The Behavior Associated to Death from External Causes in Elderly People in Brazil. A Historic Timeline from 1995 to 2010

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Abstract

Methods: This is an ecological study that aimed to understand the behaviour of deaths from external causes in the population older than 60 years old in all Brazilian states. The data was collected using the Brazilian Mortality Information System and the population data from the Brazilian Institute of Geography and Statistics and from the SUS Informatics Department organized in historic series from 1995 to 2010.

Results and Conclusions: It is not possible to deny that deaths from external causes in elder citizens is not in an increasing and statistically significant tendency in most Brazilian states. This brings preoccupation about the issue, since discussions on the subjects are limited in the country, which makes this study good for future references in the field.

Introduction

A well-known fact for all mankind is that the population of the world is aging. Some impact phenomena such as the lower in the birth and mortality rates, consequently increasing the life expectancy, requires discussions about the growth of the elderly population, which brings the need of a commitment to the necessities of this age group and to the creation of social and health policies able to embrace such necessities in a true effective way. [1, 2]

Events like the speed as the world population is aging, the social transition process that the families have been through, the epidemiological transition and others deep changes incite us to believe that

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the understanding of the aging phenomenon is of an utmost importance. Especially when its development happens out of a proper social structure. [3, 4]

The general life expectancy of the world increased and this is, and should be, considered as an advance. The speed of this increase in Brazil has been twice faster than in the European Countries. As an example of this, we may consider that in 1900, the life expectancy of the Brazilian population was 33.7 years old, while in 2000 it was 70 [3]. The current elderly is "result" of a country that has aged quickly without of proper legislations capable of considering the manners of living and dying of this population and pointing answers to this process. [2, 3, 5]

In developed countries, with low rates of population growth, this aging process has been associated in many different ways to issues like the abusive use of drugs, crimes, mental illnesses, vandalism, diet-related problems, housing standards and difficulty in dealing with the production of garbage. In addition, in developing countries, some distinct patterns have been noted, as the numbers of deaths from chronic-degenerative diseases are also considered along the growing numbers of deaths from external causes. [5, 21]

Mortality (Deaths) from External Causes is the term used by the health sciences referring to deaths by: a) homicides and suicides, physical and psychological aggressions; b) traffic accidents, transportation accidents, falls, drowning; c) injuries and traumas caused by such events. Summarizing, there are 20 classifications of different types that make death not happen in the ordinary natural way, becoming a great social problem yet to be faced. The illnesses and injuries that happen in the health of the population are defined by systems of categorizations that consider those 20 classifications, relating morbidities through statistic criteria within a manageable number of categories. [5, 8, 18]

As some of the countries of the world, Brazil has one of these systems. It is named SIM and it was

created by the Brazilian Ministry of Health in 1975. The name SIM is a Portuguese acronym to Mortality Information System. Its purpose is to gather quantitative and qualitative data about the deaths occurred in the country from the causa mortis informed by the physicians who attested each occurrences. This system is a unification of forty models of instruments of data gathering used during the years in the country. It has variables that allow anyone to build indicators and process epidemiological analyses. [30]

SIM incorporates two classifications of deaths from external causes. The first one compiled in the Ninth Edition, the one that gathers information from 1979 until 1995 in its database, all distributed into 17 chapters and supplemental classifications, which are: supplementary classification of external causes from injuries and poisoning (Code E); supplementary classification of factors that influence the health state; and opportunities of contact with the health services (Code V).

The other one is the Tenth Review, which has been adopted since 1990 bringing the following changes: the introduction of an alphanumeric code consisting of four characters, a letter followed by three numbers; the inclusion of three new chapters, namely: Chapter V–Mental and behavior disorders; Chapter XIX–Injuries, poisoning and some other consequences derived from external causes; and Chapter XX–External causes of morbidity and mortality. [6, 13, 14]

Since the problematic is now set, it is interesting to introduce that the aim of this study is to describe what is the behavior of the deaths from external causes of the elderly population older than 60 years old in the different regions of Brazil. As an inevitable consequence of the objective proposed, we also study the tendency of the increase in mortality rates in the period between 1995 and 2010.

Knowing the differences in the means of mortality of the elderly population in each different Brazilian region is something of unquestionable re-

levance, since it may lead to considerations about the determiners and implications of such different scenarios and, as consequence, basis the creation of strategies aiming to improve the general levels of life and health of the age group studied.

Material and Methods

The present study is understood as an ecological study, since the data allow the analysis of etiological hypothesis regarding the occurrence of a certain disease/phenomenon in a specific group of individuals and in a specific period, using databases referring to big populations. [9, 19]

Deaths

The SIM database was adopted in this work to gather the information about the deaths from external causes in the population older than 60 years old in each Brazilian state. It was designed a historical sequence of the deaths from 1995 to 2010 [13].

Population

To do so we also gathered the population data available in DATASUS, the Health Informatics Department of the Brazilian Ministry of Health, as well as the IBGE's, the Brazilian Institute of Geography and Statistics, both well-recognized institutions responsible for some databases related to the country. In order to accomplish our objective, we focused in constructing the population historical sequence of this age group in the same period of the deaths [14].

Data analysis

An epidemiological study depends on many factors: quality of the information; adequate control of the confounding variables; bias interference and accuracy of the researcher. The literature does not bring tendencies of associating cause and effect; it brings possible associations between variables. Measure an ecological effect of a phenomenon may have great effects, friendly or not, that will be described as

limitations and/or strengths of the research. [9, 12]

Considering the behavior of the deaths from external causes in people older than 60, it is possible to see the need of an ecological analysis with clustered data. To elucidate the behavior of the mortality under the light of statistics, we choose to work with trend analysis [9-11].

Trend Analysis

This analysis was constituted from the rates of deaths from external causes in the elderly standardized in the period from 1995 and 2010. First, all the averages of the mortality rates were calculated by each state and year (**Figure 1**). Then, the modeling process was created considering the standardized coefficients of deaths from external causes of the elderly as a dependent variable (Y) and the period of years observed as an independent variable (X). To measure the trend we chose to use regression models. Using this kind of statistical modelling to analyze time series eases the analytical interpretation and, in statistics, makes it substantially more robust. [10, 12]

A model which could also be tested and fit properly in this work would be the linear regression $Y = \beta_0 + \beta_1 X$, followed by values of higher order, in case of a third higher order ($Y = \beta_0 + \beta_1 \beta_2 + \beta_3$), considering that this model would fit when presented a higher statistical significance, estimating to be a significant trend in obtaining $p < 0.05$.

The smoothing techniques in the moving average reduced the white noise of the values of the rates.

- Performing the calculation of the period taking the average point from the historical sequence (Aiming to prevent a serial correlation);
- Polynomial Model: the polynomial model was chosen due to the adjust of the R^2 line and its statistical significance. Remained the easiest model to explain the adjust of the line for its significance;

- Joinpoint Model: performed by the log-linear regression through the Average Annual Percentage (AAP) change and the inflection points existing during the years. [10, 12]

Using an explanatory model, the polynomial regression and the AAP of the states, regions and country, the expression was adjusted to favour the better understanding of the behaviour through a coefficient of deaths in elderly throughout the period specified and in the year that the number was or was not markedly increased in the series. It is important to highlight that the coefficient of deaths from external causes in elderly included all the years of the series and every single state of all the regions of the country. It was considered statistically significant the indicators that presented the following characteristic: (*) different from zero to $\alpha = 0.05$.

The polynomial analysis and Joinpoint are models applicable to long time series, usually higher than ten years. They are frequently adopted by

studies about cancer and/or long follow-up diseases. [10, 26]

Results

Considering their averages, we can see the condition of the deaths from external causes in the Brazilian elderly population getting an extremely complex linear drawing regardless of gender, race and social status (**Figure 1**). This is due to the uneven distribution of the reported numbers of the deaths throughout the period observed in each different state background studied.

The results on **Table 1** were achieved from the application of the statistical significance and trend analysis methods of assessment.

In the elderly population of all ages in each state, as in the whole country regardless of gender, race and social status, there is an expressive trend of a statistically significant increasing. The Joinpoint of the country from the year 2000 on highlight the

Figure 1: Means of deaths from external causes in the Brazilian elderly population, from 1995 to 2010.

x-axis: Brazilian states; y-axis: Coefficient with the averages of the deaths from external causes **Source:** data SUS/IBGE/SIM

Table 1. A historical sequence of the polynomial regression and AAP of each Brazilian state and region, considering deaths from external causes in elderly. The Statistical significance of the trend analysis. Period: 1995-2010.

Abb	State Region	$Y=\beta_0+\beta_1X+\beta_2X^2$			R^2	P	AAP0	AAP1
		β_0	β_1	β_2				Year
AC	Acre	82.55	-0.64	0.40	0.54	0.006	-0.62	-
AM	Amazonas	80.13	1.49	-	0.60	<0.001	1.79*	-
AP	Amapá	106.37	-1.44	-0.42	0.33	0.076	-1.96	-
PA	Pará	65.80	1.29	-	0.79	<0.001	1.95*	-
RO	Rondonia	184.27	-4.15	-	0.78	<0.001	-2.21*	-
RR	Roraima	142.12	0.11	0.49	0.40	0.034	0.14	-
TO	Tocantins	104.63	3.05	-	0.85	<0.001	3.00*	-
N	North	106.74	-0.05	0.19	0.50	0.011	-0.08	-
AL	Alagoas	81.85	1.16	-	0.34	0.018	1.24	-
BA	Bahia	82.20	1.97	-	0.94	<0.001	2.57*	-
CE	Ceará	92.72	2.18	-	0.67	<0.001	2.72*	-
MA	Maranhão	58.93	3.19	-	0.90	<0.001	5.57*	-
PB	Paraíba	62.32	1.44	-	0.44	0.005	2.51	-
PE	Pernambuco	89.48	0.17	0.43	0.81	<0.001	-1.98*	9.70 2006
PI	Piauí	69.23	4.63	-	0.95	<0.001	7.11*	-
RN	Rio Grande do Norte	86.70	1.62	-	0.72	<0.001	1.97*	-
SE	Sergipe	105.39	-2.68	-	0.53	0.001	-3.98*	23.93 2008
NE	Northeast	81.67	1.60	-	0.77	<0.001	-0.06	3.66* 2002
DF	Distrito Federal	141.34	-1.94	0.53	0.37	0.051	-1.11	-
GO	Goiás	125.36	-0.30	0.27	0.58	0.004	-0.24	-
MT	Mato Grosso	147.71	2.90	-	0.67	<0.001	2.09*	-
MS	Mato Grosso do Sul	150.72	-0.44	-	0.03	0.499	-0.32	-
CO	Midwest	146.51	0.18	-	0.01	0.762	0.08	-
ES	Espírito Santo	137.18	2.92	-	0.80	<0.001	2.10*	-
MG	Minas Gerais	89.81	-0.27	0.41	0.73	<0.001	-0.16	-
RJ	Rio de Janeiro	137.62	-0.08	0.23	0.50	0.011	-3.18*	1.20* 2000
SP	São Paulo	113.47	-0.52	-0.15	0.45	0.021	-0.57	-
SE	Southeast	118.32	0.52	0.18	0.53	0.008	0.42	-
PR	Paraná	127.31	-0.14	-	0.01	0.735	-0.12	-
RS	Rio Grande do Sul	104.18	0.06	-	0.01	0.733	-0.03	-
SC	Santa Catarina	108.12	-1.39	-	0.79	<0.001	-1.32*	-
S	South	113.20	-0.49	-	0.28	0.034	-0.48	-
BR	Brasil	104.07	0.58	0.17	0.56	0.005	-2.35*	1.63* 2000

*: significantly different from zero to alpha = 0.05. **Source:** data SUS/SIM/IBGE.

states of Sergipe (2008) and Pernambuco (2006) of the Northeast region (2002) and Rio de Janeiro (2000), which is noticeable through the AAP and the inflection points existing throughout the years (**Table 1**).

Discussion

The numbers of the deaths from external causes of the Northern States are high during all the period observed, and placed in the region are located the two higher rates of elderly mortality in the country: Roraima (183/100,000) and Rondônia (154/100,000). Their numbers are even higher than the average of their region (107.19/100,000) as shown in **Table 1**. Four of the seven states of the region (AM, PA, RO and TO) point to increasing trends even considering a linearity in the trend of the data of the country.

As a particularity, in the North, there are only few studies about deaths from external causes [4, 13]. Its background is still not thoroughly explored, its databases show obvious frailties and its expressions of the increase of the percentage is considerably more obvious when compared to the other regions.

In some few studies about the mortality rates in the region there are reports of the occurrence of hospitalizations from motives of morbidity from external causes that brought the elderly to their death. Although the motives of the deaths reported in the system are events that happen during the hospitalization, facts such as infections, complications brought by the medicines, and medical procedures. Therefore, few reports really bring up deaths from external causes [2, 08, 19].

Another aspect about the region that must be reported here is the serious situation of issues like depression, chemical dependence from alcohol and drugs, as much as psychiatric disorders without the proper assistance. In the North there is an insufficiency of some important assistance services to the elderly population. The largest capital of the region,

Manaus, has one of the weakest trajectories during the Implementation of the Elderly Policies and poorest dealing with violence victims in the country [21, 29, 33, 35].

The Northeast region does not express significant position regarding high mortality rates in the country. The three states of the region that showed the higher rates of deaths from external causes were Sergipe (105.23/100,000), Pernambuco (98.55/100,000) and Ceará (92.79/100,000). All the other states kept their average low, around 62.75/100,000.

The expression of significance of the trend of the Northeastern states points 6 states (Bahia, Ceará, Maranhão, Pernambuco, Piauí, Rio Grande do Norte and Sergipe) as increasing significantly throughout the period studied, even considering an expressive difference among the other regions of the country. Only two states of the region do not have a statistical significance to express the increase in the deaths from external causes in the elderly, Alagoas (81.85) and Paraíba (62.32).

In Northeast there are low levels of deaths from external causes, but their tendency to increase is clear. This fact happens in contradiction to the reality of the deaths from external causes in other age groups and in the population of the region as a whole. Some studies point to the weakness of the data gathered from this region, more specifically, underreporting, low quality of the information or the distance of the actual data from the reality. [16, 29, 37]

The region has a history social deprivation and other problems due to political disregard throughout the centuries and, due this historic background, is considered one of the most violent in the country to all age groups. The capitals of the region are in third in numbers of suicides in the age group studied from 1997 to 2007 [4, 6]. Some studies bring up that there may be a strong correlation between the social deprivation and some causes of deaths, among them, the ones from external causes. To

bring and example, in Recife, one of the largest and influential capitals of the region, the implementation of policies toward the elderly and against victims from violence are still in intermediate levels. Making a projection, according to the government database Portal do Envelhecimento, the implementation of such policies in the region is still incipient if considered the size of the problem faced by the population. [29, 33, 37]

In the Midwest, the rates of deaths from external causes in elderly were considerably high. This region presents a singularity regarding the problem: the numbers, they remain unchanged in high levels in the whole period. The highest occasion was in 1995 in Distrito Federal (213.80/100,000) and the lowest in 1999 in the same state (119.55/100,000). The average among the states of the region was 145.78/100,000.

The states of the region present the highest mortality rates of the country, even higher than the national averages. However, they have an oscillatory behavior that hinders the consistency on affirming an upward tendency, with an exception in the state of Mato Grosso. [19, 21, 24]

Some studies about the region disassociated some social characteristics from the deaths from external causes, bringing that those rates actually have little influence in increasing or decreasing the indicators. The region has some particularities: in 2005 it was the region with the lowest life expectancy of the country, although the levels of social exclusion were not the highest, nonetheless it has a tendency of increasing the numbers of deaths from external causes. This way it is possible to conclude that the violence and suffering of the elderly make them live less, ergo increasing the responsibility of the state in elaborating more effective policies to face how aging is happening in the nowadays background. [2-4]

The life and health standards of the elderly population in Midwest show a unique contradictory reality when compared its social conditions and the

high levels of violence. It happens to be one of the regions of the country where the people are the youngest. However, it does not bring advances toward anticipation and pre-structuring of the background to the aging of the population in the future. Highlighting Brasília, a city with one of the worst indications of the implementation of policies toward the elderly and against violence of the country. [9, 35, 38]

The reality of the Southeast shows high rates of deaths from external causes in the group studied. States such as, Rio de Janeiro and Espírito Santo present rates with the averages higher than the very region they are placed in, with the averages 142.64/100,000 and 137.50/100,000, respectively, where the average of the region is 122.22/100,000. It is possible to see the statistical significance of the trends in increasing the rates of Rio de Janeiro and Espírito Santo on **Table 1**. Although a little lower, the average of the other states of the region, Minas Gerais and São Paulo, did not present comfortable averages, when considering the possibility of increasing the numbers. Highlighting 110.32/100,000 in São Paulo and 98.43/100,000 in Minas Gerais.

The Southeast states are characterized for being heavily populated, having a higher number of studies about aging, possessing a thorough clarification about the deaths from external causes in elderly and about the increase in its numbers [2, 3]. The conclusion taken from these facts is that there is a real increase in the number of deaths and the main reason linked to the mortality of this age group is the increase in violence in its broad way: institutional, familiar, in traffic, in the raw expression of violence concealed in the scenery where it happens. [21, 23, 26]

The South, like all of the other regions, has high rates of deaths from external causes in the group studied. The data on **Table 1** show that the states of this region have their variables between 127.62/100,000 (Paraná) and 104.45/100,000 (Rio Grande do Sul), and its average is 113.50/100,000.

Although the mortality rates present high averages in, it only expresses significant statistics in a growing tendency in the state of Santa Catarina. This region has the most long-lived people and most trustful data gathered of the country. Therefore, based on the data gathered, Curitiba and Porto Alegre are the two Brazilian capitals with the best performance in implementing policies toward the elderly and against violence, mobilizing different social segments. [3, 8, 16, 17]

There is a statistically significant tendency in the growth of deaths from external causes in the elderly population of Brazil. Observing the Joinpoint from 2000, it is possible to see a prominence in the Northeast region (2002), expressed in the states of Sergipe in 2008, and Pernambuco in 2006. Another noticeable point may be observed in the Southeast region, the state of Rio de Janeiro, in the year 2000, presented a curve bending, highlighted on **Table 1** through the mean of variation of the annual percentage and inflection points existent throughout the years.

Conclusion

After this brief overview of the Brazilian background of the deaths from external causes from 1995 to 2010, it is possible to conclude that those kids of deaths change their behavior according the improvement in the quality of the data and the information reported. The best reports allow us to detect more trustful indicators of deaths from external causes. However, in all the study there is a need of further clarifications aiming to understand better the deaths from external causes in the different social backgrounds of the country.

Considering those kids of deaths, it is necessary to draw the attention to the incipient scientific production about the issue and the undeniable growth of the elderly population. If scenario does not change, it is not possible to say that Brazil is prepared to the future of its ongoing demographic transition.

In the country, it is possible to see a predominance of deaths from external causes in elderly through readings of studies made in its different regions. Most of these studies point out to a fragility on the policies toward the protection of the elderly, they also show the presence of an increasing violence in each different regions, as in Brazil as a whole. [7, 24]

About the conclusions, there is no way to deny that the deaths from external causes of the elderly in all country happens and grows heterogeneously. The of the tendency of the growth is provocative to many possible analyses. The results of this study show the need of discussing of other aspects that influence in the construction of the databases. The improvement in the reports may explicit the relevance of the issue and the need of broaden studies as ways of subsidize social and health policies according to the current aging process of the country.

It happens to us a thought that the conclusive gaps are products of an existing prejudice about the old age and the “peculiar discomfort felt by the living in the presence of the dying” [20]. Death in the elderly population, for its unavoidable happening and the fact that it is always “expected” and “naturalized” [1], might result in a lower concern of the health professionals in understanding it better, independently of the causes.

Conflict of Interest

All the authors declare that there is no conflict of interest regarding the publication of this article.

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