Suicide in Espirito Santo and its Mountain Region, 1996-2020: temporal analysis

Suicídio no Espírito Santo e em sua Região Serrana, 1996-2020: análise temporal

Suicidio en Espírito Santo y su Región Serrana, 1996-2020: análisis temporal

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Abstract

Objective: To analyze the trend of suicide mortality in the state of Espirito Santo and its Mountain Region from 1996 to 2020.

Methods: Descriptive and analytical time series study with consolidated data on deaths by suicide in the population over 15 years old obtained from the Mortality Information System. The units of analysis were the state of Espirito Santo and its Mountain Region. The trend analysis was verified by Prais-Winsten regression and by calculating the annual percentage change.

Results: A total of 3922 deaths by suicide were reported in Espirito Santo and of these, 525 in the mountain Region. The trend of suicide mortality in the state was increasing in the general population over 15 years old (APC= 5.1; 95%CI= 0.28-9.92; p=0.039). The mortality rate continued to grow among the female population, both in relation to the state (APC= 6.5; 95%CI= 1.55-14.46; p=0.012) and in the mountain region (APC= 15.2; 95%CI= 1.21-29.20; p=0.035). Mortality increased in the age group from 30 to 59 years old in the state (APC= 3.4; 95%CI= 0.62-6.10; p=0.018) and in the Mountain Region (APC= 2.9; 95%CI= 2.02-3.86; p<0.001).

Conclusion: The suicide trend was growing in the general population of the state of Espirito Santo and its Mountain Region among young and female adults. The relevance of self-inflicted violence verified in the rates analyzed in this study points to the need to use preventive strategies, especially among women.

Resumo

Objetivo: Analisar a tendência da mortalidade por suicídio no estado do Espírito Santo e em sua Região Serrana no período de 1996 a 2020.

Métodos: Estudo descritivo e analítico de série temporal com dados consolidados dos óbitos por suicídio na população acima de 15 anos de idade obtidos no Sistema de Informações sobre Mortalidade. As unidades de análise foram o estado do Espírito Santo e sua Região Serrana. A análise da tendência foi verificada pela regressão de Prais-Winsten e pelo cálculo da variação percentual anual.

Resultados: Foram notificados 3.922 óbitos por suicídio no Espírito Santo e, destes, 525 na Região Serrana. A tendência da mortalidade por suicídio no estado foi crescente na população geral acima de 15 anos (APC= 5,1; IC95%= 0,28-9,92; p=0,039). A tendência da mortalidade se manteve crescente entre a população feminina, tanto em relação ao estado (APC= 6;5; IC95%= 1,55-14,46; p=0,012) como na região serrana (APC= 15,2; IC95%= 1,21-29,20; p=0,035). A mortalidade foi crescente na faixa etária de 30 a 59 anos no estado (APC= 3,4; IC95%= 0,62-6,10; p=0,018) e na Região Serrana (APC= 2,9; IC95%= 2,02-3,86; p <0,001).

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Conflicts of interest: none to declare.

Conclusão: A tendência foi crescente na população geral do estado do Espírito Santo e em sua Região Serrana entre adultos jovens e do sexo feminino. A relevância da violência autoprovocada verificada nas taxas analisadas neste estudo aponta para a necessidade do emprego de estratégias preventivas, especialmente entre as mulheres.

Resumen

Objetivo: Analizar la tendencia de la mortalidad por suicidio en el estado de Espírito Santo y en su Región Serrana en el período de 1996 a 2020.

Métodos: Estudio descriptivo y analítico de serie temporal con datos consolidados de las muertes por suicidio en la población mayor de 15 años obtenidos del Sistema de Información sobre Mortalidad. Las unidades de análisis fueron el estado de Espírito Santo y su Región Serrana. El análisis de la tendencia se verificó por regresión de Prais-Winsten y por cálculo de la variación porcentual anual.

Resultados: Se notificaron 3.922 muertes por suicidio en Espírito Santo, de las cuales 525 fueron en la Región Serrana. La tendencia de la mortalidad por suicidio en el estado fue creciente en la población general mayor de 15 años (APC= 5,1; IC95 %= 0,28-9,92; p=0,039). La tendencia de la mortalidad se mantuvo creciente en la población femenina, tanto con relación al estado (APC= 6;5; IC95 %= 1,55-14,46; p=0,012) como en la Región Serrana (APC= 15,2; IC95 %= 1,21-29,20; p=0,035). La mortalidad fue creciente en el grupo de edad de 30 a 59 años en el estado (APC= 3,4; IC95 %= 0,62-6,10; p=0,018) y en la Región Serrana (APC= 2,9; IC95 %= 2,02-3,86; p <0,001).

