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TREND OF MALE MORTALITY FROM EXTERNAL CAUSES TENDÊNCIA DA MORTALIDADE MASCULINA POR CAUSAS EXTERNAS TENDENCIA DE LA MORTALIDADE MASCULINA POR CAUSAS EXTERNAS

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ABSTRACT

Objective: to analyze the trend in mortality of Brazilian men from 20 to 59 years old with external causes in the period 2000-2010, based on secondary data from the Mortality Information System. **Method:** ecological time series study. The mortality rates were calculated due to external causes, and then the standardization of data was proposed. The trend analysis was proposed by the polynomial regression model, coefficients of mortality as dependent variable and year of occurrence of deaths as independent variables. **Results:** north, Northeast and South, tended significantly increased mortality ($p < 0.001$; < 0.001 , 0.015, respectively), while the Southeast region showed decreasing and stationary Center-West trend. **Conclusion:** an intersectoral coordination of government becomes necessary to develop strategies to reduce these mortality rates, as well as intervene in socio-cultural determinants that favor the occurrence of these deaths. **Descriptors:** Mortality; External Causes; Information Systems; Men.

RESUMO

Objetivo: analisar a tendência da mortalidade por causas externas de homens brasileiros entre 20-59 anos, no período de 2000-2010, a partir de dados secundários do Sistema de Informação de Mortalidade. **Método:** estudo ecológico de série temporal. Foram calculados os coeficientes de mortalidade por causas externas, e em seguida proposta a padronização dos dados. A análise de tendência foi proposta por meio do modelo de regressão polinomial, tendo como variável dependente os coeficientes de mortalidade e como independente, os anos de ocorrência dos óbitos. **Resultados:** as regiões Norte, Nordeste e Sul, apresentaram uma tendência, significativamente, crescente de mortalidade ($p < 0,001$; $< 0,001$; 0,015, respectivamente), enquanto a região Sudeste apresentou tendência decrescente e Centro-oeste estacionária. **Conclusão:** torna-se necessária uma articulação intersectorial do governo no sentido de desenvolver estratégias que contribuam para a redução dessas taxas de mortalidade, assim como intervir nos determinantes socioculturais que favorecem a ocorrência desses óbitos. **Descritores:** Mortalidade; Causas Externas; Sistemas de Informação; Homens.

RESUMEN

Objetivo: analizar la tendencia de la mortalidad por causas externas de hombres brasileños entre 20-59 años, en el periodo de 2000-2010, a partir de datos secundarios del Sistema de Información de Mortalidad. **Método:** estudio ecológico de serie temporal. Fueron calculados los coeficientes de mortalidad por causas externas, y en seguida propuesta a la estandarización de los datos. El análisis de tendencia fue propuesta por medio del modelo de regresión polinómica, teniendo como variable dependiente los coeficientes de mortalidad y como independiente, los años de ocurrencia de las muertes. **Resultados:** las regiones Norte, Nordeste y Sur, presentaron una tendencia, significativamente, creciente de mortalidad ($p < 0,001$; $< 0,001$; 0,015, respectivamente), mientras la región Sudeste presentó tendencia decreciente y Centro-oeste estacionaria. **Conclusión:** se torna necesaria una articulación intersectorial del gobierno en el sentido de desarrollar estrategias que contribuyan para la reducción de esas tasas de mortalidad, así como intervenir en los determinantes socioculturales que favorecen la ocurrencia de esas muertes. **Descriptores:** Mortalidad; Causas Externas; Sistemas de Información; Hombres.

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INTRODUCTION

Men's health has been the interest of managers, health services and researchers in studying issues involving this population group. High male mortality is among the reports that justify this growing interest. Ministry of Health data show that out of three adults who die in Brazil, two are men, and more than half of death records and hospitalizations are from men.¹

By analyzing the age pyramid, male birth rate is higher than female, but mortality is also higher, especially in younger age groups, because after 25 years old the percentage of women exceeds men's, that is, the male population is dying more and earlier.² Male mortality is higher than female across the life cycle, in some cases being fifteen times higher as happening at the age group of 20 -29 years old by murder.³

Brazilian mortality, especially among young adults, are related to poor living conditions, unhealthy behaviors and difficulty of access to health services.⁴

