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Mortality and years of life lost to suicide in Rio Grande do Norte, Brazil, 2000-2015

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ABSTRACT. Analyze the epidemiological profile of and years of life lost to suicide in Rio Grande do Norte, Brazil, from 2000 to 2015. This is an ecological study in which data on death were sourced from the Mortality Information System. Years of Potential Life Lost were calculated over the historical series. A total of 2,266 deaths by suicide were analyzed, identified during the period, with the most frequent cases being those occurring at home, by hanging, among men, black people, single people and the elderly. More Years of Potential Life Lost were counted in the economically active age group (30-39 years old). Thus, recognizing the epidemiological characteristics of suicide in Rio Grande do Norte may guide more effective actions and strategies targeting risk populations and reinforces the need for further studies focusing on regions with the highest rates in the state. Moreover, mental health care must be adapted to age and gender, besides approaching social support needs and feeling of belonging.

Keywords: suicide; epidemiology; years of potential life lost; mental health.

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Introduction

Configured as a deliberate, multifactor act executed by the individual himself or herself who wishes to end his or her life, consciously and intentionally, suicide is one of the most common types of violent deaths in the world (Associação Brasileira de Psiquiatria [ABP], 2014).

It is estimated that 800,000 people take their own lives every year in the world, with one death every 40 seconds. For 2020, the statistics indicate an increase of 50% in the annual incidence of death by suicide worldwide (ABP, 2014; World Health Organization [WHO], 2014). In Brazil, between 2006 and 2016, 79% of deaths were reported among male individuals. Analyzing age groups, the economically active population, mainly those aged between 20 and 29 years old (23%), presented higher rates, with a direct impact on indicators that address premature death, such as Years of Potential Life Lost (YPLL) (Departamento de Informática do SUS, 2016; Romeder & Mcwhinnie, 1988).

Thus, the scenario of mortality by this cause in the country is worrisome, especially in regions where there is an increase in death rates, which cannot be explained solely by higher number of death reports. In the Northeast, these cases grew 44.9% between 2000 and 2014 (Conte et al., 2012; Sistema de Informação sobre Mortalidade, 2014). However, similarities and differences between distinct regions call for the need to develop public policies capable of suiting the peculiarities of each region.

In the state of Rio Grande do Norte (RN), mortality by intentional self-inflicted injuries grew more than 100% between 2000 and 2016 (Sistema de Informação sobre Mortalidade, 2018). Moreover, a study conducted by Botega (2010) showed that the municipality of Caicó, located in RN, was third among 20 Brazilian cities with at least 50,000 inhabitants, with higher suicide rates between 2005 and 2007 (15.8/100,000 inhabitants).

In this sense, the development of health policies requires specific knowledge about suicide epidemiology, especially in RN. Thus, researchers assessing the population's health status may provide a support to management by means of information necessary for the planning of strategies aimed at reducing the aggravation.

It is worth highlighting the gap in the literature concerning studies about mortality by suicide in Rio Grande do Norte. Lack of understanding about how the phenomenon presents itself leads to less efficient

health actions, since there is no planning for strategic actions that consider vulnerable groups and regions, potentialities and specific risk factors. In light of the foregoing, the present study aimed to analyze the epidemiological profile of and years of life lost to suicide in RN.

Methodology

This is an ecological, descriptive, time series study based on secondary data on deaths by suicide recorded in the Mortality Information System (*Sistema de Informação sobre Mortalidade*) (SIM) of RN.

The dependent variable was the Standardized Mortality Ratio (SMR) for suicide. Its calculation used the average number of deaths by intentionally self-inflicted injuries categorized from the International Statistical Classification of Diseases and Related Health Problems – 10th Review (X60-84), occurred from January 1st, 2010, to December 31st, 2015. Population data, by municipality and by, were sourced from the 2010 Census and from inter-census projections, at the website of the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE). Gross rates were standardized by direct method, considering the Brazilian standard population, and expressed per 100,000 inhabitants per year.