Conclusión: La tendencia fue creciente en la población general del estado de Espírito Santo y en su Región Serrana en adultos jóvenes y de sexo femenino. La relevancia de la violencia autoprovocada verificada en los índices analizados en este estudio indica la necesidad de emplear estrategias preventivas, específicamente en mujeres.

Introduction

Considered as a serious public health problem in Brazil and worldwide, suicide is death resulting from an intentional act of killing oneself.[1] The causal complexity of the suicidal phenomenon is multifactorial, as it involves conditions of a broad psychological and socioeconomic spectrum. In 2019, suicide mortality worldwide had 700000 victims, surpassing deaths caused by malaria, HIV/AIDS, breast cancer or violent deaths from wars and homicides.[1]

Following the global trend, Brazil showed an increasing trend in suicide mortality among young adults between 1997-2019. Of the Brazilian regions, the South had the highest average mortality rate (9.18/100000 inhabitants).[2] Studies indicate that the Brazilian geographic regions with the greatest growth trends are the North, Northeast and Southeast; the South Region has a decreasing trend, but remains with high rates; in the Midwest, mortality rates are stable.[2-6]

In Espirito Santo State, a study conducted between 1980 and 2006 showed that the mortality rate ranged from 3.5 (1980) to 7.3 (2006) per 100000 inhabitants.[7] During this period, 2604 deaths from suicide, of which 77.7% of individuals were men. Another research carried out in the same state analyzed the period from 2012 to 2016 and found the occurrence of 888 cases of suicide, whose corresponding rates per 100000 inhabitants were: 4.75 (2012), 4.92 (2013), 5.09 (2014), 5.72 (2015) and 6.20 (2016).[8] Although the numbers are rising, this meant a slowdown in suicide mortality.

Despite the growing interest of researchers in the subject, there are few studies on the Mountain Region of Espirito Santo, but we highlight the work of Macente, Santos, Zandonade,[9] that explored suicide attempts and mortality among the population of Santa Maria de Jetiba, belonging to the Region. In the period analyzed by these authors (2001 to 2007), 80 suicide attempts and 28 cases of suicide were found, which corresponds to an average mortality of 12.9/100000 inhabitants and an average of 11.4 suicide attempts/year. With regard to the mortality coefficient, oscillations ranging from the highest rate in 2002, with 23.38/100000, to the lowest rate, in 2005, with 3.10/100000 inhabitants, were verified.

According to data from the Jones Neves Institute (IJN), an agency linked to the State Secretariat for Economy and Planning (SEP) of Espirito Santo, whose purpose is to produce knowledge and support public policies through the elaboration and implementation of studies, research and organization of bases of statistical and georeferenced data at the state, regional and municipal levels, aimed at socioeconomic development. The cities that make up the Mountain Region accumulate socioeconomic and demographic factors associated with the increase in suicide mortality already indicated by studies. Among these factors are: rural areas with a

predominance of Protestant European immigrants, slowed or decreasing population growth, low health and social care coverage, higher proportion of rural population, growing older adult population and low economic activity.[10,11]

