



Impacts on life expectancy due to progressive reduction of deaths from homicides and traffic accidents in the urban areas of Brazil.

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Abstract

Urban violence differs from other phenomena due to aggressive and malicious behavior that occur as a function of urban life, which is derived from living conditions in big cities. Mortality from external causes in Brazil has reached very high levels, which places it among the top three causes of death, next to cardiovascular diseases and cancer. Violence, as well as other expressions of social issues, has been a major challenge for the Brazilian state which composition by age, sex and region varies considerably. In this study we use the approach of competing risks, adopting progressive scenarios (5%, 10%, 30%, 50%, 80% and 100%) of reduction of homicides and traffic accidents by gender for all 27 capital cities, excluding São Paulo and Rio de Janeiro, which were studied separately due to the huge contingent of population. The method proposed by Chiang was used to construct simple and multiple decrement life tables in combination with the method proposed by Tsai for measuring the effect on the life expectancy after a partial reduction of deaths by causes in progressive scenarios. Comparisons were made between the mortality patterns by age groups before and after the elimination of the causes of death. Death data were extracted from the Ministry of Health and the population from the 2000 and 2010 censuses. Life expectancy for all capital cities in 2010 was about 71.8 for men and 80.3 for women. For homicides there was a decrease in the period in gains in life expectancy for all scenarios. The elimination of 100% of male homicides in 2000 to all capital cities, Rio de Janeiro and Sao Paulo caused an increase in life expectancy of 1.77, 2.29 and 2.62 years respectively. Ten years later the increase was 1.65, 1.22 and 0.62 years in the same order. With lower levels comparing with the homicides, the mortality levels from traffic accidents increased. The patterns of the probabilities of dying showed a marked increase in risk of death for ages between 15 and 30 years. Considering the different spatial contexts, the downward trend in homicide rates in Brazil was more pronounced in large capital cities, and in capitals belonging to metropolitan areas. This study reinforces the need to develop public initiatives focused on young people, prevent internalization of violence in smaller urban centers and preventive actions to reduce deaths in urban traffic which is growing fast.

Keywords: life table; Brazilian capitals; multiple decrement models; competing risks.

1. Introduction

Brazil is a country where several transitions occur simultaneously. The urban demographic transition is among those in later stages. While the country is experiencing multiple processes of societal transformation, everything happens in a scenario of exacerbated inequality, which effects are stronger and more visible in urban areas. Of the social phenomena resulting from this multifaceted scenario, there is the urban violence. It differs from other phenomena due to aggressive and malicious behavior that occur as a function of urban life, which is derived from living conditions and social inequalities in

big cities. In that sense, the violence became not only a problem for social security, but also a public health problem of major proportions ((Waiselfiz, 2010; Waters et al., 2004).

Mortality from external causes in Brazil has reached very high levels, which places it among the top three causes of death, next to cardiovascular diseases and cancer. Considering the different spatial contexts homicide rates and death from traffic accidents in Brazil were more pronounced in the capital. Together they account to more than 90% of the overall deaths by external causes in 2010. According to the Map of Violence 2013, from 2001 to 2011 the percentage of deaths from traffic accidents grew 9.2% in Brazilian capitals and the homicides decreased 12.5% (Waiselfisz, 2013).

For planning purposes and public policy it is of great value to know the effect on the life expectancy of a population when the level of a specific mortality is reduced. Given this context, the objective of this study was to investigate the effect on the life expectancy after a partial reduction of deaths by homicides and traffic accidents in progressive scenarios by gender for all 27 Brazilian capital cities in the decade 2000 - 2010.

2. Methods

In this study we used the approach of competing risks, adopting progressive scenarios (5%, 10%, 30%, 50%, 80% and 100%) of reduction of homicides and traffic accidents by gender for all 27 capital cities, excluding São Paulo and Rio de Janeiro, which were studied separately due to the huge contingent of population. The method proposed by Chiang (1968) was used to construct simple and multiple decrement life tables in combination with the method proposed by Tsai (1978) for measuring the effect on the life expectancy after a partial reduction of deaths by causes in progressive scenarios. Comparisons were made between the mortality patterns by age groups before and after the elimination of the causes of death. Death data by sex, age, causes of death and place of residence were extracted from the Mortality Information System of the Ministry of Health and the population from the 2000 and 2010 censuses conducted by the Brazilian Institute of Geography and Statistics. It was considered as homicide the categories X85-Y09 (Aggression) and as traffic accidents the categories V01 - V89, in accordance with Chapter XVIII (External causes) of the International Classification of Diseases - ICD-10.

