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HEALTH BRAZIL 2014

A situational analysis of road injuries and other external causes

Brasília – DF
2015

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Summary

PREFACE

Dear conference attendees,

Brazil is delighted to welcome you to the 2nd Global High-Level Conference on Road Safety.

Road injuries are a crucial development and public health issue, causing more than 1.24 million deaths and leaving more than 50 million people injured and disabled every year worldwide. The immeasurable human suffering and related catastrophic social and financial costs make road safety an urgent global priority.

Diverse initiatives have been adopted in recent years, in the quest for greater global engagement in this issue, such as the holding of the 1st Global Ministerial Conference on Road Safety in 2009, the Decade of Action for Road Safety (2011-2020), as well as the adoption of the Resolution on "Improving Global Road Safety" by the 68th United Nations General Assembly in 2014.

Within this context, the 2nd Global High-Level Conference on Road Safety will seek to analyze achievements and the next steps for the Decade of Action for Road Safety, as well as to discuss the pillars of its Global Plan. Furthermore, the event will be an opportunity for reflecting on road safety towards 2030, identifying targets and global indicators, as well as debating on emerging road safety issues.

Imbued with this spirit, Brazil is seeking to implement life-protecting actions that ensure reduction in traffic accidents. As such, we believe that this conference will be a historic opportunity to bring together high-level representatives of governments, international, regional and sub-regional organizations, non-governmental organizations, academic institutions and the private sector united by the commitment to reduce traffic accidents and have effective policies in place aimed at greater road safety, by means of strengthening and sharing good practices and strong high-level political engagement.

The causes of daily road traffic injuries and deaths are well known and, therefore, are avoidable. In view of this scenario, the 2nd Global High-Level Conference on Road Safety is a decisive landmark for discussing and effectively reducing traffic accidents globally. Aware as we are of the progress achieved so far, we need to advance even further. Now is the time for results!

Antônio Carlos Figueiredo Nardi
General Editor

INTRODUCTION

This publication forms part of the book entitled "Health Brazil 2014: an analysis of health situation and external causes", which is produced annually by the General Coordination of Epidemiological Information and Analysis Sector of the Noncommunicable Disease Surveillance and Health Promotion Department, located within the Health Ministry's Secretariat for Health Surveillance. This publication is comprised of eight chapters dealing with "external causes" of morbidity and mortality, with emphasis on violence and injuries. This theme continues to stand out on the Brazilian epidemiological scenario.

Chapter 1 provides an analytical overview of external causes in Brazil in 2013 and indicates that these causes accounted for 151,683 deaths recorded on the Mortality Information System that year. Chapter 2 looks at mortality due to alcohol use and highlights that there was a growth in proportional mortality due to alcohol use in both sexes, but particularly among males, over the period analyzed. Chapter 3 analyzes homicides in Brazil and one of its key findings is that the homicide rate among males is 15 times higher than among females in the age group in which homicides most occur (20-24 years old). Chapter 4 deals with domestic violence in Brazil, focussing on violence occurring between family members and intimate partners, frequently, although not exclusively, at home. Chapter 5 examines completed suicides and suicide attempts and finds slight but consistent growth in these events between 2000 and 2013.

Chapter 6 provides an overview of the profile and evolution of morbidity and mortality due to Land Transport Accidents (LTA) in Brazil in the period 2004 -2013. In turn, Chapter 7 places special emphasis on road injuries involving motorcyclists. These two chapters highlight the increased hospitalization rate due to these causes in all of Brazil's regions between 2009 and 2013. Chapter 8 describes and discusses the impact of interventions to reduce road traffic morbidity and mortality in Brazil, with emphasis on more recent interventions, such as: the Dry Law (Law No. 11705/2008 and Law No. 12760/2012), the Child Car Seat Law (National Transport Council Resolution No. 277/2008), the Life in the Traffic Project and Operation Rodovida. Chapter 9 is a descriptive study of external causes reported on the Mortality Information System and the Unified Health System (SUS) Hospital Information System between 2009 and 2013, as well as of cases of violence reported on the Violence and Accidents Surveillance System in 2013. This chapter looks in detail at the quality of information about deaths due to external causes and the need to improve hospital records on these causes.

The book Health Brazil is the product of a jointly built strategy involving universities, research centres, consultants, heath service managers and Health Ministry technical staff, among others. In addition to producing knowledge, it is also a valuable internal process for encouraging reflection and institutional enhancement, strengthening the analytical ability of the professionals involved, providing feedback to health information systems and fostering a space for debate which brings academic rationale closer to health service needs and ways of operating.

1 Situation analysis of external causes in Brazil

Table of Contents

Abstract

Introduction: External causes (EC), which include violence and accidents, have occupied an outstanding position on the epidemiological scenario for decades in Brazil and worldwide.

Objective: The objective of this study is to describe the EC situation in Brazil based on morbidity and mortality indicators available on official health information systems.

Methods: This was a descriptive study using data relating to EC morbidity and mortality among the Brazilian population between 2000 and 2013.

Results: 151,683 people died of EC in Brazil in 2013, with a mortality rate of 75.5 deaths per 100,000 inhabitants (26.4 deaths per 100,000 women; 125.5 deaths per 100,000 men). In the same year, more than 1 million hospitalizations due to EC paid by the Unified Health System (*Sistema Único de Saúde - SUS*) were recorded, the majority being among men (70%) and people aged 20-39 (36.2%). The hospitalization rate due to EC was 52.6 per 10,000 inhabitants, varying between 31.2 hospitalizations per 10,000 women to 74.5 hospitalizations per 10,000 men (hospitalization rate sex ratio=2.4).

Conclusion: The EC morbidity and mortality pattern in Brazil was comprised principally of males and those aged 20-39. Multisectoral interventions are essential to direct actions to prevent these conditions and to promote quality of life in order to improve this situation.

Keywords: External causes. Violence. Accidents. Mortality. Hospitalization. Emergency medical services. Epidemiology. Health information systems. Cause of death.

Introduction

Brazil is currently characterized by an accelerated demographic transition which has resulted in an abrupt fall in the fertility rate and high indicators of population aging. In turn the epidemiological transition is marked, among other aspects, by the challenge of chronic diseases and their risk factors, as well as the strong growth in external causes.

Since 1980, external causes (comprised of various forms of violence and accidents) have taken on an outstanding position in morbidity and mortality ranking both globally and in Brazil, especially in large urban areas, having young men as their principal victims. Reducing the magnitude and the severity of violence in our society, including by means of increasing knowledge about its risk factors, is therefore currently one of the biggest challenges for public health policies. Moreover, the growth in these undesirable events has been the driving force behind very important national and international studies.[1,2,3]

External causes are responsible for a large part of hospitalizations in Brazil and, despite accounting for less hospitalization time, their impact on public health resources is more significant than that of natural causes.[4] Furthermore they impose heavy demands on health services since it is the health system that many victims turn to when seeking emergency

and specialized care, physical rehabilitation and psychological care. External causes are therefore a relevant public health issue and their prevention has become a health priority.[4,5]

A variety of systems enable access to information that reveals the impact of external causes on the Brazilian health panorama. Owing to its range and quality, the Mortality Information System (*SIM*) enables knowledge about mortality associated with violence and accidents nationwide. The National Hospital Information System (*SIH/SUS*), which brings together the records of hospitalizations in order to pay public and private hospitals that provide care via *SUS*, is also a source of data on hospital morbidity due to accidents and violence. In 2006 the Ministry of Health implanted its Violence and Accident Surveillance System (*VIVA*) with the aim of getting information on the dimension and the profile of external causes cared for by health services, including those that did not result in death or hospitalization.[6] Together these three systems contribute in particular to situation and trend analyses of morbidity and mortality due to external causes in Brazil, as well as to informing interventions aimed at prevention.

In view of the above, the purpose of this chapter is to describe the situation of external causes in Brazil based on morbidity and mortality indicators available on official health information systems, with the aim of providing support to policies and actions to prevent violence and accidents and foster health promotion and a culture of peace in Brazil.

Methods

This is a descriptive study using epidemiological surveillance data on morbidity and mortality due to external causes in the Brazilian population between 2000 and 2013. Data on hospital mortality and morbidity available on the Mortality Information System (*SIM*) and on the National Hospital Information System (*SIH/SUS*), respectively, was used. Data on emergency care due to external causes was obtained from the Violence and Accident Surveillance System for Urgency and Emergency Sentinel Services (*Viva* Survey 2011). Population data was taken from the Brazilian Institute of Geography and Statistics' (*IBGE*) Population Projection for the country's Federative Units by sex and age (2000-2030)[i].

The records selected were those with underlying cause of death on the *SIM* System or secondary diagnosis on the *SIH/SUS* System coded as per Chapter XX of the International Statistical Classification of Diseases and Related Health Problems – Tenth Revision (ICD-10), according to the following groups: Total external causes (V01-Y98); Land transport accidents [LTA] (V01-V89); Falls (W00-W19); Assaults [homicides and legal interventions] (X85-Y09, Y35-Y36); Intentional self-harm [suicide] (X60-X84); Other external causes (V90-V99, W20-X59, X60-Y09, Y10-Y34, Y40-Y98). Hospitalizations coded only with the nature of the injury (Chapter XIX, S00-S99; T00-T98) were included in the "other external causes" group in order to avoid underestimation of the total number of hospitalizations due to external causes. *Viva* Survey 2011 data was coded in accordance

i Available at: <http://tabnet.datasus.gov.br/cgi/deftohtm.exe?ibge/cnv/projpopuf.def>

with the standard categories provided in the data collection instrument, interviewer's manual and dictionary of variables.

The descriptive variables were: sex (male, female), age group in years (0-9, 10-19, 20-39, 40-59, 60+), ethnicity/skin color (white, black, yellow, brown, indigenous), Federative Unit (*UF*) and geographic regions of residence (North, Northeast, Southeast, South, Midwest).

Absolute frequencies, proportions and mortality rates (per 100,000 inhabitants) and hospitalization rates (per 10,000 inhabitants) were obtained for total external causes and were stratified by specific causes. Percentage variation in the rates between the beginning and the end of the period was also calculated using the following formula: (rate in 2013 – rate in 2000) x 100 / rate in 2000. The mortality ratio was calculated with the aim of estimating differences in the risk of death between males and females. Average inpatient length of stay indicators were also calculated (total inpatient days/total hospitalizations in the period), as were indicators of hospital mortality (number of hospitalizations ending in death x 100/total hospitalizations in the period). The data was analyzed with the aid of Tabwin and Microsoft Excel®.

All the databases used can be accessed by the public via the *DATASUS* website, whereby patients' identification is omitted in accordance with the ethical principles of research involving human beings, in compliance with National Health Council Resolution 466, dated December 12, 2012.

Results

Mortality due to external causes – Brazil, 2013

In 2013, in Brazil, external causes accounted for 151,683 deaths registered on the *SIM* System, most of which occurred among men (82.2%) and people aged 20-39 (43.8%). With regard to ethnicity/skin color, most were brown (50.1%) and white (37,3%). The Southeast Region accounted for 36.8% of deaths (Table 1).

The mortality rate due to external causes was 75.5 deaths per 100,000 inhabitants, varying between 26.4 deaths per 100,000 women and 125.5 deaths per 100,000 men. Risk of death due to external causes among men was 4.7 higher than that found among women. In relation to age group, the highest mortality rates were found among the elderly (122 deaths per 100,000 inhabitants) and adults aged 20-39 (99.2 deaths per 100,000 inhabitants). The Southeast Region had the lowest mortality rate due to external causes (66 deaths per 100,000 inhabitants), whilst the highest rates were found in the Midwest Region (92.2 deaths per 100,000 inhabitants) and Northeast Region (86.1 deaths per 100,000 inhabitants).

Table 1 – Number (N), proportion (%) and crude mortality rate (per 100,000 inhabitants) due to external causes, by sex, age group, ethnicity/skin color, geographical region of residence – Brazil, 2013

Variables	Total external causes			LTA			Falls			Assaults			Intentional self-harm			Other causes		
	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate
Total	151,683	100.0	75.5	42,266	100.0	21.0	12,551	100.0	6.2	57,396	100.0	28.6	10,533	100.0	5.2	28,937	100.0	14.4
Sex																		
Male	124,699	82.2	125.5	34,629	81.9	34.9	7,456	59.4	7.5	52,522	91.5	52.9	8,309	78.9	8.4	21,783	75.3	21.9
Female	26,806	17.7	26.4	7,617	18.0	7.5	5,094	40.6	5.0	4,769	8.3	4.7	2,223	21.1	2.2	7,103	24.5	7.0
Not informed	178	0.1	-	20	0.0	-	1	0.0	-	105	0.2	-	1	0.0	-	51	0.2	-
Age group (years)																		
0- 9	3,745	2.5	11.9	958	2.3	3.1	156	1.2	0.5	353	0.6	1.1	3	0.0	0.0	2,275	7.9	7.2
10-19	18,296	12.1	53.4	4,161	9.8	12.1	153	1.2	0.4	10,370	18.1	30.2	785	7.5	2.3	2,827	9.8	8.2
20-39	66,376	43.8	99.2	18,564	43.9	27.7	1,016	8.1	1.5	33,755	58.8	50.4	4,494	42.7	6.7	8,547	29.5	12.8
40-59	34,262	22.6	73.9	11,804	27.9	25.5	2,429	19.4	5.2	9,597	16.7	20.7	3,536	33.6	7.6	6,896	23.8	14.9
60+	26,933	17.8	122.0	6,491	15.4	29.4	8,775	69.9	39.7	2,139	3.7	9.7	1,690	16.0	7.7	7,838	27.1	35.5
Not informed	2,071	1.4	-	288	0.7	-	22	0.2	-	1,182	2.1	-	25	0.2	-	554	1.9	-

continues

conclusion

Variables	Total external causes			LTA			Falls			Assaults			Intentional self-harm			Other causes		
	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate
Total	151,683	100.0	75.5	42,266	100.0	21.0	12,551	100.0	6.2	57,396	100.0	28.6	10,533	100.0	5.2	28,937	100.0	14.4
Ethnicity/Skin color																		
White	56,599	37.3	-	18,025	42.6	-	7,343	58.5	-	14,249	24.8	-	5,241	49.8	-	11,741	40.6	-
Black	9,946	6.6	-	2,115	5.0	-	588	4.7	-	4,529	7.9	-	529	5.0	-	2,185	7.6	-
Yellow	428	0.3	-	121	0.3	-	114	0.9	-	69	0.1	-	35	0.3	-	89	0.3	-
Brown	76,061	50.1	-	20,210	47.8	-	3,849	30.7	-	34,640	60.4	-	4,210	40.0	-	13,152	45.5	-
Indigenous	592	0.4	-	100	0.2	-	17	0.1	-	200	0.3	-	113	1.1	-	162	0.6	-
Not informed	8,057	5.3	-	1,695	4.0	-	640	5.1	-	3,709	6.5	-	405	3.8	-	1,608	5.6	-
Region																		
North	13,324	8.8	78.5	3,446	8.2	20.3	607	4.8	3.6	6,101	10.6	35.9	759	7.2	4.5	2,411	8.3	14.2
Northeast	48,020	31.7	86.1	12,665	30.0	22.7	2,247	17.9	4.0	22,163	38.6	39.7	2,494	23.7	4.5	8,451	29.2	15.1
Southeast	55,745	36.8	66.0	14,707	34.8	17.4	6,484	51.7	7.7	17,485	30.5	20.7	3,959	37.6	4.7	13,110	45.3	15.5
South	20,763	13.7	72.1	6,960	16.5	24.2	2,104	16.8	7.3	6,047	10.5	21.0	2,365	22.5	8.2	3,287	11.4	11.4
Midwest	13,831	9.1	92.2	4,488	10.6	29.9	1,109	8.8	7.4	5,600	9.8	37.4	956	9.1	6.4	1,678	5.8	11.2

Source: *MS/SVS/SIM* and *IBGE*.
LTA: land transport accidents.

Table 1 describes mortality indicators according to specific causes. Men (81.9%), the 20-39 age group (43.9%), those with brown skin color (47.8%) and those living in the Southeast Region (348%) and Northeast Region (30%) stood out among fatal victims of land transport accidents (LTA). With regard to risk of death from this cause, the highest rates were found among men (34.9 deaths per 100,000 men), the elderly (29.4 deaths per 100,000 inhabitants) and adults aged 20-39 (27.7 deaths per 100,000 inhabitants) and people living the Midwest Region (29.9 deaths per 100,000 inhabitants).