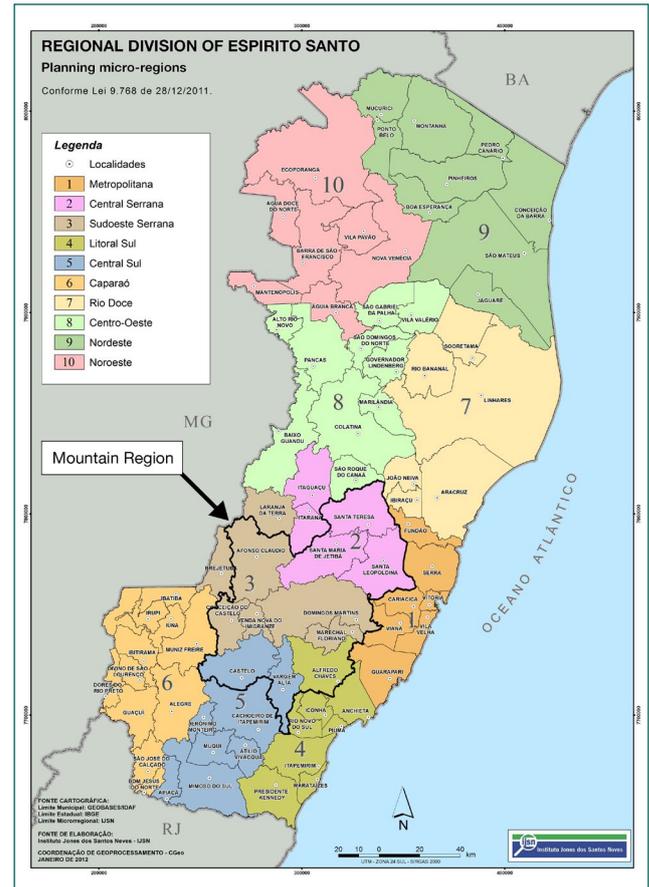The specialized literature points out that suicide mortality varies according to space, time, gender, age, culture and ethnicity.[12] Some factors associated with this type of death are the existence of mental disorders in the population, the history of suicide attempts, loss or separation of parents or spouses, intoxication/chemical dependence on psychoactive substances, unemployment and other stressful events in life.[2]

Therefore, by sharing demographic and socioeconomic characteristics associated with increasing suicide rates highlighted in the specialized literature, the trend in suicide mortality in the State of Espirito Santo and specially the Mountain Region becomes a relevant object of research. Temporal trend studies have epidemiological significance for understanding the phenomenon in order to provide essential subsidies for the reorganization practices of the Health Care Networks.[2,3] So, this study aims to analyze the trend in suicide mortality in the state of Espirito Santo and in its Mountain Region from 1996 to 2020.

Source: Government of the state of Espirito Santo. Secretary of Science, Technology, Innovation, Professional Education and Economic Development. Microregions. Vitória: Geoprocessing Coordination; 2012 [cited 2022 Dec 12]. Available at: https://inovacaoedesenvolvimento.es.gov.br/microrregioes.[10]

Figura 1. Regional division of the state of Espirito Santo

Methods

The units of analysis for this descriptive and analytical time series study on suicide mortality (1996 to 2020) were the state of Espirito Santo and its Mountain Region. With a geographic area of approximately 46000 km², Espirito Santo is organized into 78 cities, with an estimated population of 4108508 inhabitants, divided into ten micro-regions (Figure 1).[10]

The Mountain Region, highlighted in figure 1, is a geographic region with an area of 6878.19 km².[11] It is composed of 11 cities belonging to four geographic micro-regions, according to the specificities of the organization of the local geographic space: Central Serrana (Santa Teresa, Santa Maria de Jetibá and Santa Leopoldina); Southwest Serrana

(Afonso Cláudio, Conceição do Castelo, Domingos Martins, Marechal Floriano and Venda Nova do Imigrante); South Central (Castelo and Vargem Alta) and South Coast (Alfredo Chaves).[13,14]

Data collection for this study was performed in the Mortality Information System (MIS) of the Ministry of Health (MH). Consolidated numbers were collected from the Department of Informatics of the Unified Health System (Datasus). The population over 15 years old was considered as study participants. The 10th revision of the International Classification of Diseases (ICD-10) was used as database for recording deaths due to suicide (X-60 to X84).[15] Cases with missing information were not included in the data description.

Demographic data were obtained from census numbers and population estimates recorded by

the Brazilian Institute of Geography and Statistics (IBGE).[16] The study period was determined by corresponding to the years available on Datasus. Data were collected on February 2, 2022.

Deaths by suicide were analyzed according to the variables: city, general population over 15 years old; age GROUP (15 to 29 years old, 30 to 59 years old and 60 years old or older) and gender (male/female).