The independent variables were analyzed at two levels: contextual and individual. The contextual level represents socioeconomic indicators and refers to the 2000 and 2010 censuses, with information collected from the Atlas of Human Development in Brazil of the United Nations Development Programme (UNDP): GINI index, which measures the level of income concentration within a group; Human Development Index – Municipal (HDI-M), Aging Rate, Illiteracy rate among those aged 25 years old or over, Percentage of Individuals Vulnerable to Poverty, Unemployment rates among those aged 18 years old or over, and Rural population. Individual information, in its turn, was sourced from the SIM: Sex, Age group, Color, Place where death happened, CID-10 category, and Marital status.

Initially, deaths by suicide were analyzed according to four-year periods of the historical series and characterized descriptively by calculating Proportional Mortality for these variables: CID-10 category, Place where death happened, and Marital status. For the other individual independent variables, mean Mortality Rate for the four-year period was calculated, which was the total number of deaths in the total population in the central year of the quadrennium, multiplied by 100,000 and divided by four.

Besides, the study variables were checked for normal distribution through the Kolmogorov-Smirnov normality test, considering the sample size. Once data normality was detected, the correlation between the dependent variable and the contextual variables was verified. Those that presented normal distribution ($p > 0.05$) were analyzed using Pearson's Correlation Coefficient, while those with a $p < 0.05$ were analyzed by Spearman's Correlation Coefficient.

YPLL coefficients were calculated by dividing the total number of YPLL within the age limits used, expressing the estimate for the risk of losing potential years of life. Thus, seeking to compare different places and different years, coefficients standardized by age were used, as they reduce the influence of different age structures, whose technique was proposed by Romeder and McWhinnie (1988).

YPLL rates were calculated by dividing YPLL in each age group by the corresponding population, multiplied by 100,000 inhabitants. Mean YPLL was calculated from total number of deaths (YPLL/death), according to age group.

Results

In Rio Grande do Norte, there were 2,266 deaths by suicide between 2000 and 2015, with most of them reported among males (81.1%), whose mortality rate varied significantly (Santos, Barbosa & Severo, 2018). The sex ratio calculation showed a greater proportion of males compared to females throughout the historical series, with a more pronounced difference between sexes in 2004 (Table 1).

Among females, the highest SMR mean was found in the first quadrennium of the historical series. Analysis by color showed higher rates for black women and for the 50-59 age group, in the first and last quadrennia, respectively. For men, the highest SMR was found in the last quadrennium. Additionally, concerning age group, the population aged above 60 presented the highest mean, observed in 2004-2007; black men also presented higher means in that quadrennium. However, there is a significant reduction in SMR among black men in the last quadrennium (Table 2).

Table 1. Standardized Mortality Rate of Suicide in RN and Sex Ratio (2000-2015). (*pop/100,000 inhabitants).

Sex/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Male	4.80	6.35	6.06	8.22	7.64	9.73	8.42	7.29	7.97	8.14	6.72	9.24	8.39	7.92	8.63	7.79
Female	1.35	2.23	1.62	2.42	0.62	1.40	1.69	1.61	1.80	1.40	2.12	2.09	2.45	1.67	1.70	1.64
Sex ratio	3.55	2.85	3.75	3.4	12.3	6.93	4.98	4.52	4.44	5.83	3.18	4.41	3.43	4.74	5.07	4.74
	3:1	3:1	4:1	3:1	12:1	7:1	5:1	4:1	4:1	6:1	3:1	4:1	3:1	5:1	5:1	5:1

Source: Sistema de Informação sobre Mortalidade (2018).

Table 2. Mean Mortality Rate by Suicide in RN (2000-2015), according to sex, age group and color. (*pop/100,000 inhabitants).