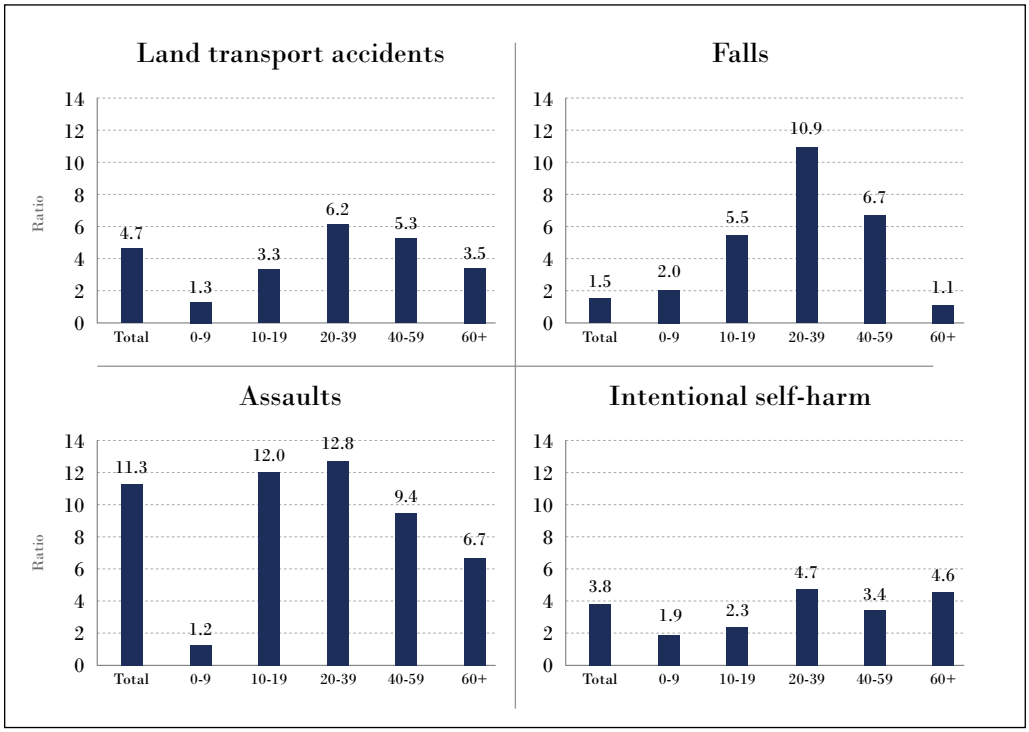
In relation to falls, the distribution of deaths according to sex was closer, with men accounting for 59.4% of deaths. The elderly (69.9%), individuals with white skin color (58.5%) and people living in the Southeast Region (51.7%) had the highest rates among deaths due to falls. Mortality rates were also more balanced between the sexes, whilst the elderly were seen to be at greater risk of death from this cause (39.7 deaths per 100,000 inhabitants). Risk of death due to falls was higher for people living in the Southeast, South and Midwest Regions (Table 1).

Yet again men (91.5%), those in the 20-39 age group (58.8%), with brown skin color (60.4%) and this time living in the Northeast Region (38.6%) were predominant among fatal victims due to assaults. Standing out with regard to risk of death from this cause were men (52.9 deaths per 100,000 men), adults aged 20-39 (50.4 deaths per 100.000 inhabitants) and people living in the Northeast Region (39.7 deaths per 100,000 inhabitants), the Midwest Region (37.4 deaths per 100,000 inhabitants) and the North Region (35.9 deaths per 100,000 inhabitants) (Table 1).

Higher frequencies of death due to intentional self-harm were found among men (78.9%), adults aged 20-39 (42.7%) and 40-59 (33.6%), those with white skin color (49.8%) and those living in the Southeast Region (37.6%). Risk of death from this cause was greater among men (8.4 deaths per 100,000 men), adults aged 40-59, the elderly (7.7 deaths per 100,000 inhabitants) and people living in the South Region (8.2 deaths per 100,000 inhabitants) (Table 1).

Graph 1 shows the mortality ratio for external causes, by sex, stratified by age group. Risk of death from LTA was 4.7 higher among men than women. In the 20-39 age group the ratio was 6.2. Risk of death from falls was more balanced between the sexes, especially among the elderly, although in the 20-39 age group higher mortality was found among males. With regard to death due to assault, risk of death was only similar between the sexes in the 0-9 age group. In the 10-39 age group risk of death from assault in males was 12 times higher than in females. In relation to intentional self-harm, risk of death among men aged 20-39 and aged 60 or more was almost five times greater than among women in the same age groups.

Graph 1 – Crude mortality ratios (per 100,000 inhabitants) due to external causes between males and females, by age group and sex – Brazil, 2013

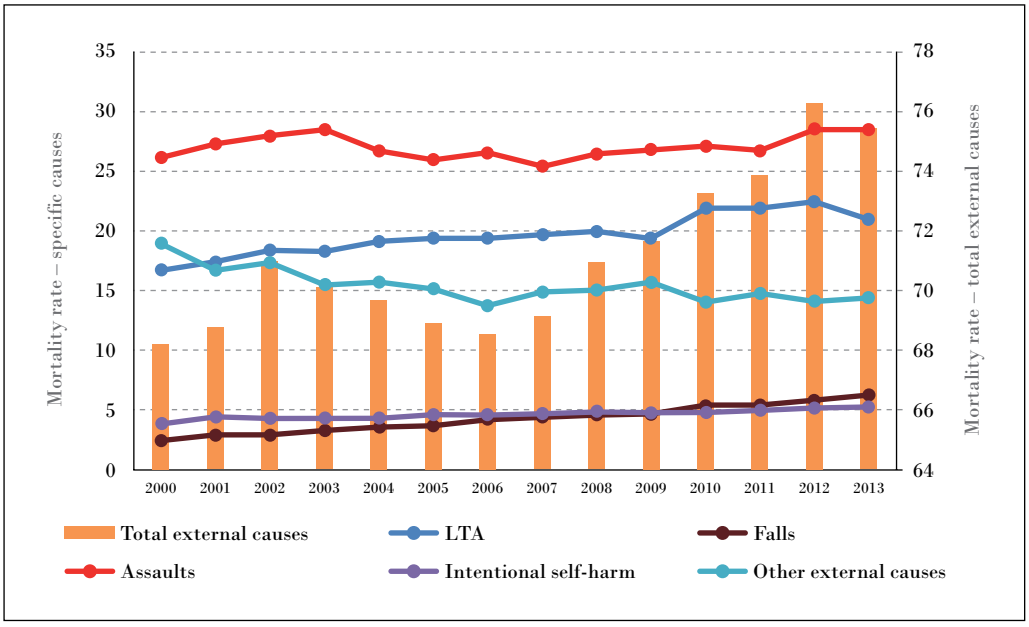


Source: *MS/SVS/SIM* and *IBGE*.

Trends in mortality due to external causes – Brazil, 2000-2013

Over the fourteen year period (2000-2013), the mortality rate due to external causes in Brazil increased by 10.5%, from 68.3 deaths per 100,000 inhabitants in the year 2000 to 75.5 deaths per 100,000 inhabitants in 2013. Assaults continued to be the specific cause most responsible for the highest mortality rate, with little variation over the period. LTA mortality rates came in second place among the rates of mortality due to external causes and increased over the period (25.7% between 2000 and 2013), in particular with effect from 2010. Although they had lower mortality rates, falls and intentional self-harm also increased over the period, by 148% and 33.3%, respectively, between 2000 and 2013 (Graph 2).

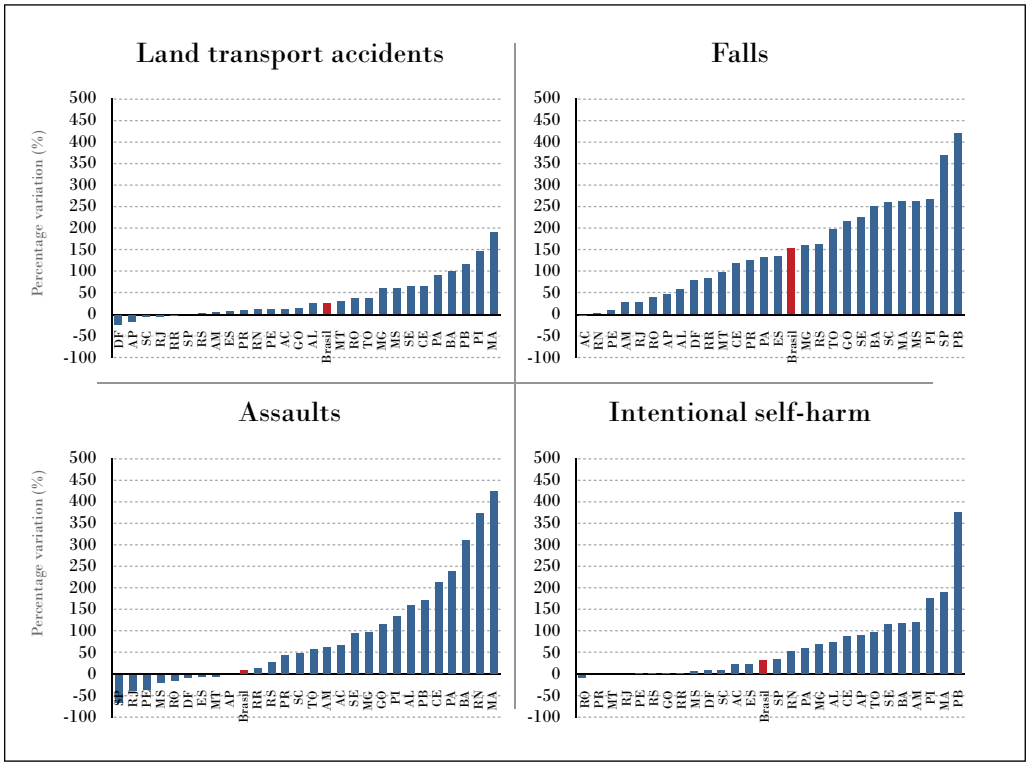
Graph 2 – Evolution of the crude mortality rate (per 100,000 inhabitants) due to external causes – Brazil, 2000-2013



Source: *MS/SVS/SIM* and *IBGE*.

Graph 3 illustrates percentage variation in the mortality rate due to specific external causes for Brazil and by Federative Unit. In the period analyzed (2000-2013), the LTA mortality rate reduced in the Federal District and in the states of Amapá, Santa Catarina, Rio de Janeiro, Roraima and São Paulo, whilst there was a marked increase in the remaining Federative Units. With regard to mortality rates from falls, the only decrease occurred in the state of Acre, whereas in the other Federative Units the rate more than doubled between 2000 and 2013. The mortality rate from assaults went down in the states of São Paulo, Rio de Janeiro, Pernambuco, Mato Grosso do Sul, Rondônia, Distrito Federal, Espírito Santo, Mato Grosso and Amapá. However, there was a large increase in the Federative Units in the country's Northeast and North Regions. The mortality rate from intentional self-harm only decreased in Rondônia and Paraná, whilst there was a marked increase in Paraíba, Maranhão and Piauí during the period studied.

Graph 3 – Percentage variation in the crude mortality rate (per 100,000 inhabitants) due to external causes – Brazil and Federative Units, 2000-2013



Source: *MS/SVS/SIM* and *IBGE*.
AC: Acre; AL: Alagoas; AM: Amazonas; AP: Amapá; BA: Bahia; CE: Ceará; DF: Distrito Federal; ES: Espírito Santo; GO: Goiás; MA: Maranhão; MG: Minas Gerais; MS: Mato Grosso do Sul; MT: Mato Grosso; PA: Pará; PB: Paraíba; PE: Pernambuco; PI: Piauí; PR: Paraná; RJ: Rio de Janeiro; RN: Rio Grande do Norte; RO: Rondônia; RR: Roraima; RS: Rio Grande do Sul; SC: Santa Catarina; SE: Sergipe; SP: São Paulo; TO: Tocantins.

Hospital morbidity due to external causes – Brazil, 2013

In 2013, in Brazil, more than a million hospitalizations due to external causes paid by *SUS* were recorded, most of which occurred in men (70%) and people aged 20-39 (36.2%). In relation to ethnicity/skin color, there was a predominance of people with white (32.2%) and brown (29.4%) skin color, although a considerable part of the records did not have information on this variable (35.2%). The Southeast Region accounted for 40.5% of all Brazil's hospitalizations (Table 2).

In Brazil, in 2013, the hospitalization rate due to external causes was 52.6 per 10,000 inhabitants, ranging from 31.2 hospitalizations per 10,000 women to 74.5 hospitalizations per 10,000 men (sex ratio=2.4). By age group, the highest hospitalization rates were found among the elderly (84 hospitalizations per 10,000 inhabitants) and among young adults aged 20-39 (57.2 hospitalizations per 10,000 inhabitants). The Northeast

Region had the lowest rate of hospitalization due to external causes in 2013 (45.4 hospitalizations per 10,000 inhabitants), whilst the highest rates were found in the Midwest Region (66.9 hospitalizations per 10,000 inhabitants) and South Region (61.7 hospitalizations per 10,000 inhabitants).

Table 2 – Number (N), proportion (%) and crude hospitalization rate (per 10,000 inhabitants) due to external causes, by sex, age group, ethnicity/skin color, geographical region of residence – Brazil, 2013

Variables	Total de external causes			LTA			Falls			Assaults			Intentional self-harm			Other causes		
	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate
Total	1,056,867	100.0	52.6	170,805	100.0	8.5	380,187	100.0	18.9	51,861	100.0	2.6	8,751	100.0	0.4	445,263	100.0	22.1
Sex																		
Male	739,720	70.0	74.5	133,562	78.2	13.4	247,061	65.0	24.9	43,314	83.5	4.4	5,390	61.6	0.5	310,393	69.7	31.2
Female	317,147	30.0	31.2	37,243	21.8	3.7	133,126	35.0	13.1	8,547	16.5	0.8	3,361	38.4	0.3	134,870	30.3	13.3
Age group (years)																		
0-9	88,364	8.4	28.2	8,193	4.8	2.6	35,570	9.4	11.3	1,686	3.3	0.5	395	4.5	0.1	42,520	9.5	13.5
10-19	143,070	13.5	41.7	26,574	15.6	7.8	47,733	12.6	13.9	8,510	16.4	2.5	1,243	14.2	0.4	59,010	13.3	17.2
20-39	383,095	36.2	57.2	82,967	48.6	12.4	109,016	28.7	16.3	27,983	54.0	4.2	3,958	45.2	0.6	159,171	35.7	23.8
40-59	256,981	24.3	55.4	38,571	22.6	8.3	94,556	24.9	20.4	10,488	20.2	2.3	2,472	28.2	0.5	110,894	24.9	23.9
60 +	185,357	17.5	84.0	14,500	8.5	6.6	93,312	24.5	42.3	3,194	6.2	1.4	683	7.8	0.3	73,668	16.5	33.4
Ethnicity/Skin color																		
White	339,951	32.2	-	49,801	29.2	-	153,479	40.4	-	8,764	16.9	-	2,522	28.8	-	125,385	28.2	-
Black	28,389	2.7	-	4,854	2.8	-	9,635	2.5	-	1,884	3.6	-	286	3.3	-	11,730	2.6	-
Brown	311,015	29.4	-	50,073	29.3	-	98,445	25.9	-	14,584	28.1	-	2,431	27.8	-	145,482	32.7	-
Yellow	3,778	0.4	-	352	0.2	-	1,512	0.4	-	105	0.2	-	30	0.3	-	1,779	0.4	-
Indigenous	1,345	0.1	-	137	0.1	-	507	0.1	-	61	0.1	-	4	0.0	-	636	0.1	-
Not informed	372,389	35.2	-	65,588	38.4	-	116,609	30.7	-	26,463	51.0	-	3,478	39.7	-	160,251	36.0	-

continues

conclusion

Variables	Total de external causes			LTA			Falls			Assaults			Intentional self-harm			Other causes		
	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate	N	%	Rate
Total	1,056,867	100.0	52.6	170,805	100.0	8.5	380,187	100.0	18.9	51,861	100.0	2.6	8,751	100.0	0.4	445,263	100.0	22.1
Region																		
North	97,007	9.2	57.1	11,373	6.7	6.7	16,130	4.2	9.5	5,890	11.4	3.5	544	6.2	0.3	63,070	14.2	37.1
Northeast	253,267	24.0	45.4	49,707	29.1	8.9	73,945	19.4	13.3	16,803	32.4	3.0	2,384	27.2	0.4	110,428	24.8	19.8
Southeast	428,487	40.5	50.7	74,808	43.8	8.9	179,655	47.3	21.3	19,539	37.7	2.3	4,596	52.5	0.5	149,889	33.7	17.7
South	177,780	16.8	61.7	20,289	11.9	7.0	73,814	19.4	25.6	4,408	8.5	1.5	677	7.7	0.2	78,592	17.7	27.3
Midwest	100,326	9.5	66.9	14,628	8.6	9.8	36,643	9.6	24.4	5,221	10.1	3.5	550	6.3	0.4	43,284	9.7	28.9

Source: *MS/SVS/SIH-SUS* and *IBGE*.
LTA: land transport accidents.