Mortality rates were calculated by the ratio of the number of deaths that occurred in the year, considering the population at risk for the same period per 100000 inhabitants. First, the crude mortality rate was calculated, then, standardization by the direct method by age was used to compare rates over the historical series. For this, a standard reference population was delimited for the other years of the time series. The most recent IBGE demographic census, which took place in 2010, was considered the standard population.[16]

The trend was analyzed using the Prais-Winsten linear regression model. Suicide mortality rates were used as dependent variables (Y), while sequential years were used as independent variables (X). This model is adopted to correct serial autocorrelation over time. First, the Y values underwent logarithmic transformation, then the Prais-Winsten autoregressive model was applied, so that the ß1 values could be estimated. The originally proposed described model was equation 1.[17]

$$\hat{Y}_t = ß_{0\,+}\,ß_{1t} \quad \text{Equation 1}$$

In this equation, $ß_0$ is the model constant; t, the time; ß, the linear coefficient; and $\hat{Y}t$ is the estimated value of the variable at t.[17]

Subsequently, the Annual Percent Change (APC) was calculated using equation 2:

$$APC = [-1+10^{\,ß1}]*100\% \quad \text{Equation 2}$$

Finally, the respective 95% confidence intervals (95%CI) were calculated for the ß1 and APC study measurements, by applying equations 3 and 4.

$$95\%CI \text{ minimum} = ß_{1minimum}*100\% \quad \text{Equation 3}$$
$$95\%CI \text{ maximum} = ß1_{maximum}*100\% \quad \text{Equation 4}$$

The trend was classified as increasing when p < 0.05 and positive linear coefficient, decreasing when p < 0.05 and negative linear coefficient, and stationary when the linear coefficient did not differ from zero (p > 0.05).[18] For the analysis, we used the STATA statistical software, version 16.0.

Because it is a study with secondary data without identification of the participants, there was no need to submit this research to the Research Ethics Committee. Resolution 466/2012 of the National Health Council was respected. The authors declare that there are no conflicts of interest (Certificate of Presentation of Ethical Appreciation: 32646820.2.0000.5060).

Results

In the analyzed period, a total of 3922 deaths by suicide were recorded in Espirito Santo. Of these, 525 occurred in the Mountain Region, representing 13.4% of all deaths notified by MIS. Table 1 shows the distribution of deaths in the general population aged over 15 years old according to gender and age group. Most were male in the age group from 30 to 59 years old in both analyzed units. The percentage of mortality by suicide in the male population was 76.1% of the deaths in Espirito Santo. In the Mountain Region, the number rises to 82.3%. Most deaths were in the 30-59 age group, with 60% of cases registered in the MIS, in both analyzed units.

Table 1. Description of deaths by suicide according to population over 15 years old, sex and age group in Espirito Santo and the Mountain Region

Population	Espirito Santo n(%)	Mountain Region/ES n(%)
General over 15 years old	3922(100)	525(100)
Gender		
Male	2985(76.1)	432(82.3)
Female	937(23.9)	93(17.7)
Total	3922(100.00)	525(100.00)
Age group		
15 to 29 years old	1025(26.1)	131(25.0)
30 to 59 years old	2354(60.0)	316(60.0)
60 years old or over	543(13.9)	78(15.0)
Total	3922(100.00)	525(100.00)

Source: MIS/MS, DATASUS, cited on February 02nd, 2022. Available at https://datasus.saude.gov.br/transferencia-de-arquivos/#

The evolution of mortality rates and the analysis of the suicide trend from 1996 to 2020 in the state of Espírito Santo and in its Mountain Region are shown in figures 2 and 3, respectively.

Throughout the historical series, the state of Espirito Santo presented suicide mortality rates among the population over 15 years old, which ranged from 5.8/100 000 to 6.6/100 000, with an increasing trend (APC= 5.1; 95%CI 0.28-9.92) (Figure 2)

(Table 2). On the other hand, the Mountain Region presented a variation in mortality from 10.4/100 000 to 8.7/100 000 (Figure 3). Among the male population, Espirito Santo and the Mountain Region had a steady trend in suicide mortality with APC= 3.5 and 95%CI= -5.69-12.71 and APC= 11.6 and 95%CI= - 27.87 to 51.01, respectively.

However, there was a growing trend of suicide in both units analyzed among the female popula-
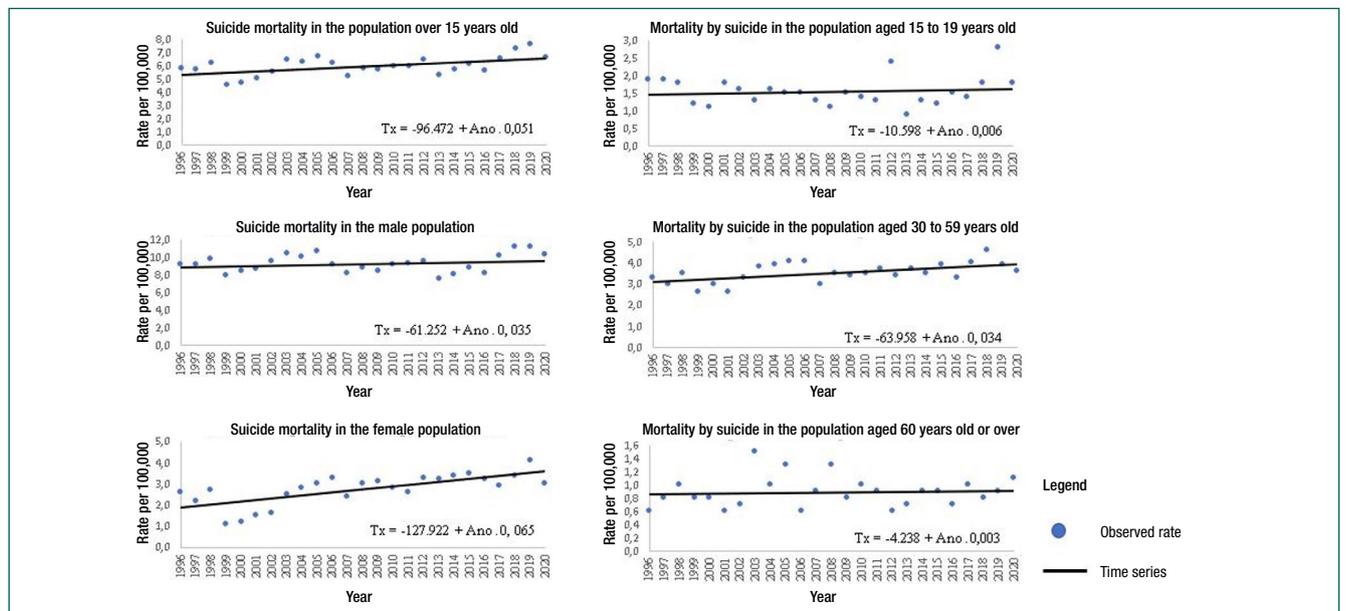
Source: MIS/MS, DATASUS, cited in February 02nd, 2022. Available at https://datasus.saude.gov.br/transferencia-de-arquivos/#.
Figure 2. Description of deaths by suicide according to population over 15 years old, gender and age group
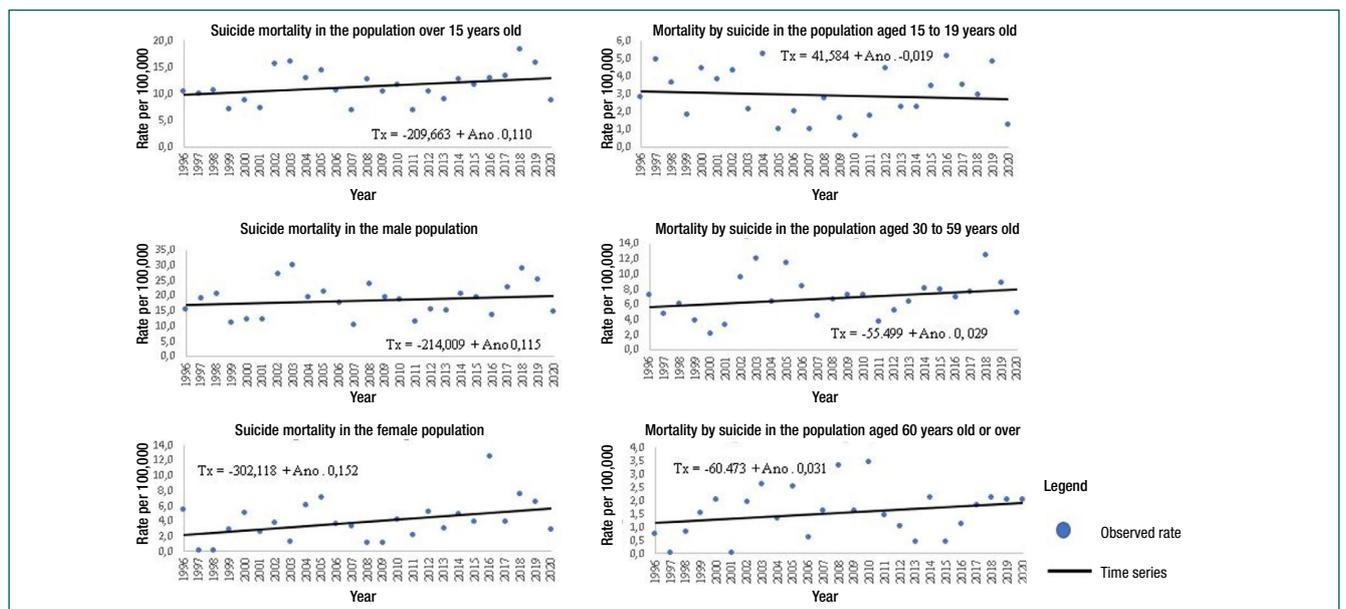
Source: MIS/MS, DATASUS, cited in February 02nd, 2022. Available at https://datasus.saude.gov.br/transferencia-de-arquivos/#
Figure 3. Description of deaths by suicide according to the population over 15 years old, gender and age group

