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Analysis of the female mortality trend due to assault in Brazil, States and Regions

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Abstract *This study aimed to analyze time trend of female mortality due to assault in Brazil, regions and states from 2002 to 2012. This is an ecological times series study with secondary data from women aged 20-59 years who died due to assault. Mortality rates were analyzed by simple linear regression and stratified by region, Gini Index and Human Development Index (HDI). The trend of female rate of mortality due to assault was stable in the country, with differences between states and regions. The Midwest had the highest rates and stagnation trend. There was an increased trend in the North, Northeast and South and a decreased trend in the Southeast. The states of the tertile with the highest HDI evidenced a declining trend and stabilization in the first and second tertiles. An increased mortality rate was recorded in states with greater social inequality. Notwithstanding the national stabilization behavior, results point to the need for social policies appropriate to the specificities of states and regions.*

Key words *Violence against women, Assault, Mortality rate, Time series studies, Mortality records*

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Introduction

Violence is a serious problem and a major challenge to the health sector, due to its repercussions and impacts in all spheres of life of individuals, groups and nations[1]. As a multifactor and complex phenomenon, violence relates to cultural practices throughout society, regardless of income or education and is constantly revised as social values and norms evolve[2]. In addition, the determination of violence is linked to historical, contextual, structural, cultural and interpersonal factors[3].

In this context, in the midst of the various forms of violence, that which is perpetrated against women encompasses the types of violence arising from unequal relations between genders[4] established and based on cultural determinants rooted in the construction of male and female roles that legitimize male power over women[5]. Female murders, known as femicides are a domination form, power and control over women and are the maximum violation of women's rights[6,7].

In Brazil, more than 90,000 women have been murdered over the past 30 years. Data show that the rate of female homicide increased from 2.3 per 100,000 in 1980 to 4.6 in 2010[8]. It is also worth noting that 40% of female homicides occur in the household, against 15% of male homicides. This fact indicates the occurrence of violent deaths of women, caused by greater interpersonal contact, as well as suggests that marital violence is central to the characterization of this phenomenon and that death is often the outcome of stories marked by violence[9].

It is believed that one of the ways to prevent the occurrence of violence against women, and consequently of deaths due to assault is the adoption of intersectoral measures aimed at the dissemination and compliance with Law 11.340/2006, known as the Maria da Penha Law[10,11]. This law is a landmark in Brazilian legislation and aims to curb all forms of violence against women, be it physical, moral, sexual, psychological, injury or death[11] and plays an important role in gender equalization.

Given the above, considering the importance of addressing violence against women and the need for data that reveal the issue and its development, this study aimed to analyze the time trend of female mortality rates due to assault in Brazil, regions and states in the period 2002-2012. We also intended to analyze the behavior of the mortality rate according to human development (Human Development Index – HDI) and inequity (Gini Index) of the federative states.

Methodology

This is a time series study based on data extracted from the Mortality Information System of the Ministry of Health. To gather data for the calculation of mortality rates, we selected death of females in the 20-59 years age group, as it is a group with a high homicide rate[8], whose basic cause of death was assault, classified as codes X85 and Y09 of Chapter XX of the 10th Revision of the International Classification of Diseases, Health Related Problems (ICD-10). The denominator consisted of the total number of women between 20 and 59 years of age by state, for each year of the study period. The rates of female mortality by assault for Brazil, regions and states were analyzed after standardization by direct method using age group of the country population in the 2010 Census as reference[12].

Mortality rates were adjusted based on the percentage of deaths due to ill-defined causes, with a proportional redistribution strategy, aiming at reducing the impact of underestimation of deaths. A percentage of 9.3% of ill-defined deaths reclassified as external causes in another study[13] was used as a parameter[13], extracting from them the percentage represented by assaults in each age group, year and state of the studied period. Further details on the rate adjustment are available from a previous study[13].