Variables	(2000-2003)		(2004-2007)		(2008-2011)		(2012-2015)	
	Male	Female	Male	Female	Male	Female	Male	Female
Mean Mortality Rate								
	6.02	1.84	7.76	1.30	7.58	1.79	7.93	1.79
Age group (years								
(10-14)	0.8	0.2	0.7	0.2	0.5	0.0	0.6	0.3
(15-19)	2.7	2.4	4.4	1.9	4.1	1.5	4.2	0.7
(20-29)	8.1	2.0	9.7	1.5	8.5	2.1	7.6	1.9
(30-29)	11.2	2.6	11.6	1.7	10.5	2.2	10.6	2.6
(40-49)	9.6	2.8	13.2	1.5	11.6	2.3	13.0	1.6
(50-59)	11.3	3.7	12.3	1.9	14.8	3.7	14.2	4.2
(60 and older)	11.1	3.7	23.3	2.8	16.7	3.4	17.5	3.1
Color								
White	4.3	1.93	5.39	1.28	6.16	1.4	5.7	1.56
Black	10.14	3.5	16.37	0.85	11.96	2.23	3.46	0.87
Brown	6.25	1.54	7.75	1.09	7.43	1.77	9.1	0.13

Source: Sistema de Informação sobre Mortalidade (2018).

Regarding place of occurrence, most deaths happened at home, with higher percentages between 2004 and 2007 among women (Table 3). The most common method for suicide, according to CID-10 category, was hanging for both sexes, with highlight to the years of 2004-2007, when 75.3% of deaths among women were caused by it; besides, an increase was found in the number of deaths by intoxication in this group throughout the historical series.

Table 3. Percentage of deaths by suicide in RN (2000-2015), according to sex, place of occurrence, CID-10 category, and marital status.

Variables	(2000-2003)		(2004-2007)		(2008-2011)		(2012-2015)	
	Male	Female	Male	Female	Male	Female	Male	Female
Place of occurrence								
Hospital	10.1	33.3	8.2	14.8	10.5	26.3	10.8	25.2
Another medical facility	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Home	63.6	56.5	61.7	75.3	62.2	62.7	65.7	63.4
Public road	5.5	2.8	8.0	4.9	7.6	5.1	8.3	4.9
Other	20.5	7.4	18.8	37	17.5	4.2	14.7	4.9
Ignored	0.3	0.0	3.2	1.2	2.3	1.7	0.6	0.8
CID-10 category								
Self-intoxication	7.8	14.8	7.6	16.0	6.8	16.1	6.6	22.8
Hanging	71.1	52.8	69.8	75.3	76.0	66.1	75.0	61.8
Gun	15.0	9.3	17.3	2.5	9.4	1.7	8.9	0.0
Smoke/Fire/Flames	1.7	12.0	1.1	1.2	2.3	10.2	0.8	5.7
Sharp object/blunt instrument	1.4	2.8	1.3	1.2	1.8	0.0	2.6	2.4
Fall from high places	0.9	2.8	0.6	2.5	1.4	4.2	2.6	4.1
Other	2.0	5.6	2.3	1.2	2.3	1.7	3.4	3.3
Marital status								
Single	50.3	46.3	53.1	44.4	53.6	42.4	48.7	45.5
Married	38.2	39.8	37.2	34.6	32.6	30.5	28.5	30.9
Widowed	4.6	9.3	3.2	12.3	2.7	5.9	2.5	10.6
Legally separated	1.4	2.8	2.1	1.2	2.5	9.3	3.2	3.3
Other	0.6	0.9	0.2	2.5	0.4	0.8	6.0	1.6
Ignored	4.9	0.0	4.2	4.9	8.2	11.0	11.1	8.1

Source: Sistema de Informação sobre Mortalidade (2018).

With respect to marital status, there was a higher percentage of deaths among single women, mainly in the first quadrennium. On the other hand, among men, there was a higher percentage of deaths at home, with highlight to the last quadrennium; most deaths from 2008 to 2011 occurred by hanging, with

reductions in mortality by intoxication being observed over the years. Furthermore, as for marital status, most men who committed suicide were single.

Spearman's linear correlation assessed the strength of association between suicide SMR and socioeconomical indicators, revealing a negative and weak linear correlation for most coefficients (*r*) (Table 4). However, a change can be observed in the correlation pattern for suicide and aging rates: in the last quadrennium, the correlation becomes direct and positive, and it can be inferred that suicide correlates with higher aging rates.

A total of 63,582.5 years of potential life were lost throughout the historical series (Table 5). The YPLL rate stood at 7,038.07 years lost for every 100,000 inhabitants. The proportion of years lost to suicide was on average 720 years per death reported from 2000 to 2015. The 30-39 age group showed higher proportion of PYLL due to suicide, and the highest numbers of potential years of life lost were found in the last quadrennium.

