# Sociodemographic characteristics and time series of mortality due to suicide among elderly individuals in Bahia State, Brazil, 1996-2013

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## Abstract

**Objective:** to describe sociodemographic aspects and time evolution of mortality due to suicide among elderly individuals in Bahia State, Brazil, from 1996 to 2013. **Methods**: time series descriptive and ecological study, with data from the Mortality Information System (SIM); Prais-Winsten regression was used for trend analysis and to calculate annual percent change (APC). **Results**: 858 deaths due to suicide were identified in elderly in Bahia; 85.4% were men, and 53.8% were in the 60-69 age group; 64.3% of deaths resulted from hanging/strangulation, followed by self-poisoning by pesticides and chemical products (13.1%); there was an increasing trend in suicide mortality rate in the general elderly population (APC 11.0; 95%CI 6.9;15.3) and in the male sex (APC 12.1; 95%CI 7.1;17.3), whilst in the female population it remained stable. **Conclusion**: in Bahia, mortality due to suicide among elderly individuals presented an increasing trend in the period studied and was higher among males.

**Keywords**: Suicide; Mortality; Aged; Epidemiology, Descriptive; Time Series Studies.

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## Introduction

Suicide consists in a complex phenomenon, related to multiple variable factors in time and space, which results in death from intentional self-harm.[1,2] It is a serious Public Health issue, pointed as one of the ten main causes of death worldwide.[1]

Every year, around 800 thousand people die due to suicide in the world, which corresponds to an adjusted global rate of 11.4 per 100 thousand inhabitants (15.0 among men and 8.0 among women).[2] In Brazil, from 2000 to 2012, 112,103 deaths due to suicide were registered among individuals older than 10 years old, a growth of 26.5% in the mortality rate, which increased from 4.9 in 2000 to 6.2 per 100 thousand inhabitants in 2012.[3]

According to the World Health Organization (WHO), age is an important factor in the occurrence of suicide. Higher mortality rates among people aged 70 or more, in comparison with younger individuals, are observed in almost all regions worldwide.[2]

Globally, the mortality rate from suicide among men aged ≥65 years, in the 1990s was around 41 deaths per 100 thousand inhabitants, reaching higher values when considering only those aged ≥75 years (50 deaths/100 thousand inhabitants).[2] In Brazil, from 2000 to 2014, around 10 thousand people died from suicide,[4] and although the mortality rate is relatively low in the country – in comparison to others –, the risk of suicide in the elderly population represents the double of the estimated to the general population.[5]

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The higher vulnerability to suicide among individuals aged 60 years or more, due to health problems and changes in their social roles, highlights the importance of understanding the magnitude of the problem. Moreover, those people get little attention from Public Health authorities, researchers and the media, who, in theirs reflections and actions, usually prioritize younger population groups.[6]

Besides that, another justification for this study, is the lack of scientific works on this subject in Brazil,

especially in places where it is evident the growth in occurences of this event, such as the Northeast region, especially Ceará and Bahia states, which represent, together, more than 40% of the deaths from suicide in the region in the period from 2010 to 2013.[4]

Aiming to subsidize the increase of knowledge about the topic and help the Health sector in its preventive actions through the identification of vulnerable groups, this study had as objective to describe the sociodemographic aspects and the time evolution of the mortality due to suicide in elderly individuals in Bahia State, from 1996 to 2013.

## Methods

This is a descriptive and time series ecological study.

In 2010, Bahia State had a population of 14,016,906 inhabitants, of which 1,450,008 (10.3%) were 60 years old or more.[7] In that same year, 4,760,071 (34%) of the state inhabitants had from complete primary education to higher education degree, and the average monthly household income per capita of those aged 10 years or more was of BRL 947.25.[7]

The data on deaths from suicide were obtained in the Mortality Information System (SIM), available in the website of the Brazilian National Health System IT Department (Datasus), of the Ministry of Health. The period of the study (1996 to 2013) was determined for corresponding to the years of coverage of the current International Statistical Classification of Diseases and Health Related Problems, 10th edition (ICD-10).