In addition to the stratification by geographic regions, state mortality rates were analyzed by HDI tertiles and the Gini Index. These indexes were extracted from the publication Atlas of Human Development in Brazil[14]. HDI measures the level of economic development and the quality of life of the population with ranges from zero to one, where zero evidences no human development and one shows total human development. The Gini Index measures the distribution of income in the country, which refers to social inequalities, varying from zero to one, where zero equates to a situation of full equality and one points to extreme inequality. The Gini index was categorized into tertiles, in which states with the lowest inequality (0.49-0.56) were allocated in the first tertile, followed by states of the second tertile (0.59-0.62) and those with larger inequalities belonging to the third tertile (0.63-0.65). The state HDI was classified in tertiles, where the first tertile is the one with the lowest development (0.631-0.673), the second tertile (0.674-0730) and the third tertile (0.731-0.824), which is the one with the highest level of human development.

Data used were initially organized in Excel for Windows and later analyzed in the statistical program Stata 13.0. Time trend analyses were performed using linear regression, after identifying the non-correlation between standard errors over time, using the Breusch-Godfrey test. In the simple linear regression analysis, mortality rates due to assault, tertiles of Gini index and HDI were considered as dependent variables (y) and the years of the period as independent variable (x).

In order to estimate the increase or decrease of mortality rates, the regression coefficients, their 95% confidence intervals and the respective p-values of statistical significance tests were shown. In addition, the annual percentage variation was calculated by the ratio of the regression coefficient in relation to the mortality rate at the beginning of the analyzed period. Variations of the mortality rate due to assault were considered significant with a significance level of α=5% in linear regression. The fractional polynomials model was used to confirm the use of the linear regression model, in which it was observed that even with five degrees, the best model is not different from the linear model ($p = 1.0$).

For temporal observation and presentation of the dependent variable, three maps with standardized state mortality coefficients were also constructed for 2002, 2007 and 2012 using Tabwin and Excel programs.

This is a research using exclusively public domain secondary data and is exempt from submission and approval by the Ethics Committee of Research with Human Beings, according to Resolution Nº 466/2012 of the National Health Council.

Results

In Brazil, the mortality rate due to assault of females in the 20-59 years group increased from 5.84 (2002) to 6.16 per 100,000 women in 2012. It is worth emphasizing that Espírito Santo was the state that recorded the highest female death rates due to assault in 2002, 2007 and 2012, and the states of Alagoas, Tocantins, Paraíba, Bahia, Amazonas, Maranhão, Pará, Paraná and Minas Gerais showed substantial increase in their rates in the period (Table 1). The distribution of mortality in 2002, 2007 and 2012 throughout the Brazilian territory can be viewed in Figure 1.

Analyzing mortality rates due to assault in the Brazilian geographic regions, we highlight the high mortality rate in the Midwest compared to other regions, with a trend towards stagnation of this indicator in the study period. There was an upswing in the North, Northeast and South regions, evidenced by increases of 5.74%, 5.49% and 2.92% in the yearly mortality rate, respectively. On the other hand, there was an average annual decline of 3.41% ($p < 0.05$) (Table 2 and Figure 2a) in the Southeast.

Reviewing women death rates due to assault according to the HDI, a stable trend is noted in the first and second tertile. This is possibly explained by a mortality rate downswing in the period 2005-2008, which is characterized by the only rate declining period compared to other periods (2002-2004 and 2008-2012) that express an apparent increased female mortality due to assault (Figure 2b). However, in the third tertile, time evaluation evidenced a falling trend with an average yearly reduction of 1.58% per year during the period evaluated (Table 2).

In relation to the Gini index, there was an increase in the rate of female mortality due to assault in the states with the highest social inequality, with an average annual rate increase of 1.70% in the second tertile and 4.83% in the third tertile (Table 2). The states belonging to the first tertile showed a stable trend in this period. At the beginning of the period, this tertile had the highest mortality rate (2002), while it recorded the lowest female mortality rate in 2012 (Figure 2c).