Table 4. Correlation coefficient between suicide and socioeconomic indicators in RN (2000-2003 and 2012-2015).

	Quadrennium I (2000-2003)		Quadrennium IV (2012-2015)	
Variables	*R*	p-value	*R*	p-value
GINI index	-0.083	0.29	-0.018	0.81
Unemployment rate – 18 years old or over	0.007	0.93	-0.101	0.19
Rural population	0.064	0.41	-0.063	0.41
Individuals vulnerable to poverty	-0.154*	0.04	-0.054	0.48
Aging rate**	-0.026	0.73	0.160*	0.03
Illiteracy rate - 25 years old or over**	-0.197*	0.01	-0.079	0.31
HDI-M	0.219*	0.00	0.103	0.18

Source: Sistema de Informação sobre Mortalidade (2018).

Table 5. Years of Potential Life Lost, Suicide Means and Rates, according to age group, in RN (2000-2015).

Age group	Quadrennia												Total		
	2000-2003			2004-2007			2008-2011			2012-2015					
	YPLL	Mean	Rate	YPLL	Mean	Rate	YPLL	Mean	Rate	YPLL	Mean	Rate	YPLL	Mean	Rate
1-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-14	345	57.5	27.65	287.5	57.5	24.09	172.5	57.5	14.58	345	57.5	28.50	1150	230	94.81
15-19	1680	52.5	133.25	2100	52.5	167.83	1785	52.5	148.71	1522.5	52.5	129.48	7087.5	210	579.28
20-24	2470	47.5	221.83	3230	47.5	261.79	2945	47.5	236.19	2707.5	47.5	225.12	11352.5	190	944.94
25-29	2210	42.5	251.54	2635	42.5	246.70	2890	42.5	239.80	2550	42.5	205.02	10285	170	943.05
30-34	1762.5	37.5	200.60	2137.5	37.5	231.43	2062.5	37.5	200.41	3112.5	37.5	265.40	9075	150	897.84
35-39	2242.5	32.5	273.58	1982.5	32.5	228.56	2177.5	32.5	241.32	1950	32.5	196.69	8352.5	130	940.14
40-44	1155	27.5	174.46	1650	27.5	208.11	1760	27.5	206.62	1540	27.5	174.58	6105	110	763.75
45-49	652.5	22.5	127.53	945	22.5	152.69	1035	22.5	136.90	1507.5	22.5	181.45	4140	90	598.56
50-54	682.5	17.5	153.18	542.5	17.5	112.43	1015	17.5	177.21	1102.5	17.5	155.82	3342.5	70	598.63
55-59	237.5	12.5	66.46	375	12.5	89.18	412.5	12.5	91.35	587.5	12.5	112.00	1612.5	50	358.99
60-64	157.5	7.5	53.64	195	7.5	60.23	240	7.5	61.90	255	7.5	60.67	847.5	30	236.43
65-69	37.5	2.5	17.01	55	2.5	20.82	57.5	2.5	19.94	82.5	2.5	23.83	232.5	10	81.61
Total	13632.5	360	1700.72	16135	360	1803.88	16552.5	360	1774.93	17262.5	360	1758.55	63582.5	720	7038.07

*Significant correlation ($p < 0.05$); **Pearson's Correlation. Source: Sistema de Informação sobre Mortalidade (2018).

In this sense, the study on mortality by suicide in RN showed a higher proportion of deaths among males, with greater representativeness of men in the older age group. This finding is aligned with studies on mortality by suicide in the elderly in different Brazilian regions. Minayo, Pinto, Assis, Cavalcante, and Mangas (2012), assessing suicide trends in the elderly population in Brazil and Rio de Janeiro, from 1980 to 2006, detected an increase in suicide rates among senior individuals, from 595.3 deaths/year in 1980 to 7,994 deaths/year in 2006. An increase trend was also found in the states of Piauí, Ceará and Rio Grande do Norte, and decrease in Amazonas, São Paulo and Roraima for those aged between 60 and 69 years old (Pinto, Silva, Pires & Assis, 2012; Santos & Barbosa, 2017).