According to the Ministry of Health, the main cause of death among men aged 40-59 years old are diseases of the circulatory system, with 25% of deaths, external causes with 18% and cancer with 16%. However, among young adults (20-39 years old) external causes are responsible for 64% of deaths. In Brazil, the risk of death from such causes is 5.1 times higher in men than in women⁵ and happen in poorer regions.⁴

Deaths from external causes including injuries resulting from accidents (related to traffic, drowning, poisoning, falls or burns) and violence (assault/murders, suicide, suicide attempts, physical, sexual and psychological abuse). These causes deserve special attention from the health sector to work with prevention and promotion, as the immediate expenses related to these victims are mainly on this sector. In 2010, men had 70.5% of hospitalizations due to external causes in services funded by the Unified Health System (SUS).⁵

Mortality due to these causes was higher in male population, especially in young adults, in the period of 1991-2000, with 82.8% of these deaths occurred

among men, and the average mortality rate was five times higher than in women.⁶ Study conducted in São Luis (MA)⁷, found that in 2005 about 82.28% of deaths from external causes were male, showing important to study the behavior of external causes, specifically, in this population.

Thus, the reduction of mortality rates occurs more slowly and to a lesser extent in the male population when compared to female population.⁸

Men are more vulnerable to violence and crimes, as aggressor or as a victim, 87% of violent crimes are committed by men.⁹ This situation of violence usually is associated with excessive consumption of alcohol and drugs, more frequent in this population.¹⁰ The use of alcohol and tobacco is higher among young men and often their social interaction is mediated by using these substances.¹¹

Although men are most vulnerable and die earlier, they hardly seek health services, especially primary care, considering themselves as invulnerable. Recently the National Policy for Integral Attention to Men's Health (PNAISH) was established that one of its actions aims to increase male access to health services, strengthen primary care, investing in prevention and promotion health actions to achieve a reduction of morbidity and mortality of this population.¹⁰

With this information, it is important to know the trend of male mortality from external causes, because this knowledge can support the development of strategies with potential to reverse or control the situation presented. This study aims to analyze the trend in mortality from external causes of Brazilian men aged 20-59 years old in the period 2000-2010.

METHOD

Epidemiological, ecological, temporal series study about male mortality from external causes, in the period between 2000 to 2010, held from secondary data obtained from the Mortality Information System (MIS) of the Ministry of Health.¹²

The study included five Brazilian regions, North, Northeast, Southeast, South and enter-West, and was based on mortality data by external causes in the

male population aged 20-59 years old. It was decided to investigate this age group due to the scope of the National Integral Attention to Men's Health Policy (PNAISH).¹⁰ Deaths classified in Chapter XX were selected (External causes of morbidity and mortality), including V01 to Y98 categories of the 10th International Classification of Diseases and Related Health Problems, 10th Revision (ICD-10).¹³

The mortality rates due to external causes were calculated under the denominator 100,000 inhabitants. Information relating to the resident population in the period studied, rates calculation basis, corresponded to data from the Brazilian Institute of Geography and Statistics (IBGE), available by the Informatics Department of SUS (DATASUS), from the Ministry of Health, in December 2012.

The standardization of mortality rates was by direct method, in which the male population of Brazil in 2010 was considered standard for macro-regions. It was considered the standardization necessary to have mortality rates that were comparable with each other and throughout the study period.

From the external cause mortality rates found, the trend analysis was held using polynomial regression model with dependent variables (y) the male death rates from external causes and as an independent (x) the years occurrence of deaths.

In order to minimize the serial correlation between the terms of the regression equation, the independent variable of the period 2000-2010 was centered by the midpoint of the series (X-2005), avoiding collinearity problems.¹⁴

Polynomial models of first, second and third order were tested, and the analysis of the best graphic format and the value of R² adjustment rate indicated the best curve to be fitted to the data, and tested models of 1st order ($Y = \beta_0 + \beta_1X$), 2nd ($Y = \beta_0 + + \beta_1X \beta_2X^2$), 3rd ($Y = \beta_0 + + \beta_1X \beta_2X^2 + \beta_3X^3$) where β_0 is the average rate of the period and β_1 is the average annual increment.

