







Gender differentials in suicide mortality

Diferenciais de gênero na mortalidade por suicídio

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ABSTRACT

Objective: to identify gender differences in suicide mortality in Northeastern Brazil. **Methods:** the deaths from suicide recorded in the Mortality Information System were analyzed. The Chi-square (χ^2) for independence and odds ratio tests were used. The time trend was evaluated by the Joinpoint method. **Results:** in the period studied there were 27,101 suicide deaths in the Northeast, with a predominance of the male gender (79.5%). Adolescent women, with high schooling, widows, and divorcees are more prone to suicide than men. The male gender is more likely to use firearms and hanging, while the female gender uses more smoke, fire and flames and self-intoxication to commit the act. The most significant increase in mortality was among men (3.1%; $p < 0.05$). **Conclusion:** there was a greater prevalence and tendency to increase suicide among men, as they use more lethal means to commit the act compared to women.

Descriptors: Suicide; Mortality; Gender and Health; Time Series Studies; Ecological Studies.

RESUMO

Objetivo: identificar diferenças de gênero na mortalidade por suicídio no Nordeste brasileiro. **Métodos:** analisaram-se os óbitos por suicídio registrados no Sistema de Informação sobre Mortalidade. Foram empregados os testes de Qui-Quadrado (χ^2) para independência e razão de chances. A tendência temporal foi avaliada pelo método *Joinpoint*. **Resultados:** no período estudado ocorreram 27.101 óbitos por suicídio no Nordeste, com predominância do gênero masculino (79,5%). As mulheres adolescentes, com alta escolaridade, viúvas e divorciadas são mais propensas ao suicídio em comparação aos homens. O gênero masculino tem mais chances de utilizar armas de fogo e enforcamento, enquanto as mulheres utilizam mais fumaça, fogo e chamas e autointoxicação para cometer o ato. O aumento mais expressivo da mortalidade se deu entre os homens (3,1%; $p < 0,05$). **Conclusão:** houve maior prevalência e tendência de aumento do suicídio entre os homens, pois estes utilizam meios mais letais para cometer o ato em comparação às mulheres. **Descritores:** Suicídio; Mortalidade; Gênero e Saúde; Estudos de Séries Temporais; Estudos Ecológicos.

Introduction

According to the World Health Organization, about 800,000 people die every year from suicide, and for each adult who performs this act, at least 20 others attempt against their own lives without success. It is a complex and multifactorial phenomenon that is among the top twenty causes of death worldwide, surpassing the deaths resulting from wars and homicides. In light of this, self-provoked deaths represent a serious global public health problem that occurs most frequently in low and middle-income countries where, in turn, most of the world's population is concentrated⁽¹⁻²⁾.

Brazil is among the ten leading countries in absolute suicide numbers and, among the Brazilian regions, the Northeast region is highlighted, given the considerable increase of 72.4% in the rates of the bill of review observed in recent years⁽²⁻³⁾. In the period from 2010 to 2014, 75.0% of the Northeastern municipalities had suicide mortality rates of up to 7.19 deaths per 100,000 inhabitants, and the states of Piauí and Ceará had the highest average mortality rates (7.77 and 6.92 deaths per 100,000 inhabitants, respectively)⁽⁴⁾.

Associated with the problem are general factors such as income inequality, low level of education, unemployment and the presence of mental disorders such as anxiety and depression⁽⁴⁻⁵⁾. However, there are conditioning factors that are more common among individuals of a certain gender. Among them, we can mention the high consumption of alcohol and other substances, the presence of financial, criminal, and work-related problems among men, while among women suicide is more due to physical health problems, family issues, marital conflicts, and abusive relationships. In addition, the literature widely reports that women are more exposed to mistreatment and violence, especially sexual violence, which contribute to the highest rates of suicide attempts in this population⁽⁵⁻⁷⁾.

Although research has shown a steady increase

in suicide mortality in Northeastern Brazil in recent decades^(3,8-9), There are still few studies aimed at understanding the occurrence of this bill of review, according to the gender in the region⁽⁹⁾. In this scenario, it is understood that the evaluation of individual factors that may lead to suicide among men and women contributes to a greater basis for health professionals in the formulation of intervention strategies aimed at reducing mortality in both populations. Therefore, this study aimed to identify gender differences in suicide mortality in Northeastern Brazil.

Methods

This is a time-series ecological study that used secondary data from the Mortality Information System, which is fed from the Death Certificate. The scenario of this investigation is the Northeast, a Brazilian region constituted by nine states: Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe, totaling 1,794 municipalities. According to the latest 2010 demographic census conducted by the Brazilian Institute of Geography and Statistics, the population of the Northeast totals 53,081,950 people, which corresponds to about 28.0% of the population living in Brazil⁽¹⁰⁾.