Discussion

Data of this study show a stable trend in the female mortality rates due to assault in the period 2002-2012 in Brazil. This is possibly explained by the decline during the period in the Southeast region and increases in the North, Northeast and South regions. In addition to regional inequalities in the time trend of female mortality due to assault, specific socioeconomic aspects were also observed. States in the lower HDI tertiles and those belonging to the tertiles with the highest inequality had a higher mortality rate.

The stable female mortality rate due to assault at the national level seems to follow some patterns evidenced in other countries as well. A recent study reveals a stagnant mortality of women due to homicide in the country, which is also evidenced in the United States, Ecuador and Chile[15]. On the other hand, in Italy, female homicide is on the rise, accounting for 30.9% of all homicides in 2011[16]. Regardless of development

Table 1. Gini Index, HDI, crude and standardized rates and mortality trend due to assault for women aged 20-59 years in Brazil by Federative Unit, 2002, 2007, 2012).

State	GINI index (tertile)	HDI (tertile)	Standardized mortality rate			Coefficient of regression* (CI 95 %**)	Annual variation***
			2002	2007	2012		
North							
Acre	0.63 (3)	0.663 (1)	6.08	7.29	5.86	0.15 (-0.32;0.35)	2.46
Amazonas	0.65 (3)	0.674 (2)	3.43	4.54	8.65	**0.40 (0.17;0.62)**	**11.94**
Amapá	0.60 (2)	0.708 (2)	10.17	9.83	7.05	**-0.39 (-0.83;-0.38)**	**-3.83**
Rondônia	0.56 (1)	0.690 (2)	10.48	4.96	7.79	-0.23 (-0.64;0.18)	2.19
Roraima	0.63 (3)	0.707 (2)	4.15	6.59	4.77	0.09 (-0.17;0.37)	2.16
Tocantins	0.60 (2)	0.699 (2)	4.77	5.60	10.12	**0.46 (0.08;0.83)**	**9.64**
Pará	0.62 (2)	0.646 (1)	3.85	6.11	7.95	**0.40 (0.30;0.49)**	**10.38**
Northeast							
Alagoas	0.63 (3)	0.631 (1)	7.57	9.38	11.09	**0.42 (0.14;0.70)**	**5.54**
Bahia	0.62 (2)	0.660 (1)	2.31	4.83	8.07	**0.55 (0.45;0.65)**	**23.80**
Ceará	0.61 (2)	0.682 (2)	4.93	4.08	6.31	**0.12 (-0.03;0.28)**	**2.43**
Maranhão	0.62 (2)	0.639 (1)	2.57	2.65	5.17	**0.28 (0.10;0.45)**	**10.89**
Paraíba	0.61 (2)	0.658 (1)	3.87	5.08	9.18	**0.62 (0.45;0.79)**	**16.02**
Pernambuco	0.62 (2)	0.673 (1)	9.11	8.70	6.09	-0.23 (-0.42,0.05)	-2.52
Piauí	0.61 (2)	0.646 (1)	3.10	3.38	4.16	0.04 (-0.05;0.15)	1.29
Rio Grande do Norte	0.60 (2)	0.684 (2)	2.38	3.81	4.96	**0.33 (0.17;0.50)**	**15.21**
Sergipe	0.62 (2)	0.665 (1)	6.09	4.68	7.96	0.18 (-0.04;0.42)	2.95
Midwest							
Distrito Federal	0.63 (3)	0.824 (3)	5.56	4.96	6.16	0.08 (-0.01;0.19)	1.43
Goiás	0.55 (1)	0.735 (3)	7.98	5.47	9.60	0.26 (-0.01;0.53)	3.25
Mato Grosso	0.55 (1)	0.725 (2)	10.27	10.33	8.45	**-0.27 (-0.46;-0.08)**	**-2.62**
Mato Grosso do Sul	0.56 (1)	0.729 (2)	9.97	6.62	8.44	-0.08 (-0.35;0.18)	-0.80
South							
Paraná	0.53 (1)	0.749 (3)	5.26	5.47	7.80	**0.23 (0.09;0.37)**	**4.37**
Rio Grande do Sul	0.54 (1)	0.746 (3)	4.76	4.22	6.20	**0.13 (0.02;0.25)**	**2.73**
Santa Catarina	0.49 (1)	0.774 (3)	3.99	2.82	3.96	0.04 (-0.08;0.16)	1.00
Southeast							
Espírito Santo	0.56 (1)	0.740 (3)	12.06	13.84	11.35	0.07 (-0.34;0.49)	0.58
Minas Gerais	0.56 (1)	0.731 (3)	4.30	5.51	6.09	**0.10 (0.02;0.19)**	**2.32**
Rio de Janeiro	0.59 (2)	0.761 (3)	8.38	6.61	5.20	**-0.43 (-0.56;-0.31)**	**-5.13**
São Paulo	0.56 (1)	0.783 (3)	6.77	3.52	3.68	**-0.33 (-0.44;-0.21)**	**-4.87**
Brazil	0.52	0.699	5.84	5.14	6.16	0.01 (-0.04;0.07)	0.17