Table 2 describes *SUS* hospital morbidity indicators by specific causes. In the case of LTA hospitalizations, there was a predominance of males (78,2%), the 20-39 age group (48.6%), those with white and brown skin color (29% each) and those living in the Southeast Region (43,8%). Standing out among the hospitalization rates for this cause were men (13.4 hospitalizations per 10,000 men), adults aged 20-39 (12.4 hospitalizations per 10,000 inhabitants) and people living in the Midwest Region (9.8 hospitalizations per 10,000 inhabitants).

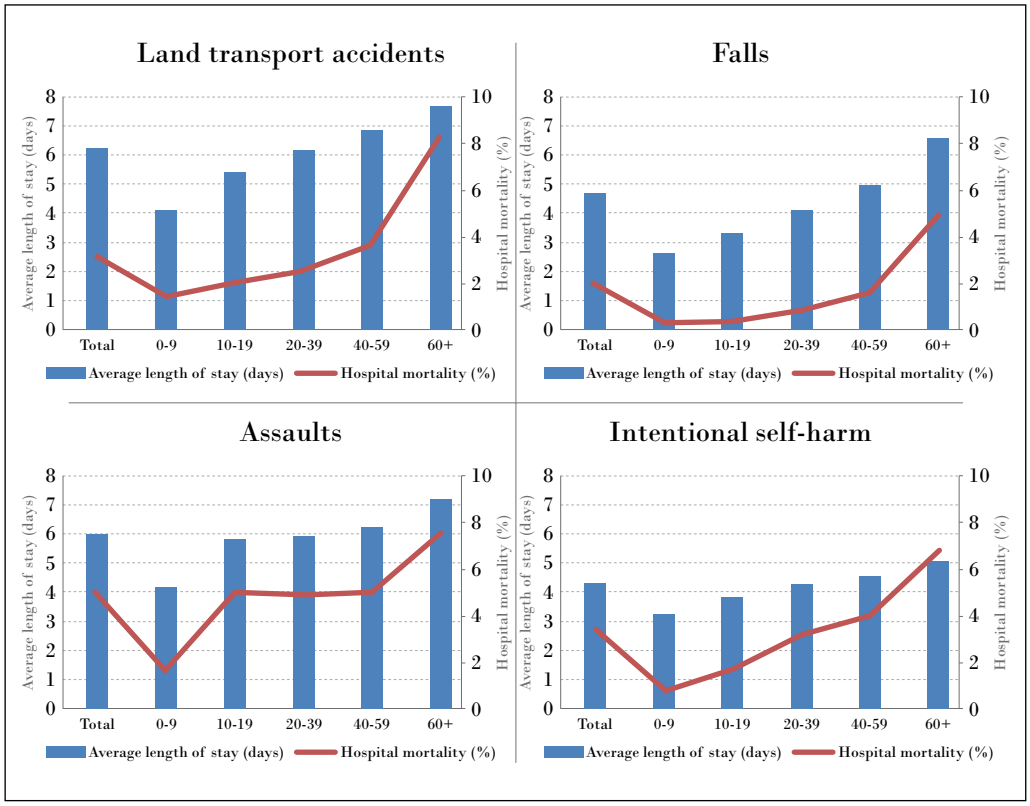
With regard to hospitalizations due to falls, the highest numbers occurred among males (65%) and individuals aged 20-39 (28.7%), people with white skin color (40.4%) and those living in the Southeast Region (47.3%). The hospitalization rate for falls was higher in men (24.9 hospitalizations per 10,000 men), those aged 60 and over (42.3 hospitalizations per 10,000 inhabitants) and people living in the South Region (25.6 hospitalizations per 10,000 inhabitants) and Midwest Region (24.4 hospitalizations per 10,000 inhabitants) (Table 2).

The highest percentages of hospitalizations due to assaults were found in males (83.5%), the 20-39 age group (54%), people with brown skin color (28.1%) and those living in the Southeast Region (37.7%) and Northeast Region (32,4%). Standing out among the hospitalization rate for these causes were men (4.4 hospitalizations per 10,000 men), young adults aged 20-39 (4.2 hospitalizations per 10,000 inhabitants) and individuals living in the North, Northeast and Midwest Regions (≥3 hospitalizations per 10,000 inhabitants) (Table 2).

The highest percentages of hospitalizations due to intentional self-harm were found among men (61.6%), adults aged 20-39 (45.2%), people with white skin color (28.8%) and people living in the Southeast Region (52,5%). The hospitalization rate for these causes was higher among men (0.5 hospitalizations per 10,000 men), adults aged 20-39 (0.6 hospitalizations per 10,000 inhabitants) and those living in the Southeast Region (0.5 hospitalizations per 10,000 inhabitants) (Table 2).

Graph 4 shows the indicators for average inpatient length of stay and hospital mortality by specific causes and age group. LTA hospitalizations accounted for the longest average inpatient length of stay (6.3 days), ranging from 4.1 days among children aged 0-9 to 7.7 days among the elderly. The highest rate of hospital mortality was found in hospitalizations due to assaults (5%), ranging from 1.6% among children to 7.5% among the elderly. Average inpatient length of stay and hospital mortality showed an increase directly proportional to the increase in patients' age for all external causes of hospitalization.

Graph 4 – Hospital mortality (%) and average inpatient length of stay (days) due to external causes, by age group – Brazil, 2013

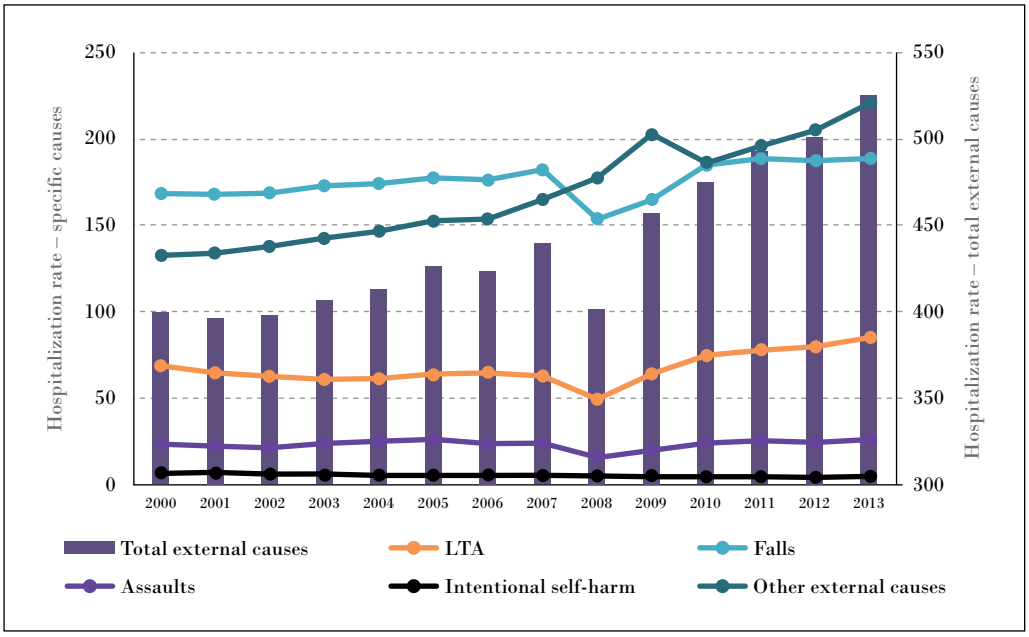


Source: *MS/SVS/SIH-SUS*.

Trends in hospital morbidity due to external causes – Brazil, 2000-2013

Over the fourteen year period (2000 a 2013), the rate of hospitalizations due to external causes in Brazil increased by 31.4%, from 400.1 hospitalizations per 10,000 inhabitants in the year 2000 to 525.7 hospitalizations per 10,000 inhabitants in 2013. Falls accounted for the highest mortality rates between 2000 and 2007, when they were overtaken by hospitalizations due to other external causes. LTA came in third place in deaths due to external causes, with an increasing hospitalization rate between 2009 and 2013. Assaults and intentional self-harm had the lowest hospitalization rates throughout the whole period analyzed (Graph 5).

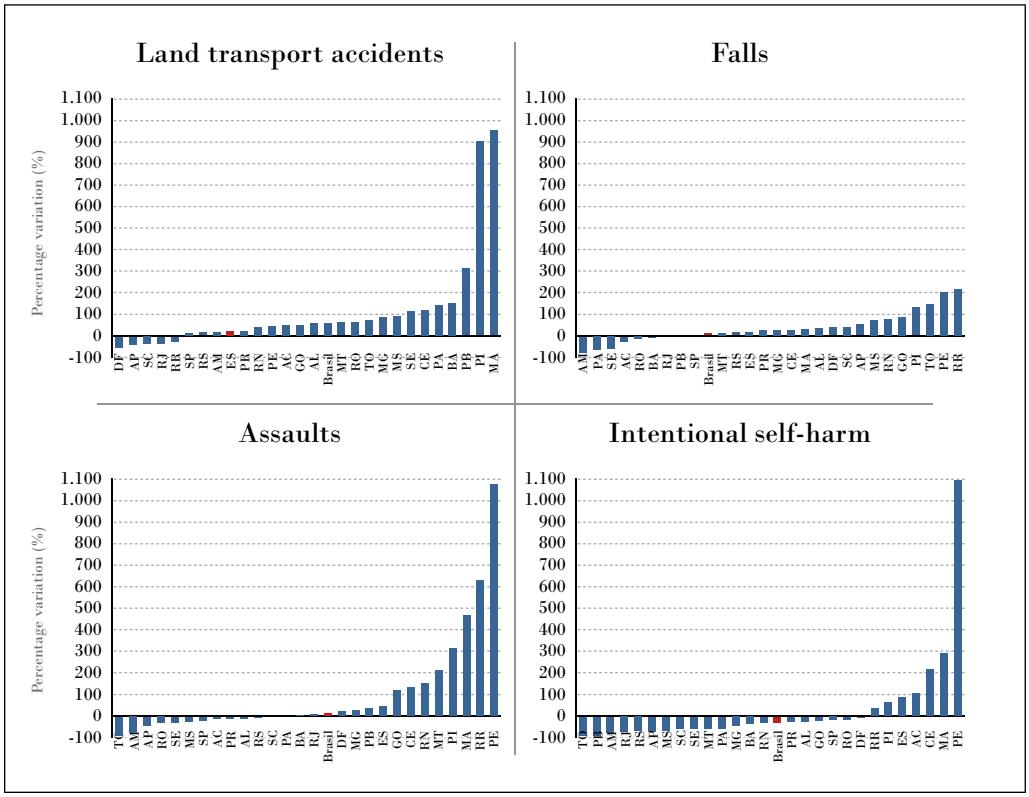
Graph 5 – Evolution of the crude hospitalization rate (per 10,000 inhabitants) due to external causes – Brazil, 2000-2013



Source: *MS/SVS/SIH/SUS*.
LTA: land transport accidents.

Graph 6 shows the percentage variation in the rate of hospitalizations due to specific external causes for Brazil and for the Federative Units. The LTA hospitalization rate went down in Amazonas, Maranhão, Rio de Janeiro, Rio Grande do Sul and in the Federal District, and increased in the remaining Federative Units, especially in Roraima, Pernambuco, Tocantins, Sergipe, Mato Grosso do Sul, Piauí and Mato Grosso. With regard to the hospitalization rate for falls, there was a decrease in the states of Amazonas, Pará, Sergipe, Acre, Rondônia, Bahia and Rio de Janeiro, whilst in Roraima, Pernambuco, Tocantins and Piauí the hospitalization rate more than doubled. The hospitalization rate for assaults decreased in several Federative Units, but showed a marked increase in Pernambuco, Roraima, Maranhão, Piauí, Mato Grosso, Rio Grande do Norte, Ceará and Goiás. There was also a reduction in the hospitalization rate for intentional self-harm in several Federative Units, although there was a considerable increase in Pernambuco, Maranhão and Ceará.

Graph 6 – Percentage variation in the crude hospitalization rate (per 10,000 inhabitants) due to external causes – Brazil and Federative Units, 2000-2013

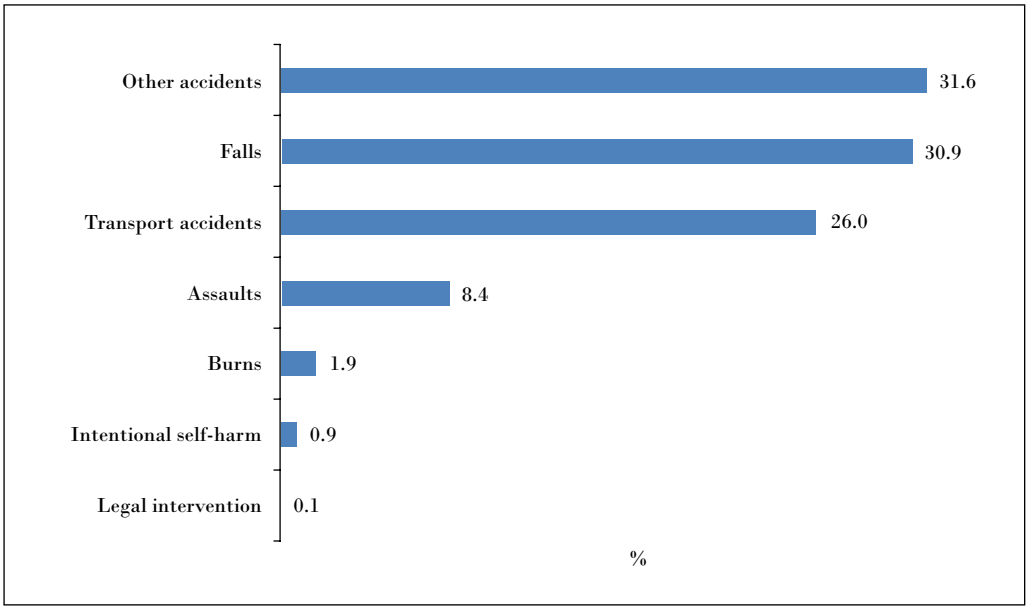


Source: *MS/SVS/SIH-SUS* and *IBGE*.
AC: Acre; AL: Alagoas; AM: Amazonas; AP: Amapá; BA: Bahia; CE: Ceará; DF: Distrito Federal; ES: Espírito Santo; GO: Goiás; MA: Maranhão; MG: Minas Gerais; MS: Mato Grosso do Sul; MT: Mato Grosso; PA: Pará; PB: Paraíba; PE: Pernambuco; PI: Piauí; PR: Paraná; RJ: Rio de Janeiro; RN: Rio Grande do Norte; RO: Rondônia; RR: Roraima; RS: Rio Grande do Sul; SC: Santa Catarina; SE: Sergipe; SP: São Paulo; TO: Tocantins.

Emergency care for external causes – State Capitals and Federal District, 2011

The *Viva* Survey 2011 was conducted in 71 urgency and emergency sentinel services in 24 state capitals and the Federal District. Excluding cases in which the type of occurrence was not informed (<1%), 47,455 cases were recorded, 42,958 (90.4%) of which were due to accidental causes and 4,497 (9.6%) were classified as events resulting from violence. Emergency care for falls came in first place (30.9%), followed by LTA (26.2%) and assaults (8.4%). Other accidents (suffocation, foreign bodies, drowning, poisoning/intoxication, injuries caused by sharp objects, injuries caused by firearms, accidents involving animals, objects falling on people, striking against objects/people, sprains, being crushed by objects) accounted for 31.6% of occurrences (Graph 7).