The net probability of dying in the range $x + x + n$ was calculated by the following formula:

$${}_nq_x = 1 - P_i \left[\frac{D_i - D_{ij}}{D_i} \right]$$

Where:

D_i = deaths from all causas;

D_{ij} = deaths from a specific cause;

The impact of homicide deaths and traffic accidents was measured by the difference between life expectancy at birth (e^0) calculated from the general life table, and the life expectancy (e^1) derived from the corresponding multiple decrement life table. The partial elimination of the deaths considered was: 5% 10%, 30%, 50%, 80% and 100%. The results of the impacts on the life expectancy for men and women are presented for the 25 capital cities, as a whole, and separately for the Rio de Janeiro and Sao Paulo in 2000 and 2010. Comparisons were made between the mortality patterns by age groups before and after the elimination of the causes of death.

3. Results

Table 1 shows the life expectancy at birth for all capital cities in 2000 and 2010. For the latter, the levels were about 71.8 for men and 80.3 for women. In the same table the comparative overall picture in terms of life expectancy at birth and life expectancy with total and partial elimination of homicides and traffic accidents to the capital as a whole, and separately for Rio de Janeiro and São Paulo, 2000-2010 is presented. The elimination of 100% of male homicides in 2000 to all capital cities, Rio de

Janeiro and Sao Paulo caused an increase in life expectancy of 1.77, 2.29 and 2.62 years respectively. Ten years later the increase was 1.65, 1.22 and 0.62 years in the same order. For all three spatial aggregations, the men experienced greater increases on life expectancy than women. The gains for traffic accidents were less strong for all simulations, as shown in more detail in Table 2.

Table 1 - Life expectancy (e^0) and life expectation with elimination of deaths by traffic accidents and homicides (e^1) for the Brazilian capital cities by sex, 2000 - 2010

Life expectancy	Male			Female		
	2000	2010	$\Delta \%$ 2010/2000	2000	2010	$\Delta \%$ 2010/2000
<u>Capital cities</u>						
Life expectancy (e^0)	68.34	71.75	4.98	77.55	80.39	3.66
Life expectancy eliminating traffic accidents (e^1)	68.92	72.42	5.07	77.73	80.58	3.67
Life expectancy eliminating homicides (e^2)	70.11	73.39	4.68	77.71	80.53	3.63
<u>São Paulo</u>						
Life expectancy (e^0)	68.14	73.06	4.92	77.78	80.98	4.11
Life expectancy eliminating traffic accidents (e^1)	68.43	73.60	7.56	77.87	81.11	4.28
Life expectancy eliminating homicides (e^2)	70.77	73.68	4.11	77.99	81.06	4.80
<u>Rio de Janeiro</u>						
Life expectancy (e^0)	67.56	70.80	4.80	77.35	78.88	1.98
Life expectancy eliminating traffic accidents (e^1)	68.07	71.32	4.82	77.55	79.02	1.89
Life expectancy eliminating homicides (e^2)	68.85	72.02	4.60	77.52	78.98	1.88

Source: Basic Data from Health Ministry and Censuses, 2000 e 2010.

The results of years of earnings added to life expectancy by partial elimination of deaths from homicide and traffic accidents showed very similar results (Table 2). The pattern of differences in life expectancies before and after removal of causes of deaths was linear for all combinations of scenarios involving the two causes of death for both sexes and geographical areas. This means that the gains in years added to life expectancy, increased at a constant rate for each increase of one percentage point in the proportion of reduction of deaths from traffic accidents and homicides in the Brazilian capitals. However, to São Paulo and Rio de Janeiro, the pattern of differences, although constant, was less pronounced than for the group of capitals, especially for men.

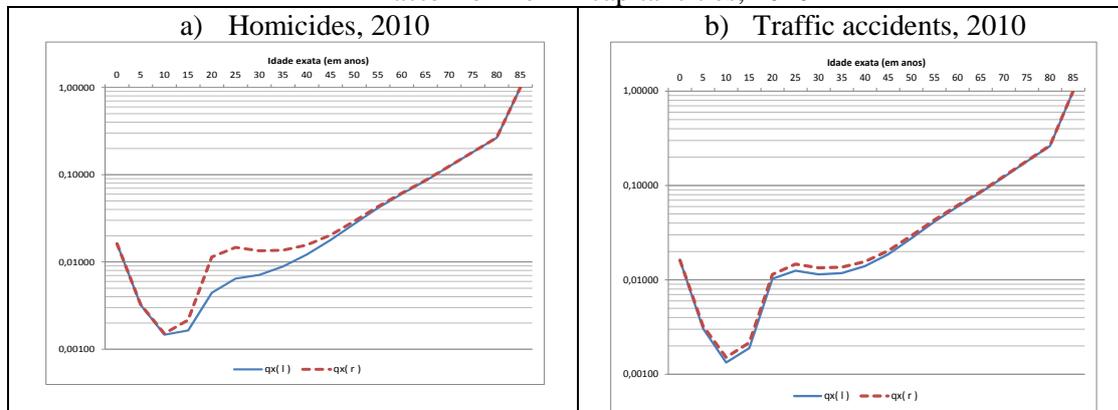
Briefly, after the elimination of the causes of death, the patterns of probability of dying by age group showed a marked difference in the risk of death for ages between 15 and 30 years in both years and sex for homicides, especially for men. As for traffic accidents, the differences in the patterns were not as evident. This feature was similar for all geographic areas. Figure 1 illustrates this behavior for 2010 for the capital cities: a) Homicides and b) Traffic accidents.