All the deaths of individuals aged 60 years or more, who lived in Bahia State and had suicide as its underlying cause, classified in ICD-10 as 'external causes of morbidity and mortality', under the codes X60 to X84, were included. The ICD-10 categories corresponding to suicide were:
- intentional self-poisoning by medicines, biological substances and unspecified drugs (X60-X64);
- intentional self-poisoning by alcohol (X65);
- intentional self-poisoning by pesticides and chemical products (X68-X69);
- intentional self-harm by hanging, and strangulation (X70);
- Intentional self-harm by drowning/submersion (X71);
- intentional self-harm by firearm (X72-X74);
- intentional self-harm by smoke, fire and gas (X75-X77);
- intentional self-harm by sharp or blunt objects (X78-X79);

- intentional self-harm by jumping from a high place (X80);
- intentional self-harm by unspecified means (X84); and
- other causes (X81-X83; X66-67)

To characterize the deaths, the following variables were considered:
- sex (male; female);
- age group (in years: 60 to 69, 70 to 79; 80 or more);
- ethnicity/skin color (white; black; brown; Asian; indigenous);
- marital status (single; married; widowed; divorced/separated; other); and
- education level (in years of schooling: none; 1 to 7; 8 to 11; 12 or more)

The distribution of deaths per group of cause was described according to sex and age group.

To analyze time evolution, we calculated the total mortality rates from suicide in elderly individuals (per 100 thousand inhabitants), and also according to sex. The rates were adjusted by age, through direct method, using the elderly Brazilian population of 2010 as reference. The population data were obtained from the Brazilian Institute of Geography and Statistics (IBGE), available in Datasus website, and referred to the population count (1996), demographic censuses (2000; 2010), intercensal projections (1997 to 1999; 2001 to 2012) and population estimates (2013).

In the time trend analysis, we used the proceedings of Prais-Winsten general linear regression, which considers the serial autocorrelation. For this, we estimated the annual percent change (APC) and its respective 95% confidence intervals (95%CI).[8] The p values were obtained using Wald test. A 5% statistical significance level was adopted. The program Microsoft Office Excel 2010 was used for tabulation, descriptive analysis and rates calculation, and the program Statistical Package for the Social Sciences (SPSS) version 21.0 was used for trend analysis.

This study met the ethical principles of the Resolution of the National Health Council No. 510, dated April 7th, 2016.[9] Since it used only data publicly available and without identification of the subjects, submission to the Ethics Research Committee was exempted.

## Results

From 1996 to 2013, 858 deaths from suicide among individuals aged 60 years or more were identified in Bahia State. When these deaths were distributed according to sociodemographic characteristics (Table 1), it was observed that 85.4% of them were males, 53.8% were in the age group from 60 to 69 years, 54.0% were from the ethnicity/skin color brown and 43.9% were married. With regard to education level, 33.5% had from 1 to 7 years of schooling. It is important to highlight the proportion of non-informed data for the variables ethnicity/skin color (17.7%), marital status (15.3%) and education level (36.6%) (Table 1).

As to the means used, 64.3% of the deaths were due to intentional self-harm by hanging and strangulation, followed by intentional self-poisoning by pesticides and chemical products, with 13.1%. Similar results were found in the distribution by sex (66.9% and 12.7% in the male sex; 49.6% and 15.2% in the female sex) and by age group (64.5% and 12.8% in the 60 to 69 years group; 63.8% and 13.5% in the 70 to 79 years; and 64.9% and 13.2% in 80 years or more) (Table 2).

The time evolution of the mortality rates from suicide in elderly individuals is presented in Table 3. There was an increase of 206.3% in the mortality rate due to suicide in elderly individuals in Bahia, which grew from 2.2/100 thousand inhabitants in 1996 to 6.8/100 thousand inhabitants in 2013, with annual increase of 11.0% (95%CI 6.9;15.3) and a significant and increasing trend. In the male sex, there were higher rates (3.9 in 1996 and 12.7 in 2013), with significant and increasing trend (APC 12.1%; 95%CI 7.1;17.3), whereas in the female sex there were smaller rates (0.8 in 1996 and 2.0 in 2013), with stability throughout the period (Table 3).

## Discussion

In Bahia, mortality by suicide in elderly individuals is prevalent in the male sex, in the age group from 60 to 69 years. It was observed an increasing trend in the mortality rate by suicide among elderly individuals as a whole; especially in men, whose rate was, approximately, 4 to 10-fold higher than in women, in the years studied.

The growth observed in this study was more marked when compared to Brazil as a whole (16.2%) and to the Northeast region (57.2%), from 2000 to 2012;[3] and to other Brazilian states, such as Minas Gerais (42.9%)[10] from 1999 to 2008, and Ceará (145.8%) from 1980 to 2009.[11]

**Table 1 – Sociodemographic characteristics of deaths by suicide in elderly individuals, Bahia State, 1996-2013**

| Characteristics | N | % |
|---|---|---|
| **Sex** | | |
| Male | 733 | 85.4 |
| Female | 125 | 14.6 |
| **Age group (in years)** | | |
| 60-69 | 462 | 53.8 |
| 70-79 | 282 | 32.9 |
| ≥80 | 114 | 13.3 |
| **Ethnicity/skin color** | | |
| White | 175 | 20.4 |
| Black | 63 | 7.3 |
| Brown | 463 | 54.0 |
| Asian | 4 | 0.5 |
| Indigenous | 1 | 0.1 |
| Unknown | 152 | 17.7 |
| **Marital status** | | |
| Single | 207 | 24.1 |
| Married | 377 | 43.9 |
| Widowed | 110 | 12.8 |
| Divorced/separated | 30 | 3.5 |
| Other | 3 | 0.4 |
| Unknown | 131 | 15.3 |
| **Education level (in years of schooling)** | | |
| None | 194 | 22.6 |
| 1-7 | 287 | 33.5 |
| 8-11 | 50 | 5.8 |
| ≥12 | 13 | 1.5 |
| Unknown | 314 | 36.6 |

It is important to highlight that the growth observed not only can be a consequence of the rise in the number of cases, but also of the possible advances in the coverage of SIM and filling of death certificates (DC), due to a better identification and classification of suicide as cause of death.

In Brazil, the difficulty to estimate suicides steams from the incompleteness of records[12] and from cultural reasons. Other problems in quality are identified, many of them due to the lack of information accuracy in its record source – such as the Police and the Forensic Medicine Institutes –, and on the other hand, from the social turmoil caused by suicide, not only in the elderly, but also in the general population, due to the stigma and social prejudice related to this event.[12]

There are many factors related to suicide in elderly individuals. Among them, we can highlight mental disorders, especially depression, physical illness or the presence of terminal diseases, along with the fear of an extended life without dignity, social-related problems, such as isolation, lack of a support network and loneliness, besides the ideation, past attempts and easy access to the means used to commit the act.[6,13] Moreover, stressful moments, such as the loss of relatives, psychosocial factors, like alcoholism and use of other drugs, which interfere in the psychological, psychiatric

and biological factors of the elderly, can lead them to self-destruction.[13-15]

In this study, the deaths due to intentional self-harm involving elderly individuals were prevalent in the male sex, with an increasing trend of the mortality rate. This result supports what was verified for Brazil (2000 to 2012)[3] and other states, such as Minas Gerais (1999 to 2008)[10] and Espírito Santo (1980 to 2006).[15]

Among the possible justification for this finding, we can mention sex-related fragilities, which constitute important factors in the explanation of suicide occurrence.[17] In the old age, the masculinity

which values stoicism, control of emotions, macho attitudes and competitiveness tends to intensify; and the fact of other adults assume the functions as head of the family and in society, previously occupied by the elderly individual, leads him to feel useless, incapable, powerless and humiliated.[18] Besides, the removal from work due to retirement or chronic disease, financial difficulties and problems regarding relationships or sexual performance are potential motives for suicidal behavior in elderly individuals.[18]

The smaller frequency of suicide found in female elderly individuals confirms findings of national[10,11,14]