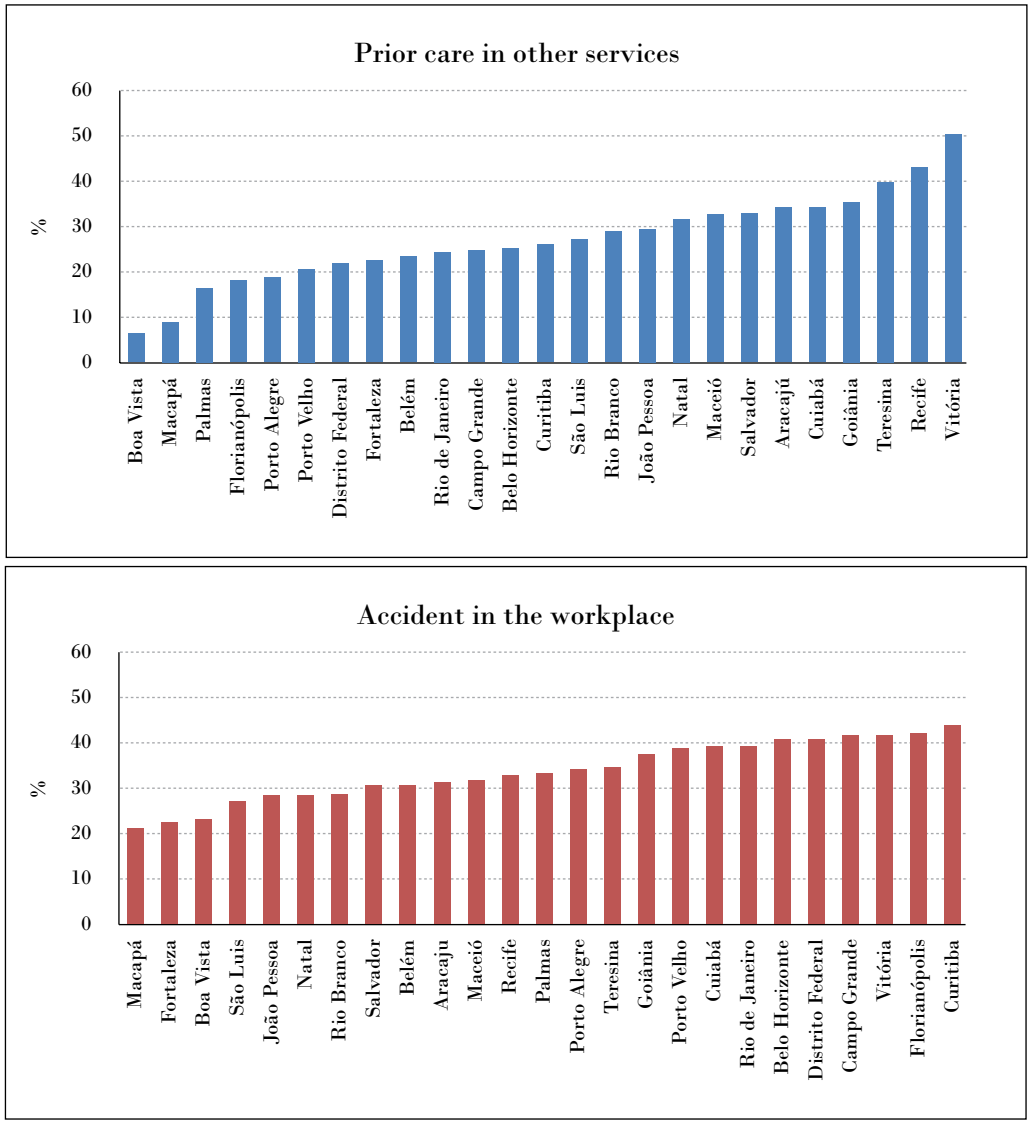
Graph 7 – Percentage distribution of emergency care for accidents and violence, by type of occurrence. State Capitals[a] and Federal District – Brazil, 2011



Source: *MS/SVS/VIVA* Survey 2011.
[a] Except Manaus/AM and São Paulo/SP.

It is important to highlight that the *Viva* Survey 2011 enabled unprecedented information to be obtained about emergency care for external causes in Brazil. For example, it was found that many victims of this type of event seek care at more than one health service. The proportion of prior care in other services for the same external cause varied between 6.6% in Boa Vista/RR and 50.6% in Vitória/ES. The proportion of care provided for accidents relating to work (accidents in the workplace) ranged from 21.2% in Macapá/AP to 44% in Curitiba/PR. Another important finding was the proportion of alcohol consumption in the six hours prior to the event. When looking at care provided for both accidents and violence, this proportion varied between 9.5% in Macapá/AP and 24.9% in Salvador/BA. The proportion of alcohol consumption in cases of care provided for violent causes is noteworthy and varied between 33.4% in Vitória/ES and 56.9% in Recife/PE (Graph 8).

Graph 8 – Selected characteristics of emergency care provided for accidents and violence. State Capitals[a] and Federal District – Brazil, 2011



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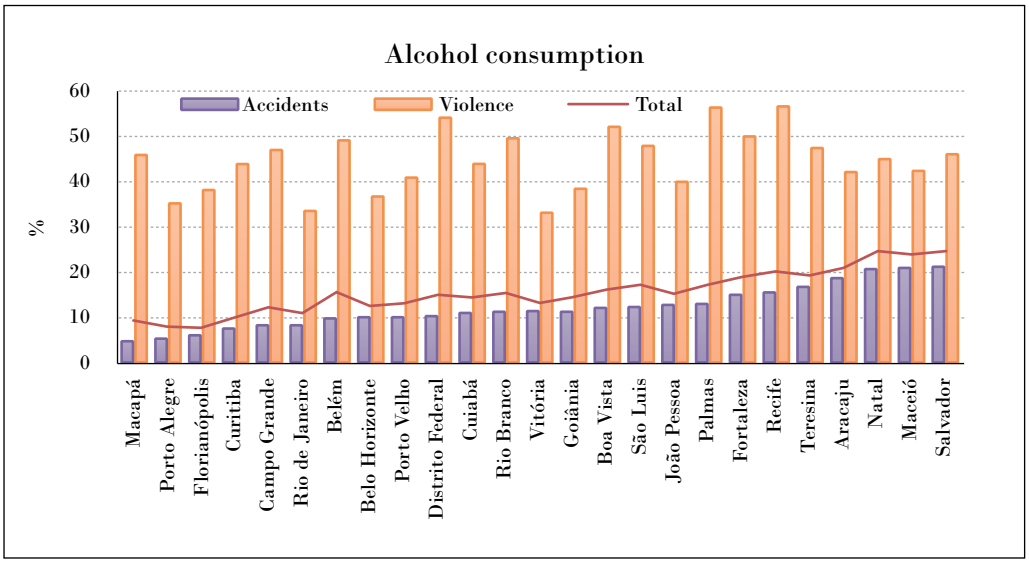
conclusion



Source: *MS/SVS/VIVA* Survey 2011.
[a] Except Manaus/AM and São Paulo/SP.

Discussion

Deaths due to external causes occurred predominantly among males, among people aged 20-39 and people with brown skin color. The first profile can be attributed to the exposure of young men to certain work activities with increased risk, alcohol consumption, aggressive behavior and dangerous driving.[7] With regard to ethnicity/skin color, this should not be considered a risk factor, but rather is related to vulnerability provoked by the adverse social insertion of some ethnic groups.[8]

Corroborating with the data presented in this study, the predominance of mortality due to assaults among total deaths due to external causes, in both youth and adults, is a phenomenon that has been studied considerably in recent decades, and has been recognized as a very complex problem with multiple causes. This phenomenon is associated with poor living conditions, family instability, lack of quality schooling opportunities and consequent difficulty in being placed on the formal employment market, barriers to moving up the social ladder, precarious leisure options and the enticement of drug trafficking and access to firearms.[7] These conditions determine and are reflected in different facets of social inequalities, this being a recurring reality in the lives of poor young adults in Brazil and who are frequently both victims and aggressors in terms of urban violence.

Studies with similar findings to those of this study explain predominant involvement of males aged 20-39 in situations of aggression owing to cultural gender issues.[5] Violence is often a way of solving conflicts among men. Moreover, these subjects may have violent behavior owing to troubled family and social factors, domestic violence, use of alcohol and drugs, low income, social isolation, among other factors.[5]

Accelerated industrialization and migratory movements have resulted in cities absorbing a large number of people, whilst this process has not been accompanied in a timely and sufficient manner by urban infrastructure and this has contributed to unleashing a series of social problems. Factors such as the increase in the number of vehicles, poor road maintenance conditions, lack of traffic control and impunity for offenders have contributed to the increase in LTA. Furthermore, drug trafficking and access to firearms in metropolitan regions and their spread to cities in the inner regions of the Brazilian states, which once were peaceful, characterize the increase of violence there.[2,7,9]

With regard to LTA, since the 1980s male adults have stood out as the main victims, above all those in the 20-39 age group. This association has been explained by different factors. Greater exposure of these subjects to jobs that require greater exposure to this form of accidents, such as professional bus and lorry drivers, travelling on business, the use of motorbikes to provide delivery services, among others. In addition, factors linked to behaviors proper to this group, arising from immaturity and inexperience, such as not obeying the highway code, spirit of defiance, the combination of alcohol and drugs with driving and speeding, can contribute to the greater occurrence of this type of accident.[7]

Notwithstanding, when it comes to risk of death (lethality), the elderly are the most affected age group. As such, the very process of growing old needs to be taken into consideration as it brings with it physiological alterations that interfere with elderly individuals' responses to trauma, making them susceptible to greater severity of the consequences of LTA.[10,11]

With regard to morbidity due to external causes, it must be emphasized that hospitalizations account for only part of all individuals affected. The statistics do not include victims who died at the place where the event occurred, or individuals with slight injuries that did not require hospital care. Nor do they include victims who paid for their hospital care or who were covered by private health insurances. Nevertheless, *SIH/SUS* hospitalizations reflect severe morbidity due to external causes in the population receiving *SUS* care.

A reduction in LTA hospitalization rates was observed after 1998 when the new Brazilian Highway Code was introduced. The Code established a variety of traffic-related measures, such as punishment of offenders, traffic education aimed at prevention and driver awareness-raising, among others. This factor clearly demonstrated how a sectorial policy can have impact on morbidity and mortality arising from the cause in question. In recent years, however, an increase in this indicator has been seen. As such it is important to enforce the measures the Code provides for, foster health promotion actions related to risk and protection factors with the aim of raising people's awareness about adopting safe and healthy habits. More recently the "Dry Law" (drink-driving) has been being put into effect and traffic control and penalties regarding the association between drinking and driving will be a primordial factor for inverting this scenario.[12,13]

Falls in elderly individuals are of particular concern owing to the high rates of associated morbidity and mortality, as well as the onus for *SUS* which has increasing expenditure with treatment for this type of injury.[14] Because of the harm falls cause, whether in the

form of bone fractures or flesh injuries, the impact on outpatient and inpatient care is noticeable both in the public and the private health systems.[15]

In addition to the direct impact of external causes on potential years of life lost, these conditions have repercussions on the incidence of disabilities and death among people of working age, with social, economic and family consequences. The costs of these events place an economic onus on the country as a whole, including with regard to health care, legal costs and lost productivity. The *SIH/SUS* System enables only part of hospital expenditure on external causes to be envisaged, and consideration also needs to be given to Health Sector expenditure on materials, equipment and human resources, as well as social security expenditure and outpatient expenditure in relation to emergency care.[16,17]

It is relevant to highlight that the quality of the information available for studying external causes in Brazil still needs to be improved. An example of this is the significant percentage of incomplete records with regard to the ethnicity/skin color variable on the *SIH/SUS* System, this being 6.6 times greater than the percentage of incomplete records for the same variable on the *SIM* System. There are also shortcomings in information quality with regard to the underlying cause of death and secondary diagnosis of occurrences arising from external causes, thus bolstering the "events of undetermined intent" and "other external causes" categories. Despite the evident increase in the use of information systems for the purpose of epidemiological analyses in Brazil in recent years, there needs to be continuous investment in improving the quality of filling in forms.[18,19]

The complexity surrounding the phenomenon of external causes requires the joint action of several sectors (health, education, the judiciary, traffic services, social work, among others) in order to channel prevention and promotion actions so as to obtain better quality of life on the individual, family, collective and cultural level with the aim of reversing this sad reality in Brazil.

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2 Mortality due to alcohol use in Brazil

Table of Contents

Abstract

Objectives: To describe the evolution of mortality due to diseases and injuries fully attributable to alcohol in Brazil.

Methods: Specific and standardized mortality rates due to underlying or associated causes fully attributable to alcohol use were described by sex, age group, ethnicity/skin color, region of the country and Federative Unit of residence between 2000 and 2013. Data on deaths was obtained from the Ministry of Health's Mortality Information System.

Results: Deaths with underlying and/or associated causes fully attributable to alcohol accounted for 2.5% of total deaths in the period. There were more deaths among men (3.8%) than women (0.7%). In both sexes there was a higher proportion of deaths in the 40-49 age group (27.9%) and Black/Brown skin color (48.8%). Alcoholic liver disease accounted for 54.6% of deaths with underlying cause fully attributable to alcohol. There has been an upward trend in specific mortality rates due to underlying and/or associated causes fully attributable to alcohol in age groups above 50-59 years, especially in people with brown skin color. Rates increased most in Brazil's Northeast region in the period 2000-2013.

Conclusion: Alcohol is a significant cause of premature death in Brazil, especially among men and people of Black/Brown skin color.

Keywords: Mortality Registries. Mortality. Alcohol-induced disorders. Alcohol-related disorders. Epidemiology, Descriptive. Temporal distribution.

Introduction

The World Health Organization (WHO) calculates that the harmful use of alcohol caused 3.3 million deaths in 2012. This means that 5.9% of all deaths worldwide are attributed to alcohol. Alcohol consumption is among the five main risk factors of premature death and disability and affects a considerable proportion of young people.[1]

Alcohol is the causal factor of more than 200 diseases and lesions described in the International Classification of Diseases (ICD-10). Among the health problems caused by alcohol are alcohol dependence, cirrhosis of the liver, cancer, cardiovascular diseases, neurological disorders, depression and greater exposure to accidents and violence.[1,2] Recently evidence has also indicated the contribution of alcohol to the occurrence of communicable diseases, such as tuberculosis.[2]

The influence of alcohol on health is also related to the pattern of its consumption. Chronic consumption can lead to dependence, resulting in mental disturbances, liver disease, cardiovascular diseases, neoplasms, among others. Episodic and acute alcohol use is an important risk factor for violence (assault, homicide, suicide), traffic and work accidents, among others.[1,3]

Apart from the drinking patterns, individual characteristics, such as metabolism, genetic vulnerability, age, sex and lifestyle influence the consequences of alcohol consumption on the body. Once absorbed, alcohol reaches all parts of the body, reducing motor co-

ordination and reflexes. Initially, alcohol produces a state of euphoria and disinhibition, but after consuming larger quantities it leads to the depression of the nervous system, although this varies depending on the amount consumed and individual sensitivity.[1,3,4,5,6]

The immediate effects of alcohol use have impact on almost all types of accidents owing to the reduction in psychomotor skills. Consumption of large quantities increases risk exponentially.[7] Heavy use on a single occasion also has an important relationship with suicide and violence.[8]

Mental disturbances related to alcohol use (abuse and dependence) form part of the neurological outcomes induced by alcohol.[1] Epilepsy is another disease that can be induced by alcohol, especially convulsions induced by withdrawal.[9] Gastrointestinal diseases are also important causes of death attributable to alcohol consumption, above all cirrhosis of the liver and chronic and acute pancreatitis.[1]

Evidence on the relationship between alcohol consumption and the risk of cancer has been documented since the 1990s,[10] although the mechanisms involved are not yet completely understood.[1] The main types of alcohol-related cancer are tumours in the oral cavity (mouth), pharynx, larynx, oesophagus, bowel, liver, pancreas, as well as breast cancer in women.[1,10]

The relationship between alcohol consumption and ischaemic heart/cerebrovascular diseases is complex and is linked to the amount consumed and pattern of use. Despite the controversial beneficial effects of the use of moderate quantities on reducing the risk of cardiovascular diseases,[2,11,12,13] the intake of alcohol over long periods of time can lead to high blood pressure, alcoholic cardiomyopathy, atrial fibrillation and haemorrhagic strokes.[2]

Globally, alcohol consumption varies widely. It is estimated that average per capita consumption is 6 litres a year, being higher in Europe (12.2 litres) and lower in the Middle East (0.6 litres). In Brazil the average consumption consumption is 8.8 litres per capita.[3] Although there is higher alcohol consumption and fewer abstemious people in high-income countries, the harm resulting from the use of these substances occurs mainly in developing countries.[1,3]

As such, the problem in countries in the Americas is greater than the global average. In Brazil, annual consumption of litres of pure alcohol per inhabitant aged over 15 is above the average for the Americas region. Moreover, alcohol use in Brazil is the third biggest risk factor contributing to the burden of disease.[14]

In 2014, via the Global Action Plan for the Prevention and Control of Noncommunicable Diseases, the WHO and the member states approved the target of reducing by 10% adult and adolescent alcohol consumption or morbidity and mortality due to alcohol.[15] It is therefore necessary to establish measures and public policies that help these targets to be met, as well as to strengthen systems that monitor alcohol consumption and morbidity and mortality patterns.