* Calculated using standardized mortality rates for all years of the study period. ** Confidence Interval of 95%. *** Annual percentage average variation.

over time and socioeconomic and geographical differences, we highlight the high rates of female mortality due to assault in Brazil. According to the Map of Violence, in 2012, the country ranked seventh in the female homicide world ranking, where El Salvador, Trinidad and Tobago and Guatemala[8] held the first three spots.

Some states report a trend of increased rates, as observed in Bahia, Paraíba, Rio Grande do Norte, Maranhão, Amazonas, Pará and Tocantins. Similar data were found in a study on femicides in Brazil from 2003 to 2007[17]. It is also worth considering that female deaths due to assault are an indicator of gender violence, since women are more penalized in societies that are more violent. Conditions of violence in society favor gender inequality, resulting in high rates of female mortality due to assault[18], as seen in the states of Espírito Santo and Alagoas, which also have high rates of male homicides[19].

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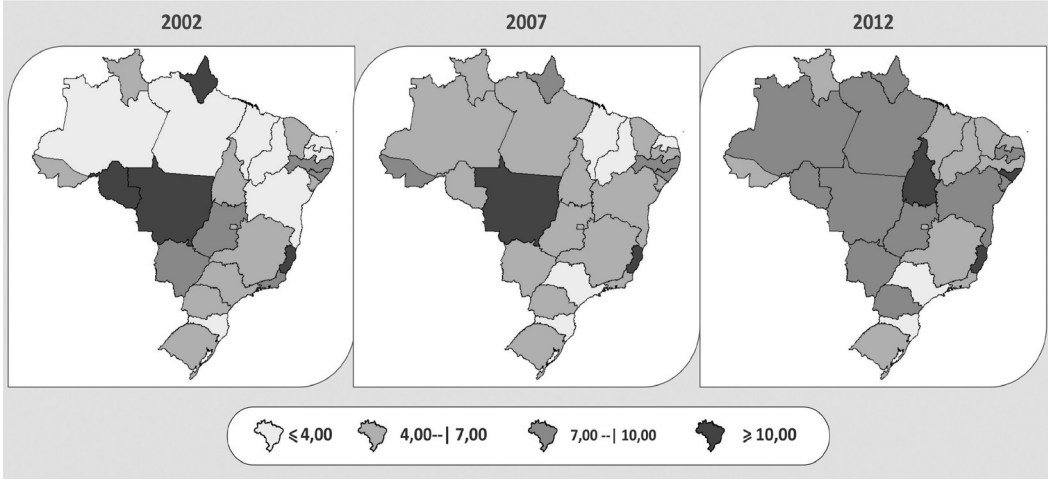

Figure 1. Distribution of mortality due to assault for women aged 20-59 years in Brazil, 2002, 2007 and 2012.

Table 2. Coefficients of regression and percentage change in mortality rates due to assault for women aged 20-59 years in Brazil by region, tertiles of Gini coefficient and HDI, 2002-2012.