**Table 2 – Distribution of deaths by suicide in elderly individuals, according to the ICD-10 categories[a] according to sex and age group, Bahia State, 1996-2013**

| ICD-10 categories[a] | Total | | Sex | | | | Age group | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male | | Female | | 60 to 69 | | 70 to 79 | | 80 or more | |
| | N | % | n | % | n | % | n | % | n | % | n | % |
| Intentional self-poisoning by medicines, biological substances and unspecified drugs | 8 | 0.9 | 5 | 0.7 | 3 | 2.4 | 7 | 1.5 | – | – | 1 | 0.9 |
| Intentional self-poisoning by alcohol | 3 | 0.4 | 3 | 0.4 | – | – | 2 | 0.4 | 1 | 0.3 | – | – |
| Intentional self-poisoning by pesticides and chemical products | 112 | 13.1 | 93 | 12.7 | 19 | 15.2 | 59 | 12.8 | 38 | 13.5 | 15 | 13.2 |
| Intentional self-harm by hanging and strangulation | 552 | 64.3 | 490 | 66.9 | 62 | 49.6 | 298 | 64.5 | 180 | 63.8 | 74 | 64.9 |
| Intentional self-harm by drowning/submersion | 14 | 1.6 | 6 | 0.8 | 8 | 6.4 | 8 | 1.8 | 3 | 1.1 | 3 | 2.6 |
| Intentional self-harm by firearm | 68 | 7.9 | 66 | 9.0 | 2 | 1.6 | 42 | 9.1 | 21 | 7.4 | 5 | 4.4 |
| Intentional self-harm by explosive material | 18 | 2.1 | 7 | 0.9 | 11 | 8.8 | 7 | 1.5 | 5 | 1.8 | 6 | 5.3 |
| Intentional self-harm by sharp or blunt objects | 12 | 1.4 | 11 | 1.5 | 1 | 0.8 | 6 | 1.3 | 5 | 1.8 | 1 | 0.9 |
| Intentional self-harm by jumping from a high place | 26 | 3.0 | 18 | 2.5 | 8 | 6.4 | 14 | 3.0 | 8 | 2.8 | 4 | 3.5 |
| Intentional self-harm by unspecified means | 33 | 3.9 | 27 | 3.7 | 6 | 4.8 | 12 | 2.6 | 18 | 6.4 | 3 | 2.6 |
| Other intentional self-harm | 12 | 1.4 | 7 | 0.9 | 5 | 4.0 | 7 | 1.5 | 3 | 1.1 | 2 | 1.7 |
| **Total** | **858** | **100.0** | **733** | **100.0** | **125** | **100.0** | **462** | **100.0** | **282** | **100.0** | **114** | **100.0** |

a) ICD-10: International Statistical Classification of Diseases and Health Related Problems – 10th Revision.

**Table 3 – Trends of mortality rate by suicide in elderly individuals, according to sex, Bahia State, 1996-2013**

| Sex | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | APC$_%$[a] | 95%CI[b] | p-value[c] | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male | 3.9 | 6.6 | 4.9 | 3.8 | 6.2 | 4.8 | 5.1 | 7.5 | 5.4 | 9.1 | 7.8 | 10.8 | 10.0 | 8.0 | 8.2 | 6.8 | 8.5 | 12.7 | 12.1 | 7.1; 17.3 | <0.001 | Increasing |
| Female | 0.8 | 1.6 | 0.2 | 1.0 | 0.9 | 1.0 | 0.5 | 0.7 | 1.1 | 1.8 | 1.0 | 0.3 | 0.5 | 1.4 | 1.1 | 1.5 | 1.2 | 2.0 | 9.9 | -2.9; 24.3 | 0.126 | Stable |
| **Total** | **2.2** | **3.9** | **2.4** | **2.3** | **3.3** | **2.8** | **2.7** | **3.8** | **3.1** | **5.1** | **4.0** | **5.0** | **4.8** | **4.4** | **4.3** | **3.9** | **4.5** | **6.8** | **11.0** | **6.9; 15.3** | **<0.001** | **Increasing** |

a) APC: annual percent change.
b) 95%CI: 95% confidence interval.
c) Wald test.

and international[19] studies, possibly justified by the fact that women take more care of their health and sociability. Even during old age, they keep their roles as caretakers, doing household activities and keep a close and communicative relation to relatives and their community, besides being culturally more resistant to pain and suffering.[17]

Most elderly individuals in Bahia State who committed suicide were between 60 and 69 years old, which is similar to results found in Espírito Santo State (1980 to 2006)[16] and Santa Catarina State (2009),[20] and different from what was found in studies conducted in Rio Grande do Sul State (1980 to 1999)[14] and in countries such as China (2013 to 2014),[21] which show the eldest group of elderly individuals (80 years or more) as the one most involved with thoughts, attempts and execution of suicide.