The objective of this study is therefore to describe the evolution of mortality due to diseases fully attributable to alcohol between 2000 and 2013, according to demographic variables and Brazil's Federative Units and regions.

Methods

The data source used in this descriptive study was the Mortality Information System (*SIM*) for the period 2000-2013. *SIM* was created in 1975 and computerized in 1979. It is the Brazilian Ministry of Health's oldest information system. The data provided by this system are the principal source of information about the causes of deaths in Brazil's municipalities, states and regions. All deaths occurring in the Brazilian territory must be registered on *SIM*, regardless of whether they occurred in hospitals or whether there was medical care.

Table 1 lists all conditions 100% attributable to alcohol or, in other words, disease conditions which could have occurred only as a result of alcohol consumption.

In order to calculate the number of deaths caused by alcohol, we used 78 ICD-10 codes which included the term alcohol in the name of the category or subcategory,[2,14] as per Chart 1. This study included all death certificates mentioning any of these codes.

Chart 1 – Alcohol-attributed diseases and conditions*

ICD-10	Disease
E24.4	Alcohol-induced pseudo-Cushing's syndrome
F10.0–F10.9	Mental and behavioural disorders due to use of alcohol
G31.2	Degeneration of nervous system due to alcohol
G62.1	Alcoholic polyneuropathy
G72.1	Alcoholic myopathy
I42.6	Alcoholic cardiomyopathy
K29.2	Alcoholic gastritis
K70.0–K70.4 e K70.9	Alcoholic liver disease
K85.2	Alcohol-induced acute pancreatitis
K86.0	Alcohol-induced chronic pancreatitis
O35.4	Maternal care for (suspected) damage to foetus from alcohol
P04.3	Foetus and newborn affected by maternal use of alcohol
Q86.0	Foetal alcohol syndrome (dysmorphic)
R78.0	Finding of alcohol in blood
X45.0–X45.9	Accidental poisoning by and exposure to alcohol
X65.0–X65.9	Intentional self-poisoning by and exposure to alcohol
Y15.0–Y15.9	Poisoning by and exposure to alcohol, undetermined intent
Y90.0–Y90.9	Evidence of alcohol involvement determined by blood alcohol level
Y91.0–Y91.9	Evidence of alcohol involvement determined by level of intoxication

Fonte: 10th Revision (ICD-10).
*As per the International Statistical Classification of Diseases and Related Health Problems - 10th Revision (ICD-10).

With regard to the description of death by cause, only records containing the above codes for the underlying cause of death were used. The data were stratified by year, sex, age group, ethnicity/color and Federative Unit of residence. Specific mortality rates were calculated by age group and sex, taking as the denominator the population estimates produced by the Brazilian Institute of Geography and Statistics (*IBGE*).

Linear interpolation taking data from the 2000 and 2010 censuses was used to obtain the size of the Brazilian population in the period 2000-2013 by age group, sex and ethnicity/color.

Standardized mortality rates were also calculated using the direct method with the aim of enabling mortality rates to be compared between Brazilian region and ethnicity/skin color over the period. The Brazilian population in 2010 was taken as the standard population for the standardization procedure.

The study was conducted exclusively with publicly available data, in compliance with National Health Council Resolution 466, dated December 12th 2012, which established regulatory guidelines and norms for research involving human beings.

Results

Deaths by underlying and/or associated cause fully attributable to alcohol in the period 2000-2013

Between 2000 and 2013, 219,205 deaths having as their underlying cause a disease fully attributable to alcohol and 367,954 deaths having this group of diseases with underlying and/or associated cause were registered in Brazil. As such, deaths having their underlying cause fully attributable to alcohol accounted for 1.5% of total deaths registered on the *SIM* System in the period, whilst deaths with underlying and/or associated cause attributable to alcohol accounted for 2.5% (Table 1).

In males, deaths having their underlying cause fully attributable to alcohol accounted for 2.3% of total deaths in the period, whilst deaths having their underlying and/or associated cause fully attributable to alcohol accounted for 3.8%. In females these proportions were lower, 0.4% and 0.7%, respectively. In both groups proportional mortality attributable to alcohol increased over the period, although variation was less in females (Table 1).

Table 1 – Number and proportional distribution (%) of deaths with underlying cause and with underlying and/or associated cause of death fully attributable to alcohol, by sex – Brazil, 2000-2013

Year	Total			Male			Female		
	N	% of deaths with underlying cause fully attributable to alcohol	% of deaths with underlying and/or associated cause fully attributable to alcohol	N	% of deaths with underlying cause fully attributable to alcohol	% of deaths with underlying and/or associated cause fully attributable to alcohol	N	% of deaths with underlying cause fully attributable to alcohol	% of deaths with underlying and/or associated cause fully attributable to alcohol
2000	948,666	1.2	1.9	552,127	1.9	3.0	393,606	0.3	0.5
2001	961,492	1.3	2.0	561,166	1.9	3.0	399,576	0.3	0.5
2002	982,807	1.3	2.0	571,402	2.0	3.1	410,737	0.3	0.5
2003	1,002,340	1.3	2.1	582,810	2.0	3.2	418,714	0.3	0.5
2004	1,024,073	1.4	2.2	593,750	2.1	3.4	429,625	0.3	0.6
2005	1,006,827	1.5	2.5	582,311	2.3	3.8	424,064	0.4	0.6
2006	1,031,691	1.5	2.5	593,786	2.3	3.9	437,429	0.4	0.7
2007	1,047,824	1.6	2.6	602,592	2.4	4.0	444,714	0.4	0.7
2008	1,077,007	1.6	2.7	619,278	2.5	4.2	457,269	0.4	0.7
2009	1,103,088	1.5	2.6	631,225	2.4	4.1	471,389	0.4	0.7
2010	1,136,947	1.6	2.7	649,378	2.5	4.2	487,137	0.4	0.8
2011	1,170,498	1.6	2.8	665,551	2.5	4.4	504,415	0.4	0.8
2012	1,181,166	1.6	2.8	670,743	2.4	4.4	509,885	0.4	0.8
2013	1,210,474	1.6	2.8	686,668	2.4	4.4	523,195	0.4	0.7
Total	14,882,920	1.5	2.5	8,562,787	2.3	3.8	6,311,755	0.4	0.7

Source: *SIM/SVS*.

A higher proportion of deaths with underlying or associated cause fully attributable to alcohol use can be seen in the 40-49 age group, both in males (27.8%) and females (29.0%) (Table 2).

Table 2 – Distribution of deaths with underlying and/or associated cause fully attributable to alcohol use, by age group and sex – Brazil, 2000-2013

Age group (years)	Male		Female		Total	
	N	%	N	%	N	%
<20	1,214	0.4	285	0.7	1,500	0.4
20-29	12,786	3.9	1,505	3.7	14,293	3.9
30-39	47,912	14.7	6,295	15.3	54,210	14.8
40-49	90,296	27.8	11,894	29.0	102,201	27.9
50-59	86,359	26.5	9,814	23.9	96,182	26.2
60-69	53,642	16.5	6,090	14.8	59,739	16.3
70-79	25,104	7.7	3,403	8.3	28,508	7.8
80 e +	8,070	2.5	1,779	4.3	9,850	2.7
Total	325,383	100.0	41,065	100.0	366,483	100.0

Source: *SIM/SVS*.
Note: 1,471 deaths with unknown age: 1,299 males; 131 females and 76 with sex unknown).

In both sexes, Black and Brown ethnicity/skin color had the highest proportion of deaths, comprising 47.7% males and 56.8% females. The ethnicity/skin color of 27,134 cases of deaths with underlying and/or associated cause fully attributable to alcohol use was not informed and accounted for 7.4% of total deaths registered with these causes (Table 3).

Table 3 – Distribution of deaths with underlying and/or associated cause fully attributable to alcohol use, by ethnicity/skin color and sex – Brazil, 2000-2013

Ethnicity/color	Male		Female		Total	
	N	%	N	%	N	%
White	145,329	44.5	13,986	34.0	159,319	43.3
Black	34,860	10.7	6,643	16.1	41,508	11.3
Yellow	1,099	0.3	125	0.3	1,224	0.3
Brown	121,010	37.0	16,770	40.7	137,791	37.5
Indigenous	791	0.2	185	0.5	978	0.3
Not informed	23,593	7.2	3,487	8.5	27,134	7.4
Total	326,682	100.0	41,196	100.0	367,954	100.0

Source: *SIM/SVS*.

Among the underlying causes of mortality studied, alcoholic liver disease contributed most to the total number of deaths the underlying cause of which was fully attributable to alcohol use, accounting for 54.6% (N=119,657) of deaths in the period. The second most common cause was mental and behavioral disorders due to use of alcohol, accounting for 40.3% (N=88,331) of deaths. The third main cause was alcoholic cardiomyopathy which accounted for 1.9% (N=4,179) of deaths. Deaths caused by intentional or accidental alcohol poisoning accounted for 0.5% of deaths fully related to alcohol in the period studied (N=1,119) (Table 4).

Table 4 – Absolute and relative (%) distribution of deaths with underlying cause fully attributable to alcohol use, by underlying cause – Brazil, 2000-2013

Causes	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total (N)	Total (%)
E24.4 Alcohol-induced pseudo-Cushing's syndrome	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0,0
F10.0-F10.9 Mental and behavioural disorders due to use of alcohol	4,771	5,044	5,096	5,213	5,762	6,351	6,627	6,943	7,313	6,834	7,073	7,335	6,944	7,025	88,331	40.3
G31.2 Degeneration of nervous system due to alcohol	19	36	20	21	29	36	103	86	115	113	115	155	137	133	1,118	0.5
G62.1 Alcoholic polyineuropathy	36	29	28	26	29	28	26	39	38	27	29	38	31	39	443	0.2
G72.1 Alcoholic myopathy	-	-	-	2	-	2	1	-	2	5	2	-	6	2	22	0.0
I42.6 Alcoholic cardiomyopathy	318	289	322	296	397	363	287	280	287	261	283	290	256	250	4,179	1.9
K29.2 Alcoholic gastritis	41	40	34	31	44	44	20	16	31	25	20	28	30	20	424	0.2
K70.0-K70.9 Alcoholic liver disease	6,419	6,520	7,053	7,074	7,513	7,974	8,429	8,885	9,394	9,318	9,918	10,311	10,377	10,472	119,657	54.6
K85.2 Alcohol-induced pancreatitis	-	-	-	-	-	-	-	-	-	103	346	359	375	401	1,584	0.7
K86.0 Alcohol-induced chronic pancreatitis	117	144	127	127	147	206	154	192	184	184	172	169	181	158	2.262	1.0

continues

conclusion

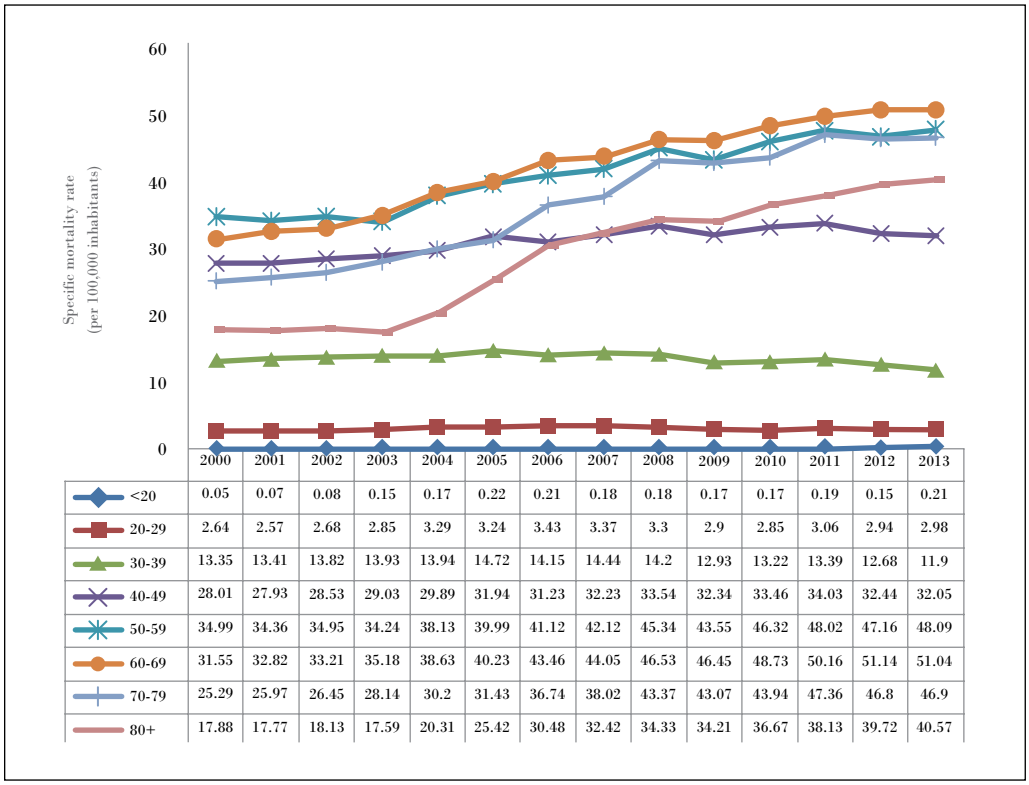
Causes	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total (N)	Total (%)
P04.3 Foetus and newborn affected by maternal use of alcohol.	2	3	5	5	4	5	2	4	5	3	2	3	7	2	52	0.0
Q86.0 Foetal alcohol syndrome (dysmorphic)	1	1	-	1	1	1	1	1	-	1	2	1	-	-	11	0.0
R78.0 Finding of alcohol in blood	-	-	-	-	-	-	1	-	-	-	-	-	-	1	2	0.0
X45.0-X45.9 Accidental poisoning by and exposure to alcohol	10	15	16	10	15	10	11	7	15	11	22	50	79	121	392	0.2
X65.0-X65.9 Intentional self-poisoning by and exposure to alcohol.	8	9	10	21	11	17	21	29	35	23	35	36	41	56	352	0.2
Y15.0-Y15.9 Poisoning by and exposure to alcohol, undetermined intent	12	16	15	19	10	16	18	22	20	21	24	42	56	84	375	0.2
Total	11,750	12,146	12,726	12,846	13,962	15,053	15,701	16,504	17,439	16,930	18,043	18,817	18,520	18,764	219,205	100.0

Source: *SIM/SVS*.

Risk of death due to diseases fully attributable to alcohol, 2000-2013, by age group

Specific mortality rates due to underlying and/or associated causes fully attributable to alcohol use remained stable in the under 20, 20-29, 30-39 and 40-49 age groups. In the other age groups analyzed mortality rates tended to increase, especially in groups aged over 60. The highest rates were found in the 60-69 age group, with 31.55 deaths per 100,000 inhabitants in 2000 and 51.04 deaths per 100,000 inhabitants in 2013 (Graph 1).