Table 2. Analysis of suicide mortality trends (100000 inhabitants) by general population, gender and age group

Unit of analysis	Estimates	General population	Gender		Age group		
			Male	Female	15-29 Years old	30-59 Years old	≥60 years old
Espirito Santo	APC	5.1	3.5	6.5	0.6	3.4	0.3
	(95%CI)	(0.28-9.92)	(-5.69-12.71)	(1.55-14.46)	(-2.08-3.29)	(0.62-6.10)	(−0.81-1.32)
	p-value	0.039	0.438	0.012	0.646	0.018	0.625
	Trend	Growing	Stationary	Growing	Stationary	Growing	Stationary
Mountain Region	APC	11	11.6	15.2	-1.9	2.9	3.1
	(95%CI)	(-10.70-32.71)	(-27.87-51.01)	(1.21-29.20)	(-10.41-6.56)	(2.02-3.86)	(-0.94-7.11)
	p-value	0.305	0.55	0.035	0.643	< 0.001	0.127
	Trend	Stationary	Stationary	Growing	Stationary	Growing	Stationary

APC - Annual Percentage Change; 95%CI - 95%Confidence Interval

tion. In this cutout, the state presented mortality rates that varied from 2.6/100 thousand, in 1996, to 3.0/100 thousand in 2020 (APC= 6.5; 95%CI= 1.55-14, 46). In the Mountain Region, higher and increasing mortality rates were observed (APC= 15.2; 95%CI= 1.21-29.2) (Table 2).

Regarding suicide stratified by age groups, we observed the stationary coefficients. Only the age group from 30 to 59 years old showed an increasing trend, in Espirito Santo, from 3.3/100 thousand to 3.6/100 thousand (APC= 3.4; 95%CI= 0.62-6.10) (Figure 2) (Table 2). In the Mountain Region, during the study period, the mortality rate ranged from 7.13/100 000 to 4.83/100 000 (APC= 2.9; 95%CI= 2.02-3.86) (Figure 3) (Table 2).

Discussion

The time series of the suicide mortality rate in Espirito Santo and its Mountain Region from 1996 to 2020 was increasing among the general population aged over 15 years old in the female population and in the age group from 30 to 59 years old. Among these, the growth of rates in the female population in the Mountain Region was faster.

According to the classification system of the World Health Organization (WHO), mortality by suicide is judged: low when it represents less than 5 cases/100000 inhabitants; middle, between 5 and 14/100 thousand inhabitants; high, between 15 and 29/100 thousand inhabitants; and very high when it reaches 30/100 000 inhabitants.[1] According to this criteria, the suicide rate in Espirito Santo is indicated as middle and with an increasing trend for the general population over 15 years old. The values found for the Mountain Region are considered middle to high for the general population, and for the male population, the levels are at high levels, given the evidence of values above 15 cases/100000 inhabitants.

According to the 2019 WHO report, suicide remains one of the leading causes of death worldwide. The global average, in 2019, was 9.0/100 thousand inhabitants for the general population, 5.4/100 thousand inhabitants for the female population and 12.6/100 thousand inhabitants for the male population.[1] This indicates that the Mountain Region had higher rates than the world's.

In this study, the analysis showed an upward trend towards suicide in the general population of the state of Espirito Santo. This result is similar to studies that analyzed this type of death in Brazil, which also showed an increase in suicide mortality rates in its general population.[2-6,18]

Epidemiological studies indicate that suicide mortality is more common among the male population. This fact has been maintained over time in all countries, according to data made available by the WHO, although in southern India, Cambodia, Vietnam, China and some islands in the Pacific Ocean, such as the Philippine archipelago, the disparity is smaller.[5,11,18-20] The worldwide trend towards greater occurrence in the male population was also observed in Espirito Santo and its Mountain Region.