The information collected refers to deaths that occurred from 2008 to 2018 and that mention suicide as a basic cause in death certificates, being selected only those whose categories X60 to X84 were cited according to the 10th International Classification of Diseases (ICD-10). The data on the deaths were obtained from the website of the Department of Informatics of the Brazilian Ministry of Health's Unified Health System⁽¹¹⁾. It should be noted that the data collection took place from October 2019 to February 2020. The variables on the death certificate used in this study were: residence status, year of death, causes of death according to ICD-10, place of occurrence, gender, age group, marital status, skin color and schooling per years of study. In turn, demographic data on the population of the northeastern states were collected on

the Brazilian Institute of Geography and Statistics website. It provides information that was collected in the last demographic census conducted in 2010, as well as inter-census projections (2008 and 2009 and 2011 to 2018).

In the exploratory analysis of the epidemiological profile of suicide deaths (univariate analysis), the quantitative categorical variables were described as absolute and relative frequencies. Bivariate analyses were also performed using the software R version 4.0.2[®] with the use of the Chi-square (χ^2) for independence and the odds ratio (OR). In the χ^2 test it was considered $p < 0.05$ as necessary for the rejection of the nullity hypothesis. The 95% confidence interval (95%CI) was adopted and the same was used to conclude on the χ^2 hypothesis test, since if it contains the value 1, it means that there is no difference regarding the two variables in question.

For the analysis of the temporal evolution of mortality, the raw data of suicide recorded each year were tabulated in Microsoft Office Excel software spreadsheet and imported into the free Joinpoint Regression Program version 4.6.0.0. The Annual Percentage Change (APC) was calculated using 95%CI, where a negative APC value indicates a decreasing trend and a positive value indicates an increasing trend. Each inflexion point added to the model represents a change in the linear trend, that is, there could be only one straight line in the analyzed period or its change would indicate the insertion of an inflexion point with the inclusion of a new straight line segment to the time series⁽¹²⁾.

A significance level of 5% was established to test the null hypothesis that the APC of the series was equal to zero. For the APC analysis the results with $p < 0.05$ or 95%CI only positive (increasing tendency) or only negative (decreasing tendency) are significant⁽¹²⁾. The year of the suicide occurrence was defined as an independent variable and the mortality rate in each year, calculated directly in the program and standardized according to the logarithmization crite-

ria previously exposed. To do so, the number of deaths was selected as the numerator and the population of the chosen year as the denominator, considering the coefficient for 100,000 inhabitants. The results of the regression analysis by inflexion points were performed for the general population of the Northeast region, as well as for the male and female genders.

This study was approved by the Research Ethics Committee of Universidade Estadual do Piauí under protocol number 3,286,816/2019 and Certificate of Ethics Presentation number 07557818,4,0000,5209. It is emphasized that all ethical and legal aspects were respected, as recommended by Resolutions 466/12 and 510/16 of the National Health Council.

Results

Table 1 shows that 27,101 deaths from suicide were registered in the Northeastern region of Brazil in the period from 2008 to 2018, with most of the deaths occurring among males ($n=21,541$; 79.5%), with seven years or less of study ($n=14,549$; 72.5%), single ($n=14,627$; 59.2%), brown ($n=19,285$; 76.8%), and about one among five individuals were in the 20-29 age group ($n=6,095$; 22.5%).

Statistically significant associations ($p < 0.001$) were observed between the gender of the individual who committed suicide and age, schooling, marital status and skin color. It was noted that there are 2.21 (95% CI: 2.02-2.42) times more chances of suicide being committed by female adolescents in the age range of 10 to 19 years, than by male adolescents. It was also found that women who committed suicide had higher education than men, having 2.24 (95% CI: 2.00-2.50) times more chances of committing suicide when they had 12 or more years of study. In addition, women were more prone to suicide when widowed (OR: 2.48; 95%CI: 2.17-2.84) and legally separated (OR: 1.37; 95%CI: 1.19-1.59) and men were more prone when self-declared brown (OR: 1.45; 95%CI: 1.35-1.56) or black (OR: 1.30; 95%CI: 1.13-1.49). (Table 1).