The best model is chosen according to the following criteria: best function according to the scatter plot, best adjustment analysis of residues (normality and homoscedasticity of errors), highest statistical significance by ANOVA and the highest rate of determination (R²).¹⁵ The significance level was 5%.

Since this is a study using secondary database, of public domain available on the Internet, the submission of this study to the approval of the Research Ethics Committee was not necessary.

RESULTS

Table 1 shows the standardized mortality rates of male population in the age group of 20-59 years old, due to external causes, stratified by Brazilian region.

Table 1. Number of deaths, crude and standardized rates* of male mortality from external causes (per 100.000 inhabitants) by Brazilian regions, 2000 to 2010. Brazil, 2012.

	Regions														
Year	North			Northeast			Southeast			South			Center -West		
	Number of deaths	Crude rate	Standardized rate	Number of deaths	Crude rate	Standardized rate	Number of deaths	Crude rate	Standardized rate	Number of deaths	Crude rate	Standardized rate	Number of deaths	Crude rate	Standardized rate
2000	3.976	133,79	131,51	15.930	147,32	144,74	36.524	191,34	189,55	9.607	145,35	145,29	5.544	182,83	180,69
2001	4.320	141,53	140,07	16.615	151,73	148,87	37.021	191,12	189,51	9.987	149,01	149,09	5.579	180,12	178,80
2002	4.832	155,22	153,41	17.906	161,76	158,47	37.613	191,62	190,06	10.481	154,65	154,95	6.069	192,44	190,34
2003	4.948	155,67	154,03	18.596	166,21	162,76	37.067	186,45	185,09	10.724	156,44	156,75	6.081	189,43	187,40
2004	5.087	156,82	154,59	18.973	167,81	164,84	35.639	177,04	175,96	11.409	164,57	165,02	6.383	195,43	193,85
2005	5.486	161,72	159,69	19.831	171,33	168,08	33.974	164,14	163,46	11.332	159,41	159,96	6.205	182,84	181,40
2006	5.785	166,81	163,80	21.139	180,50	177,07	32.925	156,88	156,32	11.481	159,50	160,07	6.209	179,52	178,80
2007	5.909	152,67	149,61	22.942	175,39	171,48	32.181	144,37	144,53	11.752	153,18	153,73	6.372	171,96	170,57
2008	6.735	174,54	170,19	24.562	182,66	178,57	31.326	140,76	141,15	12.056	156,99	157,88	6.988	185,01	183,70
2009	6.946	175,50	171,54	25.680	187,28	183,04	31.704	140,62	141,30	12.385	159,00	160,05	7.184	186,50	185,30
2010	8.044	195,23	191,64	27.064	197,38	194,37	30.897	135,79	136,60	12.211	157,75	159,81	7.194	179,93	179,44

Fonte: MS/SVS/DATASUS/SIM, 2012.
* Standardized rate for the Brazilian population in 2010.

It is noticed an increase of rates in the North and Northeast regions (Figure 1) during the study period (2000-2010), because in 2000 they had the lowest mortality rates between the Brazilian

regions (131.51 and 144.74/100,000 inhabitants respectively), while in 2010 they had the highest rates (191.64 and 194.37/100,000). This means an increase

of 45.72% of the mortality rate in the North and 34.29% in the Northeast.

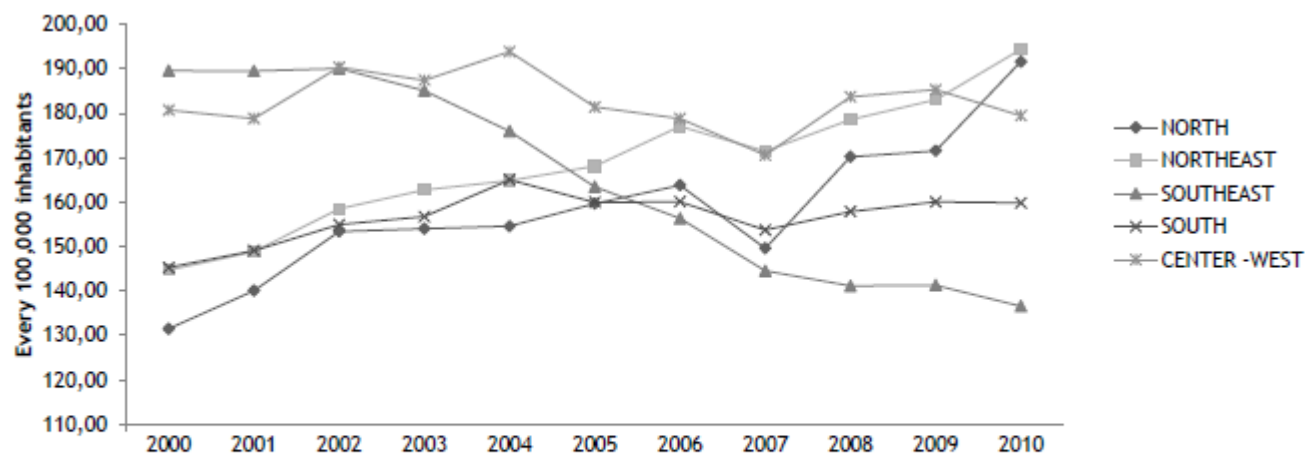


Figure 1. Evolution of standard rates* of male mortality by external causes (every 100,000 inhabitants) in the Brazilian regions, 2000 to 2010. Brazil, 2012.

Source: MS/SVS/DATASUS/SIM, 2012.
*Standard rate by the Brazilian population in 2010.

In 2000, the Southeast region had the highest mortality rate with 189.55/100,000 inhabitants, being one of the regions with higher levels of violence that year. However, this region was the only one showing a reduction of this rate in in 2010 with 136.60/100,000 inhabitants. Even showing an increase in 2002 (190.06/100,000) it showed a reduction of 27.93%, that is, developing a trend of mortality from external causes in the last decade. It is valid to point out that the Southeast region has the highest percentage of men in the age group studied (43.5%).

In the Center-West, this rate was stable in the decade of study, although the values of this mortality rate remained high throughout the period, when compared to other regions. In the South the rate increased from 145.29 in 2000 to 159.81/100,000 inhabitants in 2010, with most deaths occurring in 2004

(165.02/100,000), but when the years 2000 and 2010 are compared, the region recorded a percentage increase of the rate at 9.99%. However, it is worth noting that, in general, there is an increasing trend of mortality until about the middle of the period, from which it remains stable until the end of the review period.

Following the logic of the rates progress, the North and Northeast regions showed the largest percentage increases in the mortality rate from external causes.

It is worth noting (Figure 1) the period of 2007, when the mortality rates showed a decrease compared to 2006, in all geographical regions, being reduction of 8.66%, 3.16%, 7.54%, 3.96% and 4.60% in the North, Northeast, Southeast, South and Center-West, respectively.

In the trend analysis of mortality rates, the equations of the models found, R² value and p-value of the F test are shown in Table 2.

Table 2. Models trends of standardized rates (100,000) of male mortality from external causes by geographical regions of Brazil, 2000 a 2010. Brazil, 2012.

REGION	MODEL*	R ² **	p-value***	TREND
North	Y= 156,918 + 0,12X + 0,12X ² + 0,23X ³	0,92	< 0,001	Growing
Northeast	Y= 168,65 + 4,31x - 0,02X ²	0,94	< 0,001	Growing
Southeast	Y= 165,53 - 9,81X -0,06X ² + 0,19X ³	0,99	< 0,001	Decreasing
South	Y= 159,74 + 1,03X - 0,31X ²	0,64	0,015	Growing
Center-West	Y= 183,95 - 2,75X - 0,12X ² + 0,13X ³	0,33	0,378	Stable

Fonte: MS/SVS/DATASUS/SIM, 2012.
* Model: Y = Trend of male mortality rates by external causes. X= (year-2005)
** R² = Determination rate
*** p value, F Test.

According to Table 2, the mortality rates showed a significant increasing trend (p<0.001) for the North and Northeast regions, and (p<0.015) for the South. Over this period, the Southeast Region had a

decreasing trend (p <0.001) and the Center-West region remained stable.

Mortality trends, estimated through the parameters of the models presented in Table 2 show no linearity, and evidenced by polynomials of second and third order,

in this case featuring a non-constant trend.