Graph 1 – Specific mortality rates (per 100,000 inhabitants) due to underlying or associated causes fully associated with alcohol use, by age group – Brazil, 2000-2013



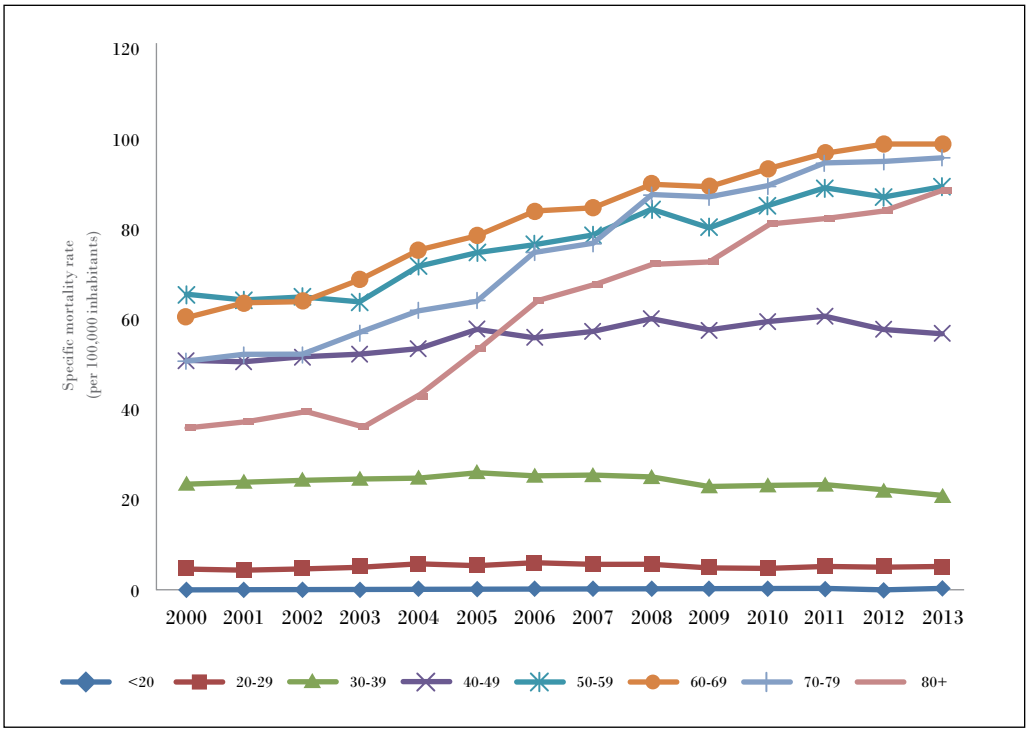
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<20	0.05	0.07	0.08	0.15	0.17	0.22	0.21	0.18	0.18	0.17	0.17	0.19	0.15	0.21
20-29	2.64	2.57	2.68	2.85	3.29	3.24	3.43	3.37	3.3	2.9	2.85	3.06	2.94	2.98
30-39	13.35	13.41	13.82	13.93	13.94	14.72	14.15	14.44	14.2	12.93	13.22	13.39	12.68	11.9
40-49	28.01	27.93	28.53	29.03	29.89	31.94	31.23	32.23	33.54	32.34	33.46	34.03	32.44	32.05
50-59	34.99	34.36	34.95	34.24	38.13	39.99	41.12	42.12	45.34	43.55	46.32	48.02	47.16	48.09
60-69	31.55	32.82	33.21	35.18	38.63	40.23	43.46	44.05	46.53	46.45	48.73	50.16	51.14	51.04
70-79	25.29	25.97	26.45	28.14	30.2	31.43	36.74	38.02	43.37	43.07	43.94	47.36	46.8	46.9
80+	17.88	17.77	18.13	17.59	20.31	25.42	30.48	32.42	34.33	34.21	36.67	38.13	39.72	40.57

Source: *SIM/SVS* and *IBGE*.

Specific mortality rates due to underlying or associated causes fully attributable to alcohol were higher among males than among females in all age groups. The rates remained stable in both sexes in the under 20, 20-29 and 30-39 age groups. In the 40-49 age group, however, the rates remained stable in males and showed a slight increase among females. Mortality rates increased in the other age groups studied, especially in those aged over 60 in both sexes. The highest rates were found in the 60-69 age group in males, with 60.79

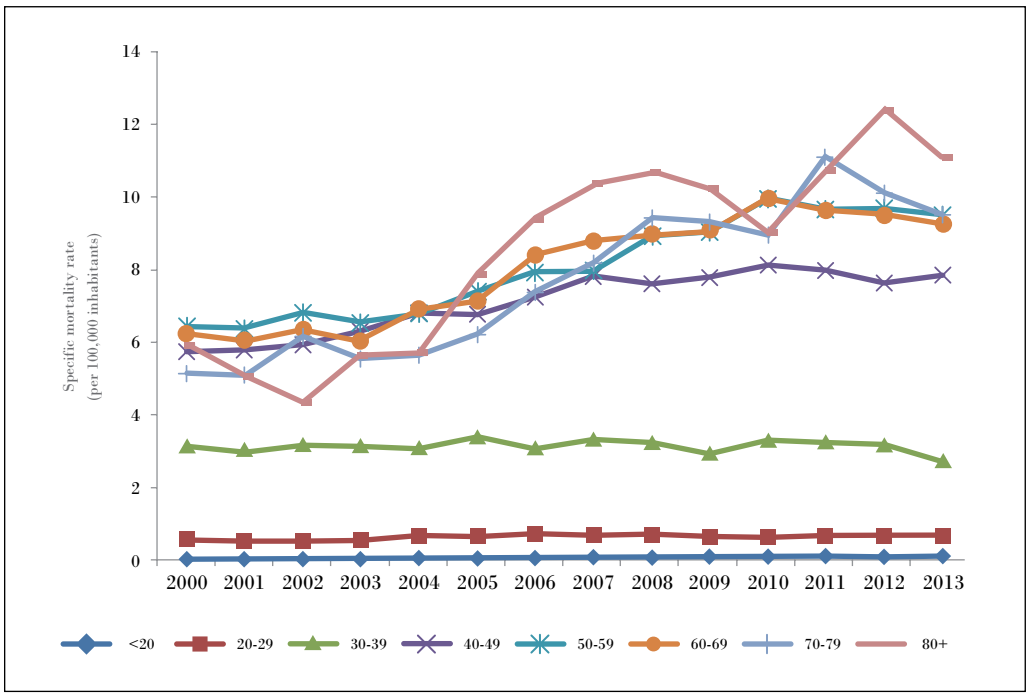
deaths per 100,000 inhabitants in 2000 and 99.48 deaths per 100,000 inhabitants in 2013, as well as in the 80 years and over age group among women, with 5.96 deaths per 100,000 inhabitants in 2000 and 11.11 deaths per 100,000 inhabitants in 2013 (Graph 2).

Graph 2a – Specific mortality rates (per 100,000 inhabitants) due to underlying or associated causes fully associated with alcohol use, by age group and sex – Brazil, 2000-2013



Source: *SIM/SVS* and *IBGE*.

Graph 2b – Specific mortality rates (per 100,000 inhabitants) due to underlying or associated causes fully associated with alcohol use, by age group and sex – Brazil, 2000-2013



Source: *SIM/SVS* and *IBGE*.

Risk of death due to diseases fully attributable to alcohol between 2000 and 2013, by race/colour

Black people had higher specific mortality rates due to underlying and/or associated causes fully attributable to alcohol use in the entire period studied. In the year 2000, the Brown skin color had the lowest rate (7.2 per 100,000), whilst with effect from 2005 the rates were lower for White skin color (13 per 100,000 in 2013). Increased rates were found in all categories between 2000 and 2013 (Table 5).

Table 5 – Specific mortality rates (per 100,000 inhabitants) due to underlying or associated causes fully associated with alcohol use, by age ethnicity/skin color – Brazil, 2000-2013

Year of Death	White	Black	Brown
2000	9.9	18.0	7.2
2001	10.0	18.9	7.7
2002	10.5	19.2	8.2

continues

conclusion

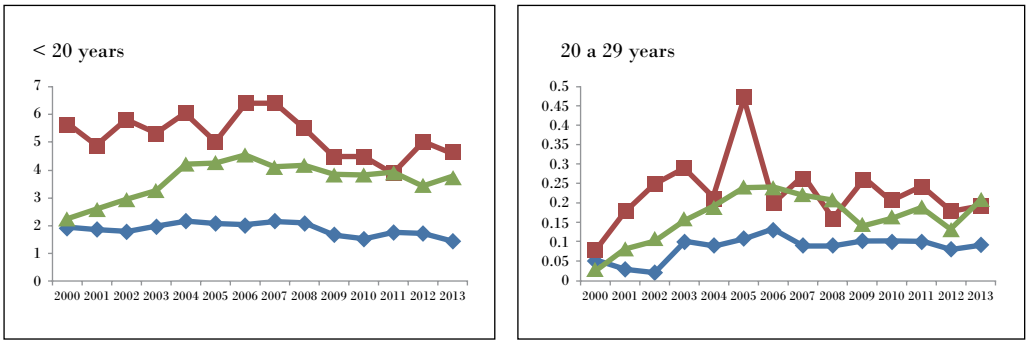
Year of Death	White	Black	Brown
2003	10.7	20.2	8.8
2004	11.5	21.6	9.8
2005	11.8	21.7	11.2
2006	11.7	21.5	12.0
2007	12.3	21.2	12.3
2008	12.8	21.9	13.6
2009	12.3	20.7	13.3
2010	12.7	22.6	14.3
2011	13.3	23.1	15.0
2012	13.1	22.3	15.1
2013	13.0	22.1	15.4

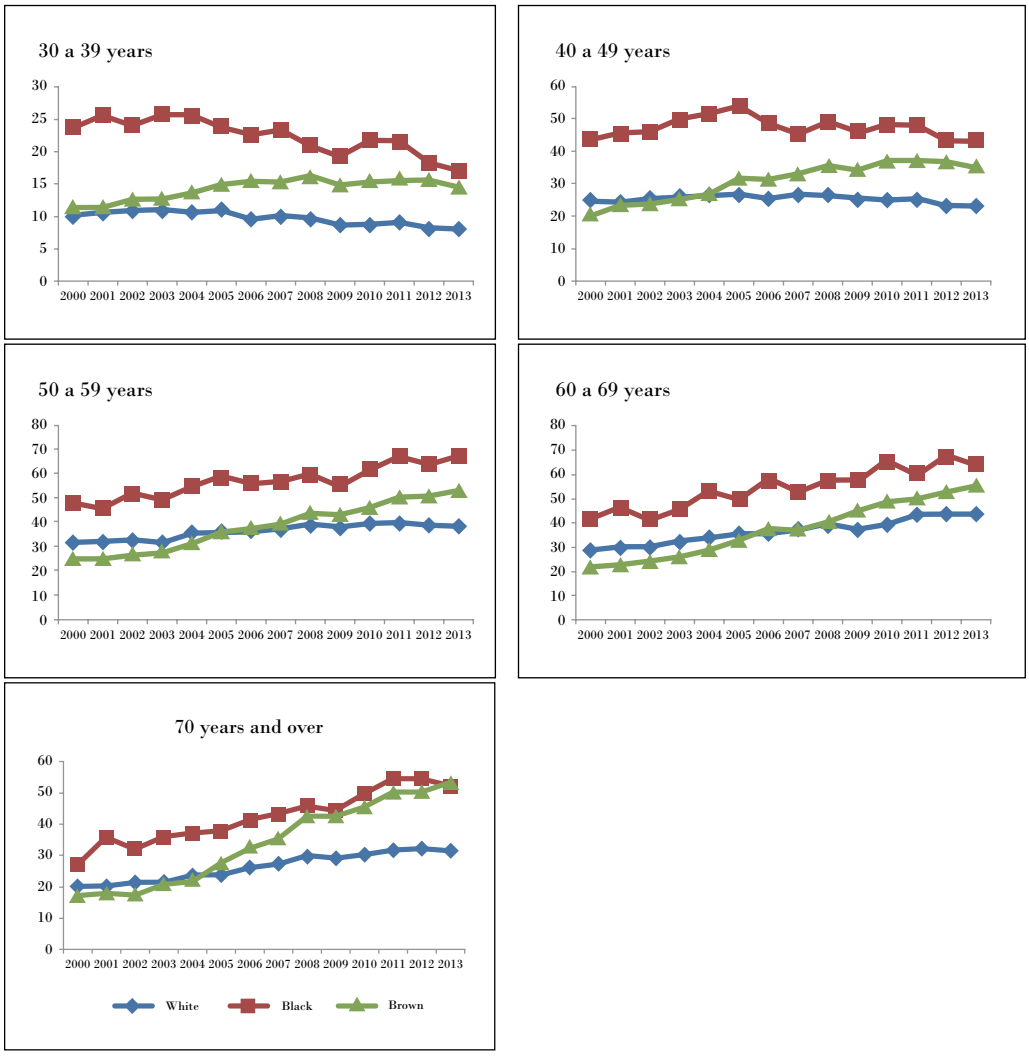
Source: *SIM*/*SVS* and *IBGE*.

Black people had higher specific mortality rates due to underlying and/or associated causes fully attributable to alcohol use in all age groups. People with brown and white skin color had similar rates in all age groups. Rates were stable in all age groups for white skin colour, whilst among people with brown and black skin color the curve is steeper, indicating greater growth in the rates, especially with effect from 40 to 49 years among people with brown skin color and with effect from 50 to 59 years among people with black skin color. The highest mortality rates in all ethnicity/skin color categories occurred in the 60-69 age group, which also showed increased rates in the period studied (Graph 3).

In the younger age groups more discrepancy was found between the mortality rates of black and white people, whereby on average the rates among black people were 2.7 times higher than those among white people in the period studied. These differences became less with effect from the 30-39 age group. In the 60-69 age group, the risk of dying as a consequence of diseases fully attributable to alcohol among black people was approximately 50% higher than among white people (Graph 3).

Graph 3 – Standardized mortality rates (per 100,000 inhabitants) due to underlying or associated causes fully attributable to alcohol use, by ethnicity/skin color and age group– Brazil, 2000-2013

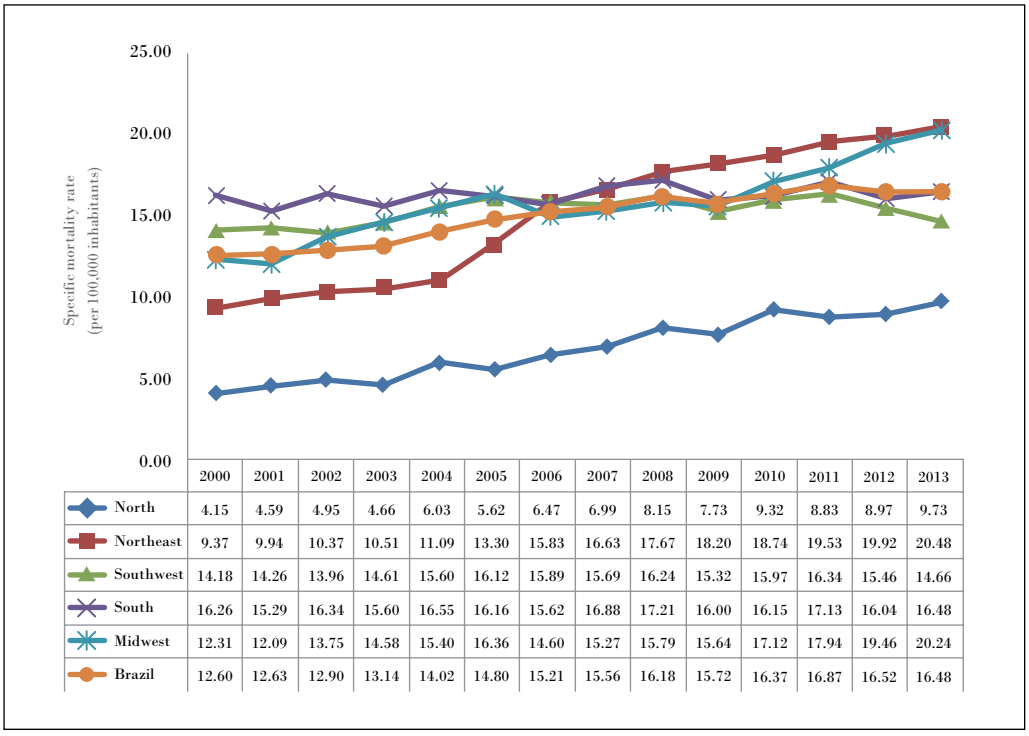




Source: *SIM*/*SVS* and *IBGE*.

The Brazilian standardized mortality rate due to underlying and/or associated causes fully attributable to alcohol use went up from 12.60 deaths per 100,000 inhabitants in 2000 to 16.48 deaths per 100,000 inhabitants in 2013. The lowest standardized mortality rates for the whole period were found in the North Region, possibly because of the lower coverage of the *SIM* System in that region. An increase in the standardized mortality rates can be seen in the North, Northeast and Midwest Regions. The Northeast Region had the highest increase in the period, with 9.37 deaths per 100,000 inhabitants in 2000 and 20.48 deaths per 100,000 inhabitants in 2013. The South and Southeast Regions had the lowest variations in the mortality rates found in this period (Graph 4).