Table 2: Gains in added years to life expectancy at birth by partial removal of deaths from traffic accidents and homicides in the Brazilian capitals, 2000 - 2010

Cause of death, sex and year	Percentage of elimination (%)					
	5	10	30	50	80	100
<u>Capitals -2000</u>						
Traffic accidents						
Male	0.03	0.06	0.18	0.29	0.47	0.58
Female	0.01	0.02	0.05	0.09	0.14	0.17
Homicides						
Male	0.09	0.18	0.53	0.89	1.42	1.77
Female	0.01	0.02	0.05	0.08	0.12	0.16
<u>Capitals -2010</u>						
Traffic accidents						
Male	0.03	0.07	0.20	0.34	0.54	0.67
Female	0.01	0.02	0.06	0.10	0.15	0.19
Homicides						
Male	0.08	0.17	0.49	0.82	1.32	1.65
Female	0.01	0.02	0.04	0.07	0.12	0.15
<u>Rio de Janeiro - 2000</u>						
Traffic accidents						
Male	0.03	0.05	0.15	0.26	0.41	0.51
Female	0.01	0.02	0.05	0.08	0.13	0.17
Homicides						
Male	0.12	0.23	0.69	1.15	1.84	2.29
Female	0.01	0.02	0.06	0.10	0.16	0.20
<u>Rio de Janeiro - 2010</u>						
Traffic accidents						
Male	0.03	0.05	0.16	0.26	0.41	0.51
Female	0.01	0.01	0.04	0.07	0.11	0.14
Homicides						
Male	0.06	0.12	0.37	0.61	0.97	1.22
Female	0.01	0.01	0.03	0.05	0.08	0.11
<u>São Paulo - 2000</u>						
Traffic accidents						
Male	0.01	0.03	0.09	0.15	0.23	0.29
Female	0.01	0.01	0.03	0.05	0.08	0.10
Homicides						
Male	0.13	0.26	0.79	1.31	2.10	2.62
Female	0.01	0.02	0.06	0.11	0.17	0.21
<u>São Paulo - 2010</u>						
Traffic accidents						
Male	0.03	0.05	0.16	0.27	0.43	0.54
Female	0.01	0.01	0.04	0.07	0.11	0.13
Homicides						
Male	0.03	0.06	0.19	0.31	0.49	0.62
Female	0.00	0.01	0.02	0.04	0.07	0.08

Source: Basic Data from Health Ministry and Censuses, 2000 e 2010.

Figure 1: Probability of dying $q_x(r)$ and net $q_x(l)$ for homicides and traffic accident as a risk factor for men in capital cities, 2010



Source: Basic Data from Health Ministry and Censuses, 2000 e 2010

4. Conclusions

The results of this study supports the showing of Waiselfisz (2013) who identify that victims are mostly young males in ages from 15 to 30 years. In 2010, life expectancy for men would be increased by up to 1.65, 1.22 and 0.62 years for all the capital, Rio de Janeiro and Sao Paulo respectively with 100% reduction in homicides. With smaller increases for traffic accidents, the figures would be 0.61, 0.51 and 0.54 years in the same order. Since they are preventable causes of death, from an economic point of view and Public Health, the reduction of deaths from these violent events would bring significant cost savings to the health of the country (avoiding, for example, hospitalizations followed by death).

Violence, as well as other expressions of social issues, has been a major challenge for the state. In overall numbers, deaths for murder in the country are impressive. However, the curve appears to decline in the last decade, caused by the policies on crime, and preventive actions, such as the disarmament campaign.

In the decade 2000-2010 some Brazilian big cities such as Sao Paulo, Rio de Janeiro and in metropolitan areas, managed to reduce the number of deaths from homicides. However, the homicide rate has increased considerably in the interior of the country. This was due to various factors such as concentration of the police force in the metropolitan areas, reduction of jobs in rural areas due to the automation of services and mainly by the growth of illicit drug users.

This study reinforces all the recommendations already issued (França and Paes, 2007, 2012; UNDP, 2014) to develop public initiatives focused on young people, prevent internalization of violence in smaller urban centers and preventive actions to reduce deaths in urban traffic which is growing fast.

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