DISCUSSION

The trend of decrease in mortality may be shown even before the increase in the coverage of the deaths in the Brazilian regions, mainly in the North and Northeast. Currently this coverage has been satisfactory throughout the national territory, since the data on the mortality produced by the IBGE are very close to the Ministry of Health, making them more reliable over time.¹⁶ Therefore, it is necessary to consider that there is an increase in the coverage of deaths, emphasizing some regions, its references will present both a growing trend as decreasing mortality, as presented earlier in this study.

In accordance with these results, studies conducted in North and Northeast states show high male mortality⁶⁻¹⁷, and the impact of deaths from external causes in life expectancy of men.¹⁸⁻¹⁹

In the country's capital during the period 1991-2000, Macapá (North) is the region with the higher male mortality, with 10.3 male deaths for each female. Then, João Pessoa (Northeast) with a male risk nine times greater. Other cities such as Recife, Vitória, São Paulo and Cuiabá was also observed elevated risk for men, and the mortality rates of around seven times larger than female.⁶

In order to estimate the impact of the main groups of causes of death, in the hope of life in Northeast Brazil in 2000¹⁹, it was observed that the group of external causes represented the second cause, in volume and earnings for all states of the Northeast and for males. However, they concluded that the vital statistics of this region are of limited use, arguing that the quality of data limits the production of reliable indicators of mortality.

Another study shows that the metropolitan area of Recife (Northeast) had a greater impact of external causes on male life expectancy because, in the absence of violent deaths, men earn 4.22 years of life, higher than found in São Paulo and Rio de Janeiro (4 years and 3.64 years, respectively), which are typically violent places.¹⁸

In the Northeast, a survey of the evolution of socio-spatial inequalities in mortality from external causes and murders in Salvador¹⁷, between 2000-2006, there an increase of 98.5% in the homicide rate. Despite the increasing number of deaths from external causes in all social strata, the most significant increases were observed in the population with the worst living conditions.

Different from the situation presented to the North and Northeast regions, the Southeast Region showed a declining trend. However, this result differs from some studies in southeastern states showed a growing trend of male mortality from external causes in general, and for some causes specific, such as murder and suicide. This is the case of the study conducted in the city of São Mateus/ES, which revealed that the trend of male mortality rate due to external causes, from 1999 to 2008, had a statistically significant increasing trend ($p < 0.001$), the rates ranged from 117.00 deaths per 100,000 inhabitants in 1999 to 204.22 in 2008, being the highest mortality rate in the age group of 20-59 years old.²⁰

Corroborating the results mentioned above, a study conducted in the Southeast region²¹ can identify higher murder rates in males, regardless of race/color when compared to other Brazilian regions, the age group most at risk for this type of death was 20-29 years old.

Another analysis of murder mortality trend, held in Belo Horizonte and the metropolitan area during the period 1980-2005, showed a high magnitude of mortality from murders mainly in young men and adults. In Belo Horizonte, the mortality rate for males, showed increasing trajectories in all age groups, with periods of acceleration, which became more evident around the 1990s, and were not observed declining periods.²²

In a trend analysis study, the results showed increase in suicide rates in Brazil and Rio de Janeiro, as well as progressive increase of deaths among males of all ages in the country. There was also the increasing of suicides for men under 60 years old in Rio de Janeiro. It is observed that in 1980 was 2.4 and 1.7 deaths of men for every woman, in Brazil and in the

state of Rio de Janeiro, respectively, a proportion that rose in 2006 to 4.0 men to every woman in the country and to 2.9 in the state.²³

Aggression mortality analysis in Brazilian population²⁴, from 1996 to 2007, showed that the Southeast region had the highest rate of mortality, with 52.9% of deaths, followed by the Northeast (23.9%). The lower rates corresponded the North (6.3%), Center-West (7.2%) and South (9.7%), respectively. When young men (15-29 years old) were specifically considered, the risk of aggression mortality was higher in the Northeast and Center-West and the lowest rate was in southern Brazil.