It is necessary to pay special attention to the situation of elderly men, since they compose the group that is most vulnerable to the phenomenon (Minayo et al., 2012). There is an imperative need for investigations and action plans aimed at preventing suicidal behavior in older men (WHO, 2014; Lutz & Fiske, 2018; Sachs-Ericsson, Rushing, Stanley, & Shefley, 2017). Among several risk factors associated with suicidal behavior in this population, major ones include mental disorders, physical diseases, multiple losses, hopelessness, emotional suffering, functional impairment and reduced autonomy (Minayo & Cavalcante,

2015; Lapierre et al., 2011). To prevent suicide in this group, there must be interventions related to professional training, public education on mental health, therapeutic bonding and proactive follow-up, besides articulation with the media and other social sectors (Política Nacional de Atenção Integral à Saúde do Homem, 2008; WHO, 2014).

Just as promising are community initiatives that promote the integration of senior citizens, feeling of belonging, mutual support, adaptation to retirement, performance of new roles, openness to new experiences, which aspects that constitute protection factors against suicidal behavior (Lapierre et al., 2011).

This scenario allows for reflections about currently available national strategies discussing suicide rates among male individuals, since they make up an important risk group. In 2008, the Brazilian Ministry of Health, through the National Policy for Comprehensive Care of Men's Health, promoted a discussion about violence as determinant of indicators of morbimortality by external causes in all dimensions (Política Nacional de Atenção Integral à Saúde do Homem, 2008). Studies suggest that elderly men are less inclined to seek help for emotional suffering, and suicide prevention programs (most of them) are more effective for women. Thus, it is important to adapt care planning to different needs related to each gender (Lapierre et al., 2011).

On the other hand, a higher incidence of psychiatric disorders in the population, such as depression, has been contributing to increasing mortality by suicide, especially among females, since they constitute the population group with the highest rates of mental disorders associated with suicide (World Health Organization [WHO], 2017). In this study, it was possible to observe an increase in mortality rates by suicide among females between the first and the last quadrennia. Although, in the literature, the female sex and self-intoxication are characteristics associated with non-lethal suicide attempts, attempts with these characteristics are frequent, and may be recurrent and raise the risk of lethal attempts (Bernardes, Turini & Matsuo, 2010; Chen et al., 2016; Stenbacka, Samuelsson, Nordstrom & Jokinen, 2018).

It is important to highlight that color represents an important variable in health information systems for the epidemiological study of different groups, within different contexts and aggravations, thus being configured as an essential element for consideration as to risk of premature mortality (Sachs-Ericsson et al., 2017). In the present study, when deaths by suicide in this stratum was analyzed, black men and women were the most affected ones by this type of death. Racism experiences may also have contributed to these results. A North-American study identified that simultaneous racism and sexism experiences lived by dark-skinned African-American women were associated with a higher risk of suicidal ideation or behavior; on the other hand, their ethnical identity protected this population against the harmful effects of gender racism, possibly blocking the internalization of negative stereotypes and reducing suffering related to gender racism (Perry, Stevens-Watkins & Oser, 2014).

Concerning marital status, it has a major influence on the mortality of a population; greater vulnerability to premature death among single people is a reality for most age groups. Thus, in this study, the mortality rate by suicide among singles is higher than that for other marital statuses, corroborating with the findings of a study conducted in Amazonas, where 79.5% of deaths occurred among single individuals (Souza & Orellana, 2013). To Durkheim (1897), when someone does not see himself/herself as part of a family, he/she cannot see the meaning of life for not being able to find a protective or supporting role in this type of setting.

Another important factor to determine the profile of mortality by suicide in a population is the place where the death happened. Currently in Brazil, the highest suicide rates occur at home (Souza & Orellana, 2013). This data aligns with the results of this study. A Brazilian study (Lovisi, Santos, Legayl, Abelha & Valencia, 2009) that investigated deaths by suicide also identified that homes were the most frequent scenarios for these occurrences. This aspect reinforces the importance of developing and assessing prevention strategies for people vulnerable to suicidal behavior that involve crisis management plan, construction of support networks, longitudinal follow-up and better access to specialized care.