	Coefficient	CI 95%*	P-value	% variation	Trend
Region					
Northeast	0 .25	0.18;0.32	< **0.001**	5.49	increase
North	0.28	0.20;0.35	< **0.001**	5.74	increase
Midwest	0.05	-0.12;0.23	0.482	0.60	stable
Southeast	-0.23	-0.29;-0.16	< **0.001**	-3.41	reduction
South	0.14	0.04;0.25	**0.01**	2.92	increase
HDI					
1º	0.16	-0.15;0.48	0.272	3.51	stable
2º	-0.04	-0.41;0.31	0.766	-0,66	stable
3º	-0.10	-0.17;0.03	**0.006**	-1,58	reduction
GINI Tertiles					
1º	-0.64	-0.14;0.01	0.094	-3.51	stable
2º	0.09	0.03;0.16	**0.010**	1.70	increase
3º	0.27	0.16;0.37	< **0.001**	4.83	increase
Brazil	0.01	-0.04;0.07	0.558	0.17	stable

* CI 95%: Confidence interval of 95%.

Another relevant aspect are the regional differences shown in this study, which imprint different mortality patterns in the country. There are high rates of female mortality due to assault in the Midwest and an increased trend in the North, Northeast and South. Studies show that femicide is found in both urban areas, where drug trafficking and armed conflicts prevail, and rural areas, border areas and land conflicts, frequently seen in the north and Midwest regions[17]. It is worthwhile to consider that some regions show an overvalued male sexual role, a deep-seated patriarchal role and female subordination, which leads to increased gender inequality[18]. On the other hand, since regional socioeconomic differences are important in our country, exploring death rates by HDI and Gini Index favors a better understanding of the time trend of this indicator. In this study, federative states with greater social inequality showed marked trends of increased fe-