Table 1 – Association between gender and the variables age, education, marital status and skin color of suicide victims in the Northeast, 2008-2018. Parnaíba, PI, Brazil, 2020

Variables*	Men	Women	Total	p-value	OR (95%CI) [†]
	n (%)	n (%)	n (%)		
Age (years)					
5 to 9 [‡]	16 (0.1)	2 (0.1)	18 (0.1)		2.07 (0.48 - 8.99) [§]
10 to 19	1,537 (7.1)	807 (14.5)	2,344 (8.7)		2.21 (2.02 - 2.42)
20 to 29	4,935 (23.0)	1,160 (20.9)	6,095 (22.5)		1.13 (1.05 - 1.21) [§]
30 to 39	4,783 (22.2)	1,053 (19.0)	5,836 (21.6)	<0.001	1.22 (1.13 - 1.32) [§]
40 to 49	3,820 (17.8)	943 (17.0)	4,763 (17.6)		1.06 (0.98 - 1.14) [§]
50 to 59	2,813 (13.1)	735 (13.2)	3,548 (13.1)		1.01 (0.93 - 1.11)
≥ 60	3,597 (16.7)	852 (15.3)	4,449 (16.4)		1.11 (1.02 - 1.20) [§]
Total	21,501 (100.0)	5,552 (100.0)	27,053 (100.0)		-
Education (years)					
None	2,385 (15.1)	447 (10.6)	2,832 (14.1)		1.49 (1.34 - 1.66) [§]
1 to 3	4,819 (30.4)	924 (21.9)	5,743 (28.6)		1.56 (1.44 - 1.69) [§]
4 to 7	4,775 (30.1)	1,199 (28.4)	5,974 (29.8)	<0.001	1.09 (1.01 - 1.17) [§]
8 to 11	2,899 (18.3)	1,114 (26.4)	4,013 (20.1)		1.60 (1.48 - 1.74)
≥ 12	961 (6.1)	532 (12.6)	1,493 (7.4)		2.24 (2.00 - 2.50)
Total	15,839 (100.0)	4,216 (100.0)	20,055 (100.0)		-
Marital Status					
Single	11,729 (59.8)	2,898 (56.8)	14,627 (59.2)		1.13 (1.06 - 1.20) [§]
Married	5,656 (28.8)	1,379 (27.0)	7,035 (28.5)	<0.001	1.09 (1.02 - 1.17) [§]
Widow	591 (3.0)	365 (7.1)	956 (3.8)		2.48 (2.17 - 2.84)
Separated	721 (3.7)	254 (5.0)	975 (3.9)		1.37 (1.19 - 1.59)
Other	923 (4.7)	207 (4.1)	1,130 (4.6)		1.17 (1.00 - 1.36) [§]
Total	19,620 (100.0)	5,103 (100.0)	24,723 (100.0)		-
Skin color					
White	2,975 (14.9)	1,193 (23.2)	4,168 (16.6)		1.73 (1.61 - 1.87)
Black	1,298 (6.5)	261 (5.1)	1,559 (6.2)		1.30 (1.13 - 1.49) [§]
Yellow	44 (0.2)	10 (0.2)	54 (0.2)	<0.001	1.13 (0.57 - 2.25) [§]
Brown	15,631 (78.2)	3,654 (71.2)	19,285 (76.8)		1.45 (1.35 - 1.56) [§]
Indigenous	44 (0.2)	16 (0.3)	60 (0.2)		1.42 (0.80 - 2.51)
Total	19,992 (100.0)	5,134 (100.0)	25,126 (100.0)		-

*Missing cases (missings/ignore) were excluded for the following variables: age (n=48), education (n=7,046), marital status (n=2,378) and skin color (n=1,975); [†]OR: Odds ratio; [‡]A age range from 5 to 9 years was not used in the Chi-square test; [§]The OR value indicates the odds ratio of the male gender over the female; ^{||}The OR value indicates the odds ratio of the female gender over the male; CI: 95% confidence interval

In Table 2, it can be seen that the intentionally self-provoked injury by hanging, strangulation, and suffocation (n=18,006; 66.5%) was the most prevalent method in both genders, with the home (n=15,926; 59.2%) being the most chosen place to commit suicide. Statistically significant associations (p<0.001) were also observed between the gender of the individual who committed suicide and the method chosen for suicide and the place where the death occurred. Male individuals are more likely to commit suicide by

shooting a firearm and explosives (OR: 3.60; 95%CI: 3.02-4.29) and by hanging (OR: 2.17; 95%CI: 2.05-2.31), while women are more likely to commit suicide using smoke, fire and flames (OR: 3.89; IC95%: 3.22-4.69) and by self-intoxication (OR: 3.07; IC95%: 2.86-3.29). In addition, women are more likely to die in hospital (OR: 2.73; 95%CI: 2.54-2.93) and men in their own homes (OR: 1.20; 95%CI: 1.13-1.27) and on public roads (OR: 1.65; 95%CI: 1.45-1.87).