The condition of being single, widowed or divorced, for contributing for the social isolation, is referred as a risk factor for suicide,[11,14] as evidenced in this study, since almost half of the elderly individuals who committed suicide belonged to these groups. Regarding the ethnicity/skin color, there was a larger proportion of cases among brown-skinned elderly, similar to what was found in a study conducted in the municipality of Recife, Pernambuco State (2009),[22] possibly because most of the population of these places self-declared as brown-skinned.

Still on social aspects, studies performed in Brazil (2000 to 2012)[3] and in countries such as Malaysia (2009)[15] point a higher number of attempts and occurrence of suicide in population groups with smaller education level (up to 7 years of schooling), which was also verified in this present study. However, there is a large proportion of cases in which this variable has not been filled, a problem also identified in Ceará State, in the 1997-2007 period.[23]

In Bahia, the analysis of completeness of data about elderly individuals' suicide from 1996 to 2010, using SIM, showed that, despite an improvement in the register of the education level field, its completeness still had a bad score (incompleteness from 20% to 50%).[12] These data reveal a fragility in the filling quality of the DC, pointing to the need of improving the quality of the registers, in order to obtain the information in the information related to the circumstances of

deaths, and also about the population groups under greater risk.

With regard to the means employed, in both sexes and different age groups, the hanging and strangulation stood out, followed by self-poisoning by pesticides and chemical products. This is similar to the results pointed in studies conducted in the municipality of Recife, Pernambuco State (2003)[23] and in countries like Cuba (1987-2014)[19] and Malaysia (2009).[15]

The wide availability and easy access to powerful toxic agents, such as industrial chemical products, home care products, cosmetics, rodenticides, as well as the diversity of medicines used during the aging process, can favor the occurrence of suicide in elderly individuals.[24] For cases which are difficult to control, such as hanging/strangulation, the monitoring by the healthcare professionals and specialized services is crucial, as well as the guidance of relatives and other acquaintances of the elderly when emergency moments are identified, aiming at preventing suicide attempts.[3]

In Brazil, we can notice that little or nothing regarding suicide involving elderly individuals is discussed in national health policies, having as examples the National Policy for Reduction of Morbidity and Mortality from Accidents and Violence[25] and the National Policy for Mental Health,[26] which emphasize the occurrence of the event in the young population, to whom they direct actions of prevention and control. Similar observation can be directed to the National Policy of Elderly Person Health,[27] which does not cover in its guidelines the phenomenon, when mentioning in the area of violence only actions to tackle domestic and institutional violence against the elderly individual. This demonstrates the importance of the resumption of the discussions about the policies and actions to promote the health of elderly individuals in the country, especially the prevention of suicide.

This study presented some limitations such as the use of SIM data, with the possible undernotification of cases due to failures in the fulfillment of death certificates.[28] The high number of cases whose underlying cause of death is classified as ill-defined or external cause with undetermined intent, reinforces the possibility of undernotification of deaths from suicide.[12,28] Also, the incomplete nature of the data, especially in variables such as education level, ethnicity/

skin color and marital status, may have hampered a better characterization of cases, and with it, the identification of vulnerable groups.

Despite these limitations, the results found point to the importance of integration between the Health sector and other social devices, aiming to ensure the support and protection of elderly individuals. Thus, the need to develop actions that promote the welfare, autonomy and sociability of this population group is clear, in order to contribute to life quality and, consequently, to reduce deaths from intentional self-harm.

## Authors' contributions

Carmo EA, Santos PHS Ribeiro BS, Soares CJ and Santana MLAA contributed to the conception and design of the study, analysis and interpretation of data and critical review of the manuscript's content. Bomfim ES, Oliveira BG and Oliveira JS contributed to the conception and design of the study, and critical review of the manuscript's content. All the authors contributed to writing, approved the manuscript's final version and declared to be responsible for all aspects of the study, ensuring its accuracy and integrity.

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