In this study is not possible to state the factors that led to the rates presented. However, some factors that may have contributed to these findings are highlighted. It is noteworthy the decreasing trend in mortality from external causes in the Southeast, having most of the national population. In this context, there is the Disarmament Statute establishment in 2003, with the intensification through the National Disarmament Campaign in the following years. This fact may have contributed to the decrease in deaths from external causes, since firearms are highlighted as the weapons most often used in acts of violence.²⁵

Besides the disarmament Statute creation, the Ministry of Health initiatives such as the Morbidity and Mortality Reduction Policy for Accidents and Violence²⁶ (2001) and the National Policy for Emergency Care²⁷ (2003), including the care of the coping plan of external causes and search of the improvement and expansion of pre, intra and post-hospital care for victims of violence, may have contributed to the changes in mortality rates.

Nacional²⁸ study compared the risk of death from Accidents (ATT) before and after the implementation of Law 11.70529, enacted in 2008, which restricts the consumption of alcoholic beverage in Brazil. There was a significant proportional reduction in risk of death from traffic accidents in Brazil, especially among men. However, this reduction was not as evident in this study, since only the Southeast and Center-West regions

showed a decline in mortality rates, but this reduction was not a reflection of this law.

Another factor that could possibly have influenced the results of this study are the disparities in economic and social development of regions such as the Human Development Index (HDI), as it is observed that the North and Northeast regions have increased social inequality, population bad living conditions, with higher illiteracy rate.

According to the Human Development Atlas in Brazil, 74% of Brazilian cities are in the “average” groups and “high development”, and about 25% of them in “low development”. The Northeast has 61.3% of the cities in the range of “low human development” and in the North, 40.1% of the cities are in this classification.³⁰

By comparison, the South and Southeast regions have lower levels of social inequality and illiteracy, possibly contributing to the adoption of a less aggressive behavior by male population. The South and Southeast regions have the most concentrated municipalities in the range of “high human development”, 64.7% and 52.2%, respectively.

Therefore, the literature already indicates higher frequency of cases of violence and mortality from external causes in the poorest populations with low literacy levels and poor living conditions, which may be related to the growing trend of mortality from external causes in north and northeast regions and a decrease in southeastern Brazil.

Another factor that may have contributed to this growing trend of mortality in the north and northeast is the low use or access to health services, particularly those focusing on prevention and health promotion, since appropriate health sector interventions have potential to reduce morbidity and mortality from external causes.

Access to health services increases according to the socioeconomic development of the region, thus people living in the Southeast and South are more likely to use health services than residents in other areas. In addition, the North and Northeast regions have lower chances of

use of these services, when the biggest difference in the chances of health service use in the Northeast was in people with higher education, which had 56.4% greater chance of use than people with low education.³¹

With these results, it is concluded that male mortality from external causes, aged 20-59 years old shows a growing trend in some Brazilian regions (North, Northeast and South), while the Southeast region, the most populous of Brazil and considered the most violent, showed a decrease trend in the study series.

In addition, this study shows the increase in mortality rates in the North and Northeast, because they presented in the beginning of the decade, lowest rates of mortality and enclose it with the highest mortality rates, corresponding to an increase of 45.72% of the North region and 34.29% in the Northeast.

It is necessary to point out some limitations in this study, the use of secondary data as well as the quality of the information assigned to the MIS. This system gathers data from death certificates, which can contain non-conformities in fulfillment. However, it is worth noting that the MIS and the Hospital Information System (SIH/SUS) have been the subject of institutional investments of the Ministry of Health and other related organs, reflecting the advancement of its coverage and the reduction of underreporting.³²⁻³³

Even with these limitations, due to the systematic and standardized monitoring the occurrence of such event, the MIS has a great potential for temporal trend studies, as they are official data also guiding the action planning and public policy development.

Despite the limitations here observed, the aspects highlighted in this study emphasize the importance of monitoring this indicator, while emphasizing the challenges to be faced to contain those numbers. The PNAISH is already highlighting the importance of these causes of death in the male population, especially among young people and the need for intensive investment in order to control the morbidity and mortality from external causes.

Therefore, there is the need for intersectoral coordination of government to develop new strategies that help reducing these mortality rates, particularly among younger men, most affected ones, as well as investment in the control of socioeconomic and cultural determinants favoring the occurrence of these deaths.

CONTRIBUTORS

Valença Neto PF and Siqueira BPJ equally participated in the study planning, analysis and interpretation of data and critical revision of the article. Nery AA and Casotti CA participated in the critical revision of the article.

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