Tabl 2 – Association between gender and the means used for suicide and the place of death by suicide in the Northeast 2008-2018. Parnaíba, PI, Brazil, 2020

Variables*	Men	Women	p-value	OR (95%CI) [†]
	n (%)	n (%)		
Category ICD-10				
X60 – X69: Self-intoxication	2,832 (13.1)	1,762 (31.7)		3.07 (2.86 - 3.29) [‡]
X70: Hanging, strangulation and suffocation	15,117 (70.2)	2,889 (52.0)		2.17 (2.05 - 2.31) [§]
X71: Drowning and submersion	179 (0.8)	72 (1.3)		1.57 (1.19 - 2.06) [‡]
X72 – X75: Firearms and explosives	1,821 (8.5)	139 (2.5)		3.60 (3.02 - 4.29) [§]
X76 – X77: Smoke, fire and flames	225 (1.0)	219 (3.9)	<0,001	3.89 (3.22 - 4.69) [‡]
X78 – X79: Sharp, penetrating or blunt object	493 (2.3)	96 (1.7)		1.33 (1.07 - 1.66) [§]
X80 – X82: High place precipitation, moving object or motor vehicle impact	508 (2.4)	242 (4.4)		1.89 (1.61 - 2.2) [‡]
X83 – X84: Other means	366 (1.7)	137 (2.5)		1.46 (1.2 - 1.78) [‡]
Total	21,541 (100.0)	5,556 (100.0)		-
Place of occurrence				
Hospital	2,849 (13.3)	1,634 (29.5)		2.73 (2.54 - 2.93) [‡]
Other health establishment	113 (0.5)	70 (1.3)		2.41 (1.79 - 3.26) [‡]
Home	12,846 (60.1)	3,080 (55.7)	<0,001	1.20 (1.13 - 1.27) [§]
Public road	1,797 (8.4)	292 (5.3)		1.65 (1.45 - 1.87) [§]
Others	3,778 (17.7)	455 (8.2)		2.39 (2.16 - 2.65) [§]
Total	21,383 (100.0)	5,531 (100.0)		-

*Missing cases (missings/ignore) were excluded for the following variables: ICD-10 category (n=4) and place of occurrence (n=187); [†]OR: Odds Ratio; [‡]The OR value indicates the odds ratio of the female gender over the male; [§]The OR value indicates the odds ratio of the male gender over the female; IC: 95% confidence interval; ICD-10: 10th International Classification of Diseases

Table 3 presents the time trend analyses obtained through Joinpoint regression for the general Northeastern population and for the male and female genders. Statistically significant growth ($p < 0.05$) of 2.8% (95% CI: 1.9-3.7) per year of suicide mortality in the general Northeastern population was evidenced. When the trend analysis was made according to gender, a significant growth ($p < 0.05$) of 3.1% (95% CI: 2.1-4.1) mortality among men and 1.8% (95% CI: 0.9-2.8) among women was observed.

Table 3 – Annual percentage variation of suicide mortality in Northeastern Brazil and according to the gender of the Northeastern population in the period 2008-2018. Parnaíba, PI, Brazil, 2020.

Population	Period	Annual Percentage Change (*95% CI)	p-value	Tendency
Northeast	2008-2018	2.8 (1.9 – 3.7)	<0.05	Crescent
Male gender	2008-2018	3.1 (2.1 – 4.1)	<0.05	Crescent
Female gender	2008-2018	1.8 (0.9 – 2.8)	<0.05	Crescent

*CI: 95% confidence interval

Discussion

The limitations of the present study are based on the use of secondary data on suicide mortality from a system that is subject to underreporting and inadequate filling, either through error in data collection or during system feeding. As an example, there are high numbers of variables with ignored and unspecified responses, which prevents a more reliable analysis of the situation. However, it should be noted that such limitations have not prevented the conduct of this study.

The evidence presented here contributes to the identification of the most common characteristics among individuals who commit suicide according to their gender. Such data can facilitate the development of prevention strategies and interventions that avoid the consummation of the act in potentially vulnerable individuals, as well as the training of health professionals to deal with the problem in their daily care practices and in the creation and review of public policies for mental health.

Several national^(3,7) and foreign⁽¹³⁻¹⁶⁾ studies have also pointed out the highest occurrence of suicide deaths among men. In view of this, although proportionally there were more suicides by hanging, strangulation, and suffocation in both genders, in the bivariate analysis differentiated patterns were found in both populations. It was noted that men use more aggressiveness and impulsiveness in their choices, having a greater chance of attempting suicide through more lethal methods such as the use of firearms and hangings, however, women are more likely to use less lethal means such as self-intoxication and poisoning, which, therefore, are more easily reversible if care is quick^(6,13).