However, although men are more likely to commit suicide, this study found a growing and accelerated trend among the female population. Macente and Zandonadi had pointed out, in research on

the period from 1980 to 2006, a stationary trend in women from Espirito Santo.[7] However, another research showed an increase in suicide rates among women from 2007 to 2016 and a decrease among men.[21] These observations, added to data from this research, indicate that suicide mortality among women is increasing and recent in the state of Espirito Santo.

The consistent pattern of suicide among males is historically related to greater access by men to the most lethal means, such as firearms. On the other hand, women are less exposed to feelings of failure in financial life, competitiveness and impulsiveness, considered risk factors. The lower occurrence of suicide among women is also attributed to religiosity, the low prevalence of alcoholism and also early psychosocial care in the face of risk signs for depression and mental illness. In addition, they participate more in support networks and seek help more often in times of crisis.[1,6]

The analysis of the evolution of rates according to age group showed an increase in the trend of suicide mortality in the age group of young adults (30 to 59 years old) and females in both analyzed units. The young adult population may be more susceptible to unemployment and the capitalist model adopted in rural areas, such as debt. The advance of the capitalist production process in the countryside led to the leasing and loss of small rural properties, the consequences of which involved indebtedness, concentration of land ownership, rural exodus and the dissolution of culture and moral values. A study carried out in the state of Rio Grande do Sul, in 2006, showed a correlation between female rural work and increased suicide rates.[11]

The Mountain Region is representative of the Pomeranian culture in Espirito Santo.[22] Self-inflicted violence among Pomeranians can be attributed to a hostile, closed and distrustful attitude towards others, factors that predispose individuals to depression, often exacerbated by alcohol use. This scenario may be due to few leisure options and a life focused on rural work.[23] There are several work-related situations that can increase the incidence of self-violence. Economic instability is one of them, as it leads to an increase in layoffs, unemployment, precarious work and bankruptcy.[24] Therefore, the combination of cultural and contextual factors may be involved with the high suicide rates identified among Pomeranian descendants.[23] Research carried out in populations of rural Pomeranian and German origin and at high altitudes have historically shown high suicide mortality rates, corroborating the results found in this study on the Mountain Region.[23,24] Furthermore, the association observed between suicide and altitude is consistent with previous research.[25,26] The process can develop hypoxia, which increases the risk of depressive symptoms and suicide.[26]

The series of analyzed data from the Mountain Region inaugurates studies on suicide in this region. Marín-León, Oliveira and Botega[27] highlight the contribution of small regions to the increase in suicide mortality rates in Brazil, which is why future research involving regional socioeconomic variables is necessary.

As limitations of this study, we point out the use of secondary data from the MIS as core data for analysis. Deaths by suicide may be underestimated, considering the possibility of inadequate completion of death certificates, so that the indicators may be even higher than those described. Suspected cases may have been recorded as deaths from external causes such as poisoning or accidents. Another limitation concerns MIS updates. Studies with the same time frame may show different mortality rates. Although the results shown in this research present limitations of the study, they denote the behavior of suicide rates in the state of Espirito Santo and in its Mountain Region, contributing to a better understanding of the phenomenon in the scenarios analyzed.

Conclusion

The suicidal trend is increasing in the general population of the state of Espirito Santo, especially among young and female adults. The relevance of self-inflicted violence that was found in the rates analyzed in this study points to the need to use preventive strategies, especially among women.

Considering its multi-causality, suicide prevention demands an intersectoral articulation that aligns public policies in priority areas in order to develop and offer mental health care to the specific public, as well as to train and qualify health professionals for the early identification of mental disorders and preventive action on suicidal behavior, with a view to building a mental health promotion process.

Collaborations

Caliman MOS contributed to the conception and design of the project, analysis and interpretation of data and writing of the article. Silva MA collaborated in the study design and analysis and interpretation of results and Andrade LS contributed with the project conception and design, analysis and interpretation of data and writing of the article. Enriquez IR collaborated with data analysis and interpretation. Bahia CA contributed with the critical review of important intellectual content; Saints MVF. Siqueira MM contributed to the design, critical review of important intellectual content and final approval of the version to be published.

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