It was possible to observe that most deaths were reported as having occurred at home. This information may attest to a greater difficulty of access to medical facilities by the population, especially for the elderly in psychological suffering, as well as the absence of an effective health assistance at household level in order to identify possible risk factors for suicide.

In the exploratory analysis of data on mortality, it is important to consider the proportionality of means used for death. In this sense, when analyzing Proportional Mortality according to the instruments most

commonly used for suicide, it is possible to observe a higher prevalence of deaths by hanging, for both men and women.

There seems to be a consensus in the literature about higher suicide rates occurring by hanging. In one of the studies conducted by Machado and Santos (2015) for Brazil, it was reported that, from 2000 to 2012, 75% of deaths were caused by hanging, corroborating with the results of this study. In the Northeast, this mortality pattern was detected as well (Santos & Barbosa, 2017).

On the other hand, a piece of data that has drawn attention in this study was the sharp reduction of Proportional mortality by use of guns over the years, especially among males. This fact may be a result of the Disarmament Statute through Law No 10826, created in 2003 and regulated in the following year, which covers the registration, possession and trading of guns and ammunition (Lei n. 10.826, 2003). This therefore suggests that a greater availability of guns is associated with higher suicide rates.

Among female individuals, a significant increase was found in mortality by self-intoxication, but this pattern was not reported for men. Self-intoxication commonly happens with the use of medication available at home (Lovisi et al., 2009). Additionally, people with previous self-intoxication episodes are more likely to die by suicide and may raise the degree of lethality of methods used for suicide (Chen et al., 2016; Stenbacka et al., 2018). In this sense, it is important to develop actions that promote a rational and safe use of medication, psychoeducation, access to different therapeutic modalities, and other actions aimed at promoting mental health and preventing suicide.

The effect of economic variables on suicide rates has been widely studied. Most researches agree on the hypothesis that income inequality raises suicide rates (Machado & Santos, 2015; Gonçalves, Gonçalves & Oliveira-Júnior, 2011). However, in this study, socioeconomic indicators isolatedly has not associated with suicide rates. It is important to investigate the complexity of relations between social inequalities and suicide, as well as risk and protection factors that may be involved in this context.

This study also showed that unemployment rates and number of deaths by suicide correlate inversely, that is, when unemployment rates increase, deaths by suicide tend to decrease. This result calls for further investigations and may be related to aspects such as financial aid programs of the Brazilian government to the unemployed, lower labor stress, and others.

Furthermore, the correlation coefficient between suicide rates and aging rates indicate a change in the pattern observed throughout the years: while in the early years of the 2000s an inverse correlation was found, that is, the higher the aging rates the lower the suicide rates, a direct and positive correlation was detected between 2012 and 2015, that is, suicide is related to higher aging rates.

Finally, the results of this study also revealed a large number of Years of Potential Life Lost to suicide in RN, with great impacts on the economically active population; significant variations were observed between the studied years as to this indicator. An investigation that sought to analyze mortality by self-inflicted violence in the state of Minas Gerais, Brazil, by calculating YPLL, presented results similar to those exposed in this study, evidencing that, as for years of life lost, the average age at the moment of death stood around 40 years old, and it is possible to attest to the potential social loss of an individual who commits suicide (Camargo, Iwamoto, Oliveira & Oliveira, 2011).

This study has as limitation the use of secondary data on mortality, which is subject to under-registration, although the option was to use the Mortality Information System for Brazil, which is a more reliable and formal system for records in the country and has had its quality significantly increased.

Conclusion

Among the 2,266 deaths by suicide identified in that period, deaths that have occurred at home, by hanging, among men, black people, single people, and the elderly, stand out. More potential years of life were lost in the economically active age group. Thus, it is important to consider risks of suicide attempt at home, with methods easy to access, in groups with characteristics associated with greater vulnerability.

This study has contributed to knowledge about suicide characteristics in Rio Grande do Norte and reveals the importance of developing specific policies, investigations and actions for mental health promotion and suicide prevention.

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