Studies show that men, unlike women, can react with greater disgust to seeking professional help, having more difficulty in talking about themselves and their feelings, acquiring hostile and competitive behaviors when faced with difficult situations^(3,15). Investigations also show the strong relationship between

the occurrence of suicidal behavior among men and factors such as parental absence and high consumption of alcohol and other psychotropic substances^(7,14).

It was observed that female adolescents were more likely to commit suicide than men of the same age range. This may be related to the greater vulnerability of this population to intra-family violence, expressed in psychological, physical, and especially sexual ways. Other risk factors pointed out by the literature refer to dissatisfaction with body image, impulsiveness, teenage pregnancy, bullying, poor school performance, and the breakdown of affective relationships^(5,17). It is also added that suicide among women aged 10 to 19 was significantly related to lower economic indicators, such as high unemployment and social inequality, which can result in increased tasks and responsibilities for adolescents in this age group⁽¹⁸⁾.

Women were found to be more likely to commit suicide when widowed and legally separated, which corroborates a study in Bushehr province, Iran, which found that the rates of self-promoted deaths were 3.5 times higher among women with these marital status compared to single women⁽¹⁹⁾. In view of the above, it should be noted that divorce, as well as the death of a spouse, often represents a stressful time and suffering for the person involved, being harmful to his or her mental health, and may lead to suicidal ideation^(6,20).

The low educational level has been pointed out by numerous investigations as a risk factor for suicide, since it contributes negatively to the social and financial issues of the individual, increasing the risk of unemployment and financial instability, exposing him/her to more precarious work activities^(3,8,20). On the other hand, the high level of education can also accompany situations that produce high degrees of this and vulnerability such as problems at work, relationship problems, competitiveness, among other experiences that can generate risks to the mental health of the individual^(8,16).

The tendency for women to use less lethal methods may result in a higher probability of failure in attempted suicide as well as the possibility that the

victim will be rescued while still alive, increasing the chances of death in the hospital. In contrast, it was observed that the home was the place where more than half of the deaths occurred, which can be strongly related to the ease of access to the methods that contribute to the suicide act, since utensils, such as those used for hanging, are part of daily routine, making the prevention of these deaths difficult to control^(3,7,15).

This study also showed a tendency to increase suicide in the Northeast for the general population as much as for the male and female genders, and is therefore in line with other studies of temporal analysis conducted in Brazil^(3,8-9). Research that analyzed the epidemiological pattern of suicide throughout the Brazilian territory showed that from 1996 to 2016 there was a 104.9% increase in suicide mortality in the Northeast region⁽⁹⁾. In contrast, research that also observed the growth pattern of suicide in Brazil from 2000 to 2012 pointed to a 77.8% increase in suicide rates among men, while among women the increase was 56.0%⁽³⁾.

A possible explanation for the growth of suicide rates in the Northeast may be associated with the intrinsic characteristics of this region of the country, such as the high degree of inequality, which interferes with the economic, educational, housing, and quality of life aspects, in addition to the increase in unemployment rates and the level of agricultural dependence in the region. Agricultural and fishing activities represent one of the main sources of income for the northeastern region, which are therefore activities considered important risk factors for suicide, mainly due to the precarious conditions in which they are developed, unfavorable weather conditions and a tendency to low productivity^(3-4,8-9).

The increase in the number of suicide deaths may also be the result of the improvement in the quality of records, data collection, and coverage of the Mortality Information System resulting from the technological expansions in the Brazilian health systems and services, in addition to better completion of death certificates and improved identification and classification of suicide as a cause of death.

Conclusion

It is concluded that there has been a significant growth in suicide mortality in the Northeast region, a phenomenon observed in both genders, with a more expressive increase in the male population. It was observed that female individuals who committed suicide had a higher education, when compared to the opposite gender. Adolescents, widows, and legally separated adolescents were more likely to commit suicide. Men are more likely to commit suicide by firing a firearm or explosives and by hanging themselves, while women are more likely to use smoke, fire and flames, and self-intoxication to commit the act.

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Colaborations

Silva IG and Silva TL contributed to the conception and design of the study, analysis and interpretation of the data and writing of the article. Sousa GJB contributed to the analysis and interpretation of the data and relevant critical review of the intellectual content. Lira Neto JCG and Pereira MLD contributed to the relevant critical review of the intellectual content. Maranhão TA contributed to the conception and design of the study, analysis, data interpretation, article writing and relevant critical review of the intellectual content. All authors contributed to the final approval of the version to be published.

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