Graph 4 – Standardized mortality rates (per 100,000 inhabitants) due to underlying or associated causes fully attributable to alcohol use, by region – Brazil, 2000-2013



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
North	4.15	4.59	4.95	4.66	6.03	5.62	6.47	6.99	8.15	7.73	9.32	8.83	8.97	9.73
Northeast	9.37	9.94	10.37	10.51	11.09	13.30	15.83	16.63	17.67	18.20	18.74	19.53	19.92	20.48
Southwest	14.18	14.26	13.96	14.61	15.60	16.12	15.89	15.69	16.24	15.32	15.97	16.34	15.46	14.66
South	16.26	15.29	16.34	15.60	16.55	16.16	15.62	16.88	17.21	16.00	16.15	17.13	16.04	16.48
Midwest	12.31	12.09	13.75	14.58	15.40	16.36	14.60	15.27	15.79	15.64	17.12	17.94	19.46	20.24
Brazil	12.60	12.63	12.90	13.14	14.02	14.80	15.21	15.56	16.18	15.72	16.37	16.87	16.52	16.48

Source: *SIM/SVS* and *IBGE*.

In the states of São Paulo, Rio Grande do Sul and Rio de Janeiro there was a decrease in standardized mortality rates due to underlying and/or associated causes fully attributable to alcohol use between 2000 and 2013, with negative variations of 17.4%, 7.2% and 4.3% respectively. On the other hand, the rates increased in the states of Maranhão, Piauí and Paraíba and had the highest percentage variation in the period (456.1%, 425.8% and 422.7%, respectively). In relation to Brazil as a whole, there was also an increase in the mortality rate fully attributable to alcohol, with a variation of 30.1% in the period. It must be highlighted that the variation in the rates, principally in the North and Northeast Regions must be viewed with caution, since it may also represent improved *SIM* coverage and not just increased deaths fully caused by alcohol (Table 6).

Table 6 – Standardized mortality rate (per 100,000 inhabitants), due to underlying and/or associated causes fully attributable to alcohol use and percentage variation in the period, by Federative Unit of residence – Brazil, 2000-2013

Federative Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Variation %
Rondônia	4.1	6.8	4.9	3.7	6.0	4.5	5.0	6.3	7.3	7.0	6.7	8.3	6.4	7.6	86.0
Acre	7.4	5.2	10.6	5.6	7.6	14.2	12.1	12.0	8.8	8.6	10.7	11.1	9.2	10.9	47.9
Amazonas	5.7	5.3	4.9	4.2	6.5	6.8	6.2	8.7	10.8	8.5	9.7	8.6	8.9	9.5	65.2
Roraima	4.6	7.6	4.9	4.3	8.9	5.8	9.1	3.5	10.0	8.3	11.3	12.1	6.4	7.1	54.8
Pará	2.7	3.0	3.3	3.8	4.3	3.6	5.0	5.1	5.6	5.2	5.9	5.7	6.3	7.2	162.9
Amapá	4.8	4.3	5.7	3.7	6.5	2.4	3.0	2.6	4.3	4.2	3.7	8.7	7.4	5.6	16.1
Tocantins	4.9	6.6	8.9	9.7	10.1	10.2	11.7	11.4	18.6	16.8	26.0	25.5	22.3	23.2	377.8
Maranhão	2.4	2.9	3.4	3.8	4.3	9.9	11.0	11.7	12.2	12.9	13.0	14.0	11.7	13.2	456.1
Piauí	3.3	4.4	7.2	7.9	6.0	7.8	14.0	14.9	15.9	16.2	14.4	15.0	15.4	17.4	425.8
Ceará	10.5	12.0	11.7	11.9	12.4	15.2	18.6	19.1	20.2	21.7	21.9	24.2	23.3	19.8	88.1
Rio Grande do Norte	9.6	9.5	10.3	10.1	10.1	12.5	13.1	13.4	14.0	14.5	15.9	15.9	15.9	16.3	70.5
Paraíba	4.1	4.9	5.4	7.9	9.1	12.9	13.8	14.2	18.7	19.4	21.4	20.9	19.8	21.4	422.7
Pernambuco	17.8	17.9	16.8	17.6	17.3	19.2	19.9	22.3	22.9	21.1	22.5	24.3	25.9	24.0	34.8
Alagoas	6.7	8.2	7.7	4.9	8.5	11.3	12.7	15.3	17.7	18.0	17.6	19.9	21.6	22.7	237.6
Sergipe	14.6	10.6	15.4	13.4	21.5	20.7	20.4	23.0	23.7	27.5	27.5	23.9	26.6	33.1	126.5
Bahia	7.7	8.4	9.2	8.9	8.8	9.2	13.2	12.8	14.5	13.9	14.5	15.6	15.6	18.1	136.2
Minas Gerais	14.6	15.3	15.9	18.6	20.1	21.2	20.4	21.0	21.5	20.8	21.8	22.5	22.9	19.7	34.8
Espírito Santo	11.7	11.6	14.6	17.3	21.9	23.9	22.7	26.2	25.6	23.7	25.5	24.8	24.5	25.4	117.0
Rio de Janeiro	9.2	9.1	8.4	8.3	9.4	9.4	9.5	10.2	10.9	9.6	10.1	9.6	8.5	8.8	-4.3
São Paulo	15.6	15.4	14.6	14.4	14.7	15.0	14.9	13.8	14.1	13.5	13.9	14.0	13.1	12.9	-17.4
Paraná	18.0	16.4	17.0	16.6	17.7	17.2	16.6	17.9	19.8	18.7	19.1	20.8	19.3	19.7	9.6
Santa Catarina	11.7	9.9	11.9	11.1	11.7	11.1	10.2	12.2	11.0	11.6	12.0	11.9	11.3	11.9	1.8
Rio Grande do Sul	15.8	15.7	16.6	15.7	16.6	16.4	16.2	16.9	16.3	14.6	14.3	14.4	14.3	14.7	-7.2
Mato Grosso do Sul	11.4	12.3	15.7	16.9	17.3	19.3	16.7	17.9	19.6	20.0	21.0	22.3	24.3	23.6	107.5
Mato Grosso	10.9	9.4	10.4	14.5	12.6	11.5	14.7	14.0	16.4	14.2	17.0	16.0	14.5	14.1	29.4
Goiás	11.4	12.2	13.2	12.8	14.5	16.0	13.4	14.0	14.8	14.0	15.4	17.2	19.1	20.5	80.4
Federal District	15.5	12.8	14.8	14.4	16.3	17.0	14.5	14.4	14.2	13.8	14.6	16.8	17.5	19.4	24.6
Brazil	12.3	12.3	12.5	12.8	13.6	14.4	14.7	15.1	15.8	15.2	15.8	16.4	16.0	15.9	30.1

Source: *SIM/SVS* and *IBGE*.
Note: The standard used to calculate the standardized mortality rate was the total Brazilian population in 2010.

Discussion

In the period between 2000 and 2013 almost 400,000 deaths with underlying and/or associated causes fully attributable to alcohol were recorded Brazil. An increase in deaths from this type of cause was found nationally, with a sharper increase in the states of the Northeast e North Regions.

It must be emphasized that the findings represent only part of the considerable problem of the impact of alcohol consumption on mortality, since the range of diseases and disabilities caused by alcohol goes beyond deaths fully associated with this substance and includes neoplasms, cardiovascular diseases, gastrointestinal diseases, infectious diseases such as tuberculosis, suicide, violence, land transport accidents and so on.[1,2,14]

It must also be highlighted that the increased mortality rates found coincide with the improvement in the quality of information on cause of death on death certificates and also with increased *SIM* System coverage, and may not therefore represent the true situation. Moreover, states with a better structured system, such as São Paulo and Rio de Janeiro, had reductions in specific mortality rates. Notwithstanding, the comparison of the estimated global burden of diseases attributed to different risk factors in 1990 and 2010 in a review study conducted by Lim et al. (2012), suggests that deaths attributed to alcohol have increased globally. According to the same study, this increase raised alcohol from eighth place among the main causes of death in 1990 to fifth place in 2010.[16]

The number of deaths was higher among men than among women, which is in in agreement with the literature[1,14,16,17] and also with the discrepancy in alcohol consumption between the sexes, given that men use this substance more frequently, regardless of the pattern of consumption [1,18,19,20] and greater frequency of problems related to alcohol consumption.[21]

The highest proportion of deaths was found in the black/brown skin color, as well as higher specific mortality rates due to underlying and/or associated causes fully attributable to alcohol use in all age groups. In a review study, Roerecke & Rehm[22] found that there is greater risk of death among people with disorders due to alcohol use. This may indicate that there is a greater proportion of people with problematic alcohol use in this group.

In a review study which included international research, Goto et al.[23] found positive association between racial discrimination and disorders related to alcohol consumption. It must also be emphasized that due to its more precarious socio-economic situation, this group has a heavy burden of risk factors which make it more vulnerable. Similarly, although they did not assess the ethnicity/ skin color variable in their study, Laranjeira et al.[21] found higher prevalence of alcohol abuse and dependence among individuals with less schooling and lower family income.

Although Brazil is a country with vast racial diversity, few studies have analyzed the relationship between alcohol consumption and its consequences and racial/ethnic differences. In a study they conducted in the state of Bahia, Almeida-Filho et al.[24] did not find a relationship between high risk alcohol consumption, defined as having at least one

episode of alcohol abuse a week, and the ethnic groups they studied. On the other hand, a study using *Vigitel* data found positive association between non-white skin colour and at least one episode of alcohol abuse per month, only among women.[20]

It must be emphasized that ethnic and racial inequalities existing in Brazil also produce health inequalities. Higher mortality due to alcohol use may be a reflection of this process. As such, the relationship between race/skin colour and alcohol use and dependence deserves to be studied in more depth in the Brazilian context both to avoid premature deaths and to reduce health iniquities.

Alcoholic liver disease was the mainly responsible for deaths due to underlying cause fully attributable to alcohol and this is in agreement with the results of a study conducted in the Americas.[14] A review study found that mortality due to this type of cause is on average three times higher than mortality due to alcohol-induced mental disorders.[22] In our study, the relationship between alcoholic liver disease and mental disorders due to alcohol use, the second main cause of death, was approximately 3/2. This may indicate underreporting of alcoholic liver disease cases in Brazil. The possible underreporting of this type of cause may be related to the social stigma associated with people dependent on alcohol, which in turn may lead patients and health professionals to resist accepting or using diagnosis in an adequate manner.[25]

On the other hand, around one thousand deaths were caused by acute alcohol poisoning. This points to the fact that a single occasion of abusive consumption, common in the initiation of young university freshers, can be fatal. Moreover, even on occasions when it does not lead to death, being drunk is strongly associated with all kinds of accidents and violence, especially among young men.[7,8]

With regard to age groups, despite the peak of mortality due to alcohol being in the 60-69 group, close to the life expectancy of the Brazilian population, an increasing trend of specific mortality rates due to underlying and/or associated causes fully attributable to alcohol use was found in the 50-59 age group, especially among people of brown race/skin color. This means that with every year that goes by alcohol contributes more to premature mortality in Brazil.[14]

Another important finding was the increase in the rates between 2000 and 2013 in some Brazilian regions, especially in the Northeast, where there was higher prevalence of alcohol abuse four days a month and the second highest prevalence nationwide of abusive alcohol consumption once a month, according to the National Health Survey.[19] The Northern Region had the lowest rates in the period, but it must be taken into consideration that despite improvements with the *SIM* System, a large proportion of deaths in this region continue to be classified with poorly defined causes.

It must be remembered that deaths associated with alcohol are avoidable and that interventions can be made to prevent them. The first action taken in Brazil in relation to alcohol occurred in 1941 with the aim of regulating the alcohol market by prohibiting the sale of alcoholic beverages to people aged under 18.[26] Advertising restrictions were later

brought into force by the Consumer Defence Code[27] and by Law No. 9294, dated July 15th 1996, in keeping with the provisions of the Federal Constitution.[28]

It was only in 2003 that the Ministry of Health implemented the Policy on Comprehensive Care for Users of Alcohol and Other Drugs. This policy was based on the principles of the Unified Health System (*SUS*) and the Psychiatric Reform. Its main guidelines are aimed at establishing and strengthening work through networks, in order to increase access to treatment, understand the problem in a comprehensive and dynamic manner, promote service users' rights, reduce harm and create day care services as an alternative to psychiatric hospitals – namely the Psychosocial Support Centres (*CAPS*) and the Alcohol and Drugs Psychosocial Support Centres (*CAPS-AD*).[29]

The National Policy on Alcohol came into force by means of Decree No. 6117, dated May 22nd 2007. The measures this policy provides for include specific actions for indigenous people and people living in agrarian reform settlements. It also provides recommendations on increasing the availability of treatment in the *SUS* network, as well as the revision of the contents about drinking and driving in courses for people who are learning to drive and for those who are renewing their driving licenses. The Decree also provides for the encouragement of the regulation, monitoring and inspection of advertising and publicity in relation to alcoholic beverages.[30]

Other important measures are the prohibition of drink-driving by means of the Dry Law (Law No. 11705, dated June 19th 2008) and the New Dry Law (Law No. 12760, dated December 12th 2012), which have resulted in a reduction in drink-driving.[31] Another recent initiative is the Life and Traffic Programme (*Programa Vida no Trânsito*), which is a partnership involving the Ministry of Health, the National Traffic Department, the Ministry of Justice, the Pan American Health Organization, the World Health Organization, the Bloomberg Foundation, among other partners, to reduce traffic accidents and promote the Decade of Action for Road Safety.[32]

In May 2010 the World Health Assembly approved the Global Strategy to Reduce the Harmful Use of Alcohol.[4] The strategy defines guidelines for the development and implementation of alcohol abuse prevention policies at all levels, as well as defining priorities for global action and urging the adoption of a set of political options for national implementation.

The strategy's recommendations include: structuring health counselling and treatment services; involving the community in the identification of needs and solutions; establishing policies for the control of blood alcohol concentration; reducing the availability of alcohol; regulating the marketing of alcoholic beverages; establishing price policies; reducing the negative consequences of alcohol consumption and intoxication; reducing the impact of illicit and informally produced alcohol on public health; and establishing alcohol monitoring and surveillance.[4]

Some of these measures have been implemented in Brazil, especially by means of the Plan to Combat Chronic Noncommunicable Diseases,[33] which sets targets for the reduction of alcohol consumption and reports on best evidence for alcohol reduction as recom-

mended by the World Health Organization:[4,15,34] a) strengthening the implementation of the pricing policy and increasing taxes on tobacco and alcohol-derived products, with the aim of reducing consumption; b) supporting the scaling up of surveillance measures relating to the sale of alcoholic beverages to the under-aged (<18 years); c) strengthening the educational measures of the Health in Schools Programme to prevent and reduce smoking and alcohol abuse among school students; d) supporting local initiatives to control the sale of alcohol, including defining times at which alcohol cannot be sold in bars and similar places.[33]

Finally, despite the progress already achieved in terms of policies, they need to be strengthened in order to be able to respond to the problems presented. To this end the involvement of a variety of stakeholders, governments, the legislative branch, health and education professionals, society, families and youth is important, with the aim of progressing with public policies and the legal framework on alcoholic beverages.

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3 Homicides in Brazil: mortality analysis from 2001 to 2013

Table of Contents

Abstract

Introduction: Mortality due to homicide is a matter of worldwide concern and is a priority in the agenda of researchers and public service managers. In Brazil in 2013 homicide was the third cause of death in the general population and the first cause of death in the 15-39 age group.

Objectives: To describe mortality due to homicide in Brazil, between 2001 and 2013, highlighting associated variables.

Methods: This is an observational descriptive study of mortality due to homicide and legal intervention in Brazil between 2001 and 2013 using data obtained from the Mortality Information System (*SIM*). Absolute and relative frequencies were calculated, as were specific and standardized mortality rates (per 100,000 inhabitants) and rate ratio between sexes.

Results: There were 56,214 deaths due to homicide in 2013, accounting for 37.8% of total deaths due to external causes, and the mortality rate was 28.1 deaths per 100,000 inhabitants. 91.7% of these deaths occurred in males, with an increasing trend in younger age groups. Rates were higher in the North and Northeast Regions and among people with black and brown skin colour.

Conclusion: The mortality rate due to homicide in Brazil remains high. Intervening in causes that lead to homicide requires encouraging, building and maintaining integrated public policies, partnerships, agreements, spaces and dialogue between Federative organs (municipalities, states and the Union) in the areas of health, public security, education, social work, sport, culture, labour and employment. It requires community participation. Intervention requires bringing the State closer to communities and families.

