), BoxMap (B), and MoranMap (C) of spatial autocorrelation of the external cause mortality coefficient in the same period; Brazil, 2019.

availability and quality of health services directly influence patient survival according to access to health services.[9]

External causes, categorized by the International Classification of Diseases as accidental or intentional injuries, represent the third most frequent group of causes of death in Brazil from 2000 to 2010, with aggression (homicide) as the main one. Injuries resulting from accidents are characterized as unintentional. However, some injuries are inflicted intentionally and can cause death, including among women.[10]

In this context, Table 2 shows a significant increase in mortality from external causes among the states, mainly in the north region, with Rondônia having the highest coefficient, as well as some states in the center-west region, namely Goiás, Mato Grosso, and Mato Grosso do Sul. Meanwhile, São Paulo and the Federal District had the best indicators of mortality from external causes.

The high coefficient of mortality from external causes (Fig. 1C) in the northern region may be related to the high rate of prostitution in the region. Poverty and domestic violence are the main factors that influence women to enter the world of

prostitution, even in childhood or adolescence, exposing the social inequality that exists in Brazil. In addition, the territorialization process of prostitution is directly related to the aggression cases that occur in this region.[11]

As shown in Figure 2, among the external causes, accidents and violence are responsible for more than 5 million deaths worldwide. They generate a large number of hospitalizations and cases of emergency care. Young, black, and poor people are the hardest hit.[12]

Mortality from aggression, as shown in the study results, is experienced in all life cycles of women, in different proportions depending on age. Economic inequality, alcohol abuse, and inappropriate parenting practices increase the risk of child abuse, youth violence, intimate partner violence, and sexual violence against women.[13]

These violations of women often affect them throughout their lives, generating trauma that can result in the consumption of illicit drugs and alcohol, mental disorders, such as depression and suicide, school dropout, unemployment, and recurrent relation-
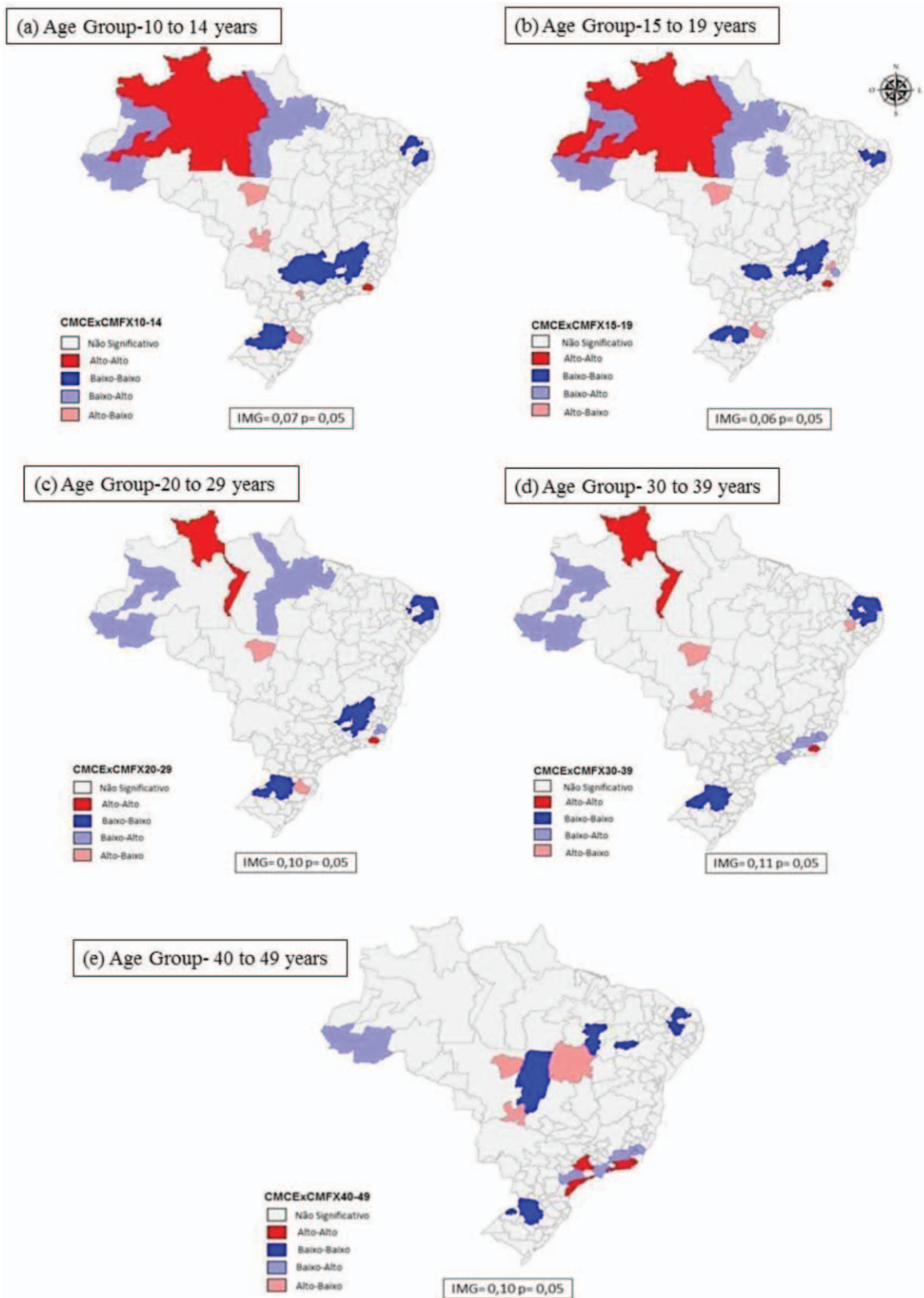
Figure 2. Spatial correlation between the external cause mortality coefficient and age ranges in women of childbearing age, from 2007 to 2016; Brazil, 2019.

ship difficulties. Furthermore, they exacerbate social divisions, perpetuating crime in communities.[14]

Figure 1B shows the high spatial correlation of mortality from external causes in the northeast region. Data from the Continuous National Household Sample Survey show the lowest per capita income in the northeast region, with Pernambuco (R $714) and Maranhão (R$605) having the lowest values recorded, well below the national average (R$1,373).[11]

The same reality is seen in Pará (R$1,204) and Amapá (R$863) in the north.[14] From this perspective, it is possible to infer that the poor income distribution observed in the country magnifies economic inequalities between regions and is associated with high levels of violence.

Another very relevant aspect is age group, as the highest external cause mortality coefficients were observed among the younger population in the study (10-29 years), as can be seen in Figure 2.

Mortality from violence in women shows steep growth until 18/19 years of age followed by a slow decline until old age. However, it is possible to observe a high incidence in female infanticide and homicide, especially in the age group of 18 to 30 years. Regarding the authors of this violence, immediate relatives or partners/former partners account for 67.2% of the total incidents.[15]

Figure 2 shows the strong correlation between mortality due to external causes and the 10 to 19 age group, mainly in the northern region of the country. Violence against women in adolescence occurs from greater exposure to risky situations and behaviors, such as smoking and drinking, which can lead to violent fates. Given this scenario, there is a need for protective legislative measures, as well as more rigorous enforcement of laws against alcohol sales to young people.[16]

Owing to their high incidence in the young population, these external causes of mortality can have a big impact on the aging trend. Thus, greater investments and strengthening of health systems are necessary for comprehensive care and the prevention of these factors.[17]

The Sustainable Development Goals aim to progressively reduce noncommunicable diseases mortality, including actions that reduce key risk factors.[7] Thus, many deaths from external causes in WCA are preventable. It is important that the responsibility for the prevention of these injuries is divided among the various public sectors, such as education, infrastructure, security, civil society, and health.[18]

Thus, the profile of female mortality is essential to support public policies aimed at improving health conditions. From this perspective, Brazil, in 2006, published Law number 11,340, which aims to curb violence against women regardless of class, race, ethnicity, sexual orientation, income, culture, education, age, and religion. To achieve the proposed objectives, the law highlights effective and integrated prevention measures including the provision of specialized police assistance through the creation of Police Stations for Assistance to Women and the promotion and implementation of educational campaigns to prevent violence against women.[19]

In this context, the country also created the Maria da Penha Law, which is seen as one of the most advanced laws related to violence against women, as it includes multiple mechanisms for creating specialized courts and encouraging the promotion of campaigns to prevent gender violence.[20]

There have been advances in our knowledge about mechanisms for preventing violence and protecting women, as well as

greater investments in the field, but there is no simple or single solution to the problem of violence. However, there is significant inequality in the level of support received by different programs, and violence prevention still does not attract political and financial support commensurate with the scale and severity of the problem.[21]

Tackling violence against women goes beyond legal efforts, but there is a need to implement long-term policies built on an understanding of the origin of violence, the associated factors, the individuals involved, and the specific needs of women. Thus, solutions to the problem must emerge through a comprehensive perspective with the objectives of reducing the effects of inequality and exclusion and, above all, empowering women.[22]

In addition, it is important to consider that health care is responsible for the well-being, appreciation and empowerment of women, promoting health education, as well as encouraging comprehensive monitoring of women's health, prenatal care, as well as performing vaginal delivery, as this offers more benefits than cesarean delivery, however, it is often not promoted and encouraged by the medical team.[23]

Also in this segment, it is worth noting that health professionals are important agents in combating and confronting violence against women. However, it is observed that this professional class is affected by physical and emotional exhaustion, with a noticeable increase in mental and behavioral disorders, such as anxiety, depression and Burnout Syndrome, which can cause a decrease in productivity and quality of care for women.[24]

Thus, it is believed that deaths from external causes in WCA are preventable through comprehensive care ranging from prevention to individual monitoring of each case. The prevention of these injuries must be encouraged by the various public sectors, such as education, infrastructure, security, civil society, and health.[18] These measures can improve the population's quality of life, contributing to social development and reducing violence.

The limitations of this study are related to the underreporting of secondary data on mortality, although, currently, the Mortality Information System in Brazil has improved in quality. Another limitation relates to the possibility of ecological bias, which could be present in the ecological correlations in the study design.

5. Conclusion

The results of this investigation showed that the main causes of mortality are neoplasms, followed by circulatory diseases and external causes. It was also seen that young women, between 10 and 29 years old, die predominantly from external causes, with violence being one of the main causes. The average mortality rates from external causes were higher in much of the north, northeast, and southeast of Brazil. Thus, the authorities need to be more alert in order to address the causes of death in this population.

This study, based on Health Information Systems, allows a better understanding of the female population's health situation and encourages the development of related laws and policies. In relation to WCA, there is still a shortage of studies related to this specific population, so the results of this study can serve as a basis for the elaboration of strategic plans for women's health.

Author contributions

Conceptualization: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Data curation: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Formal analysis: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Funding acquisition: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Investigation: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Methodology: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Project administration: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Resources: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Software: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Supervision: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Validation: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Visualization: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Writing – original draft: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

Writing – review & editing: Ana Mayara Gomes de Souza, Ketyllem Tayanne da Silva Costa, Thiffany Nayara Bento de Morais, Fábia Barbosa de Andrade.

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