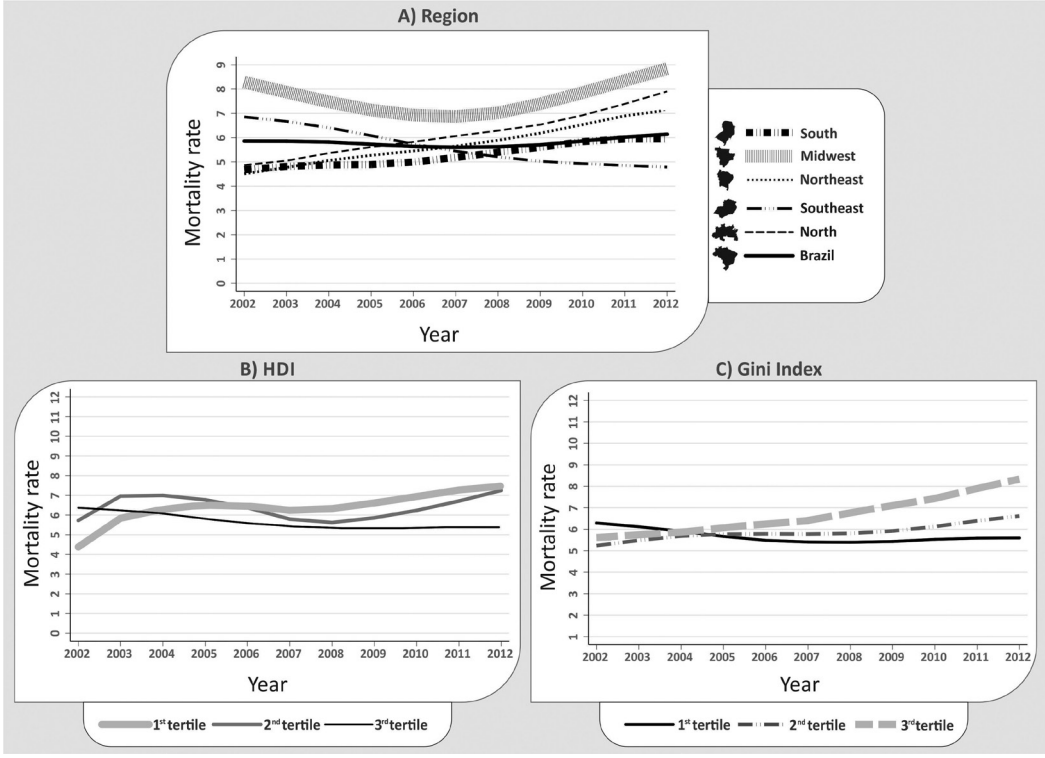

Figure 2. Time trend in mortality rates due to assault for women aged 20-59 years in Brazil by region, tertiles of Gini Index and HDI in the period 2002-2012.

male mortality due to assault between 2002 and 2012. States with lower development are stable, however, with higher rates in relation to the states with the highest HDI.

When analyzing the regional trends of HDI and Gini Index, some exceptions like Espírito Santo call attention, since they have better human development and inequality indicators, but also high mortality rates compared to other states. Thus, while socioeconomic issues are strongly linked to female mortality due to assault, factors that permeate violence transcend poverty and social inequality. These findings reinforce the idea of violence against women as a multifactorial phenomenon, which includes an interaction of individual, relational, social, cultural and environmental factors[20], in this context, there is a need to perform studies that unravel the possible factors that predispose the high rates of femicides in that State.

Another issue that deserves to be clarified in this discussion is the Maria da Penha Law. A recent study[21] evaluated the effectiveness of this Law and demonstrated that it has played an important role in containing gender violence, although its efficacy has not been uniform in the country. The implementation and wide dissemination of this Law occurred concurrently with falling rates of mortality due to assault in Brazil in 2006, followed by an increase in 2007, according to the findings of this study. This increase is possibly related to the limited implementation of services provided for in the Law, thus contributing to the lower punishment of the perpetrator and perpetration of violence[21]. Another possible justification may be the immediate increase of notifications and greater encouragement to report. However, it should be pointed out that coercive measures alone are not capable of reducing violence against women and that educational activities and activities that recognize women in society are necessary[22].

Thus, in order to contribute to reducing violence against women, health services should be integrated into a broader social service, supporting the actions of Public Security and Justice agents, playing an important role in addressing this phenomenon. Some measures have been proposed to recognize violence as a public health

problem. The World Health Organization guides and reinforces the need to notify cases of domestic violence, which is a mandatory procedure, as well as the reception and recognition of the integrity of women as subjects with human rights[23].

It is worth pondering over some limitations of this study. While the Mortality Information System has advanced in the last decades, there are still differences in the quality of information among states due to inadequate completion of death certificates, as well as misdiagnoses. Studies show that several homicides are deemed accidents or suicides, a factor that may underestimate these measures of occurrence[16,24]. On the other hand, it is questioned whether the increased trend in some states is a reflection of the real hike of the mortality rate or improvement in death registration. It is important to highlight that, in the case of improved registration, it is worth emphasizing its importance in the fight against violence, enabling a better knowledge of the reality and adoption of measures and the elaboration of policies based on the mortality profile.

Considering the results, one can see that, while the rates of female mortality due to assault in Brazil are generally stable, regional and state rates show important differences in the mortality pattern. Socioeconomic factors expressed by the HDI and the Gini Index highlight social inequalities in the occurrence and development of this mortality. In addition, these findings portray a considerable amount of violence in the country, which points to a serious public health problem at the national level. In this context, reducing conditions that favor violence becomes relevant in all Brazilian states, with special attention to local regional and socioeconomic differences, as well as the integration of health, education, social, economic and judicial assistance sectors towards addressing violence against women.

Collaborations

FMC Leite and KC Mascarello worked in design, outline, analysis, interpretation of data, writing of paper and approval of the version to be published. APSC Almeida, JL Favero and AS Santos worked in design, outline, analysis, interpretation of data, writing of paper and approval of the version to be published. ICM Silva and FC Wehrmeister worked in outline, analysis, interpretation of data, critical review and approval of the version to be published.

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