Keywords: Homicides. Mortality. Violence. Descriptive epidemiology.

Introduction

In 1932, Brearley,[1] in his book *Homicide in the United States*, when analyzing the mortality rate due to homicide, which was 9 per 100,000 inhabitants in the United States, made the following statement:

> [...] high mortality rates will probably continue high until there is a significant improvement in the regulation of firearm sales and ownership; issues concerning Black people and homicide is highly confused with other problems and a special investigation is urgently needed; homicide appears to be associated with the rapid growth of the population and of cities.

Brearley affirms the importance of firearm control in preventing homicide and highlights the need to enhance the investigation of social phenomena related to the race of victims and the unwieldy growth of populations and cities.

Mortality due to violence is of worldwide concern and is a priority in the agenda of researchers and public service managers, in particular mortality due to homicide. The United Nations Organization's (UN) Global Status Report on Violence Prevention[2] shows an estimated 475,000 deaths due homicide worldwide in 2012, with 60% among males aged 15-44, making homicide the third main cause of death among males in this age group.

Despite being a global phenomenon, homicides have a heterogeneous distribution among geographic zones and social groups, sex, race, age and social class. Over the period between 2000 and 2012, mortality rates due to homicide showed a global fall of just over 16%, but varied greatly depending on the income level in the countries. The homicide rate fell 39% in high-income countries, 13% in middle-income countries and just 10% in low-income countries. The aforementioned UN report also estimates that 165,617 deaths in developing countries in Latin America and the Caribbean were due to homicide, and that three-quarters of these deaths were due to firearms (2012 data).

Specifically in relation to the countries of the South American region, Brazil has the third highest mortality due to homicide after Venezuela and Colombia. In absolute numbers there were 47,136 deaths due to homicide in Brazil, accounting for approximately 10% of deaths due to homicide worldwide.

Violence places great pressure on health systems, criminal justice systems and social and welfare services. The social burden of death due to violence directly affects individuals and communities and is increasingly identified as a factor that corrodes political and economic development. Violence, fear and insecurity generate heavy economic costs in terms of direct expenditure on health care and indirect costs which can include insurance, commerce or transport, working hours and altered urban mobility. This is the conclusion reached by Ingram[3] in his study on the geography of violence in Brazil.

Violence in general, and homicide in particular, generate even more serious costs for democracy and its institutions, since it nurtures the fear that destroys public and interpersonal confidence, breaks down relations of citizenship and hampers citizens' participation in public life. This atmosphere of persistent insecurity can generate support for authoritarian politicians, who structure the problems in isolation based on their consequences and the culpability thereof, without intervening in their determinants.

As Carneiro[4] states, violence is the privation of rights, a long-standing object of study and curiosity of diverse areas of knowledge, such as Philosophy, Sociology, Anthropology, Psychology, Law and Health, and, in particular, Public Health.

Understanding and intervening in the determinants of violence, especially homicide, is a complex challenge for those who study public health. This is what Minayo[5] teaches us, in her study entitled *Visão ecossistêmica do homicídio* (An Ecosystemic View of Homicide) in which she concludes that regardless of the level of homicide rates:

> [...] there is a synergy between the external environment (macrosocial and macroeconomic policies), the social system (social organization, local government, community participation) and subjectivity, whether in the construction of solidarity, or in social disintegration.[5]

Methods

This is an observational descriptive study of mortality data due to homicide in Brazil between 2001 and 2013.

The source of the data used on mortality due to homicide is comprised of the records held on the Ministry of Health's Mortality Information System (*SIM*).[6]

Mortality rates were calculated using Brazilian Institute of Geography and Statistics (*IBGE*) population estimates available on the Health Ministry's website.[7] Both crude rates (specific rates by age group, for each sex/race) and standardized rates (for total age by sex – male, female and total, and also for each race) were calculated, using the direct method of standardization and the standard population was the total population of the 2010 Census.

The case definition for the purposes of analysis was based on the Qualification Form used by the Interagency Health Information Network (*RIPSA*)[8] regarding the specific mortality rate due to external causes. This form defines homicides as deaths with the underlying cause of which classified according to the codes contained in Chapter XX, external causes of morbidity and mortality, of the International Classification of Diseases - 10th Revision (ICD-10),[9] namely assaults (X85-Y09) and legal interventions (Y35-Y36).

Legal intervention consists of all cases of homicide resulting from the action of the police, the military or other agents of the law when on duty, including war operations.

The total number of deaths registered on the *SIM* System in 2013 was used in order to identify the position of external causes on the ranking of the main groups of causes of death by age group that year.

The descriptive variables selected for all the other analysis were sex (male, female), age group in years (0-9, 10-14, 15-19, 20-24, 25-29, 30-39, 40-49, 50-59, 60 and over), race/colour (white, black, yellow, brown, indigenous), schooling (none, 1-3 years, 4-7 years, 8-11 years, 12 and over, not informed), geographic macroregions (North, Northeast, Southeast, South and Midwest), Federative Units and, in some situations, large municipalities.

Homicides were regrouped according to the type of assault, as follows:

- Assault by firearm: X93-X95.
- Assault by substances: X85-X90.
- Assault by bodily force: X91-X92, Y04-Y05.
- Assault by sharp/blunt object: X99-Y00.
- Assault by unspecified means: Y08-Y09.
- Legal intervention: Y35-Y36.
- Neglect and maltreatment: Y06-Y07.

- Assault related to the use of fire: X96-X98.
- Other forms of assault: Y01-Y03.

Results

In 2013, in Brazil, according to data held on the Ministry of Health's Mortality Information System (*SIM*),[6] external causes are the third cause of death in the general population and the first cause on the 15-39 age group, whereby 91.7% of victims were male and 60.7 % had brown skin colour.

In the same year there were 56,214 deaths due to homicide, accounting for 37.8% of total deaths due to external causes. The homicide mortality rate was 28.1 deaths per 100,000 inhabitants. Some 51,524 or 91.7% of these deaths occurred among men, with an estimated specific mortality rate by sex of 51.7 deaths per 100,000 inhabitants. Women accounted for 8.3% of deaths and a mortality rate of 4.6 per 100,000 inhabitants (Table 1).

In terms of geographic region of residence, the Northeast Region had the highest mortality rate due to homicide with 39.6 deaths per 100,000 inhabitants and 21,946 cases. The specific mortality rate for the male in this Region was 74.4 deaths per 100,000 inhabitants, well above the national rate which was 51.7 deaths per 100,000 inhabitants, and resulted in the country's highest male / female rate ratio (13.3 : 1). The Midwest Region had the highest specific mortality rate for the female with 6.5 deaths per 100,000 inhabitants, above the national rate of 4.6 deaths per 100,000 inhabitants. Moreover, the male / female ratio of homicide rates in the most affected age group (20-24 years) was 15.1 : 1 (Table 1).

Regarding age groups, homicides mainly affected young people aged 15-29, with the highest rate in the 20-24 age group. The male rate in this latter group was 124.6 deaths per 100,000 inhabitants, more than double the national male rate of 51.7 deaths per 100,000 inhabitants. In 2013 the rate in the 15-19 age group was 56.3 deaths per 100,000 inhabitants, and in the period comprising 2011-2013 this group showed the highest proportional increase, overtaking the 25-29 age group, as shown in Table 1 and Graph 3.

In relation to race/colour, the highest rate of homicides occurred among people with brown skin colour (37.6 per 100,000 inhabitants) and among men with brown skin colour the rate was 69.4 per 100,000 inhabitants. Most female homicides occurred among indigenous women, with a rate of 9.5 deaths per 1,000 inhabitants.

With regard to schooling, homicides were proportionally more frequent among people with between four and seven years of schooling, or incomplete elementary education, accounting for 34.5% of occurrences.

Some 70.8% of homicides were due to assault by firearm and the frequency ratio between men and women was 16.4 : 1.

Table 1 – Number, proportional distribution (%) and crude and standardized mortality rates due to homicide – Brazil, 2013

Variable	Total			Male			Female			Rate Ratio (M/F)	Freq. Ratio (M/F)
	N	%	Rate	N	%	Rate	N	%	Rate		
Total	56,214	100.0	28.1	51,524	91.7	51.7	4,679	8.3	4.6	11.2	11.0
Geographic Region											
North	5,948	10.6	35.6	5,447	10.6	64.4	498	10.6	6.0	10.7	10.9
Northeast	21,946	39.0	39.5	20,406	39.6	74.4	1,535	32.8	5.4	13.7	13.3
Southeast	16,909	30.1	20.2	15,349	29.8	36.8	1,558	33.3	3.6	10.1	9.9
South	5,957	10.6	20.9	5,371	10.4	37.6	585	12.5	4.0	9.3	9.2
Midwest	5,454	9.7	35.5	4,951	9.6	64.5	503	10.8	6.5	9.9	9.8
Age Group											
0-4	253	0.5	1.7	135	0.3	1.7	117	2.5	1.6	1.1	1.2
5-9	100	0.2	0.6	63	0.1	0.8	37	0.8	0.5	1.6	1.7
10-14	721	1.3	4.2	595	1.2	6.8	126	2.7	1.5	4.5	4.7
15-19	9,649	17.2	56.3	9,001	17.5	103.4	648	13.8	7.7	13.5	13.9
20-24	11,473	20.4	67.1	10,772	20.9	124.6	700	15.0	8.3	15.1	15.4
25-29	9,567	17.0	54.6	8,914	17.3	101.3	651	13.9	7.5	13.6	13.7
30-39	12,715	22.6	39.4	11,620	22.6	72.2	1,090	23.3	6.7	10.7	10.7
40-49	6,409	11.4	24.6	5,777	11.2	45.2	631	13.5	4.8	9.5	9.2
50-59	3,188	5.7	15.7	2,849	5.5	29.1	338	7.2	3.2	9.1	8.4
60-69	1,306	2.3	10.4	1,130	2.2	19.5	176	3.8	2.6	7.4	6.4
70 +	833	1.5	8.7	668	1.3	16.9	165	3.5	2.9	5.7	4.0
Not informed	11	0.0	-	-	-	-	-	-	-	-	-
Race/Colour											
Yellow	65	0.1	2.3	51	0.1	4.1	14	0.3	0.9	4.7	3.6
White	14,088	25.1	15.6	12,531	24.3	28.4	1,555	33.2	3.3	8.6	8.1
Indigenous	193	0.3	22.5	143	0.3	35.3	50	1.1	9.5	3.7	2.9
Brown	34,098	60.7	37.6	31,592	61.3	69.4	2,501	53.5	5.5	12.5	12.6
Black	4,407	7.8	26.1	4,079	7.9	45.4	328	7.0	4.1	11.1	12.4
Not informed	3,363	6.0	-	3,128	6.1	-	231	4.9	-	-	13.5
Schooling											
None	1,959	3.5	-	1,776	3.4	-	183	3.9	-	-	9.7
1-3	9,911	17.6	-	9,281	18.0	-	630	13.5	-	-	14.7
4-7	19,413	34.5	-	18,008	35.0	-	1,405	30.0	-	-	12.8
8-11	9,541	17.0	-	8,623	16.7	-	918	19.6	-	-	9.4
12 +	1,111	2.0	-	903	1.8	-	208	4.4	-	-	4.3
Not informed	14,279	25.4	-	12,933	25.1	-	1,335	28.5	-	-	9.7

continues

conclusion

Variable	Total			Male			Female			Rate Ratio (M/F)	Freq. Ratio (M/F)
	N	%	Rate	N	%	Rate	N	%	Rate		
Type of Assault											
Assault by firearm	39,792	70.8	-	37,508	72.8	-	2,284	48.8	-	-	16.4
Assault by bodily force	1,578	2.8	-	1,175	2.3	-	403	8.6	-	-	2.9
Assault by sharp/blunt object	11,690	20.8	-	10,133	19.7	-	1,557	33.3	-	-	6.5
Assault by unspecified means	1,969	3.5	-	1,702	3.3	-	267	5.7	-	-	6.4
Legal intervention	580	1.0	-	573	1.1	-	7	0.1	-	-	81.9
Assault by substances	54	0.1	-	35	0.1	-	19	0.4	-	-	1.8
Neglect and maltreatment	153	0.3	-	115	0.2	-	38	0.8	-	-	3.0
Assault related to the use of fire	241	0.4	-	168	0.3	-	73	1.6	-	-	2.3
Other forms of assault	146	0.3	-	115	0.2	-	31	0.7	-	-	3.7
Not informed	11	0.0	-	-	-	-	-	-	-	-	-

Source: *SIM*.

Table 2 shows the ranking of the state capitals. First among the ten highest ranking state capitals are capitals of the Northeast Region (Maceió, Fortaleza, São Luís and João Pessoa), followed by the Northern Region (Belém and Manaus) and the Midwest Region (Goiânia).

Table 2 – State capital city ranking, by standardized homicide rate per 100,000 inhabitants – Brazil, 2013

Ranking	UF	Capital	Rate	Population
1st	AL	Maceió	82.59	996,733
2nd	CE	Fortaleza	80.86	2,551,806
3rd	MA	São Luís	67.97	1,053,922
4th	PB	João Pessoa	62.24	769,607
5th	PA	Belém	56.21	1,425,922
6th	RN	Natal	55.68	853,928
7th	BA	Salvador	50.67	2,883,682
8th	SE	Aracaju	44.79	614,577
9th	GO	Goiânia	44.60	1,393,575
10th	AM	Manaus	42.22	1,982,177

continues

conclusion

Ranking	UF	Capital	Rate	Population
11th	RR	Boa Vista	41.83	308,996
12th	PI	Teresina	40.11	836,475
13th	ES	Vitória	39.45	348,268
14th	MT	Cuiabá	37.87	569,830
15th	AC	Rio Branco	37.77	357,194
16th	RS	Porto Alegre	36.74	1,467,816
17th	RO	Porto Velho	35.34	484,992
18th	MG	Belo Horizonte	34.57	2,479,165
19th	AP	Macapá	32.48	437,256
20th	PE	Recife	30.71	1,599,513
21st	PR	Curitiba	28.84	1,848,946
22nd	DF	Brasília	26.88	2,789,761
23rd	TO	Palmas	23.29	257,904
24th	RJ	Rio de Janeiro	21.44	6,429,923
25th	MS	Campo Grande	16.66	832,352
26th	SP	São Paulo	14.01	11,821,873
27th	SC	Florianópolis	11.75	453,285

Source: *SIM*.

Chart 1 shows mortality rate ranking by defined cause of death and age group. Homicide can be seen to be the first cause of death in the 15-19, 20-29 and 30-39 age groups and is the second cause of death in the 10-14 age group.

Chart 1 – Mortality rate ranking by defined cause and age group – Brazil, 2013

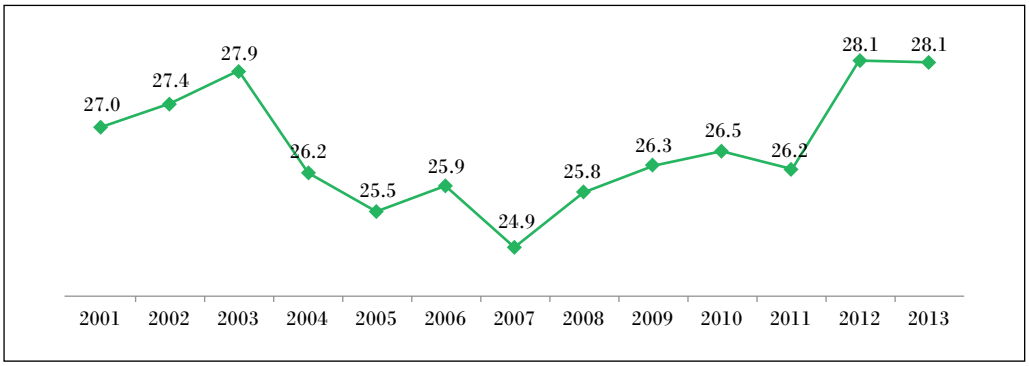
Ranking	0-9	10-14	15-19	20-29	30-39	40-49	50-59	60 +
1st	Accidents	Accidents	Homicides	Homicides	Homicides	Malignant neoplasms	Malignant neoplasms	Malignant neoplasms
2nd	*Influenza and pneumonia*	Homicides	Accidents	Accidents	Accidents	Heart diseases	Heart diseases	Heart diseases
3rd	Malignant neoplasms	Malignant neoplasms	Malignant neoplasms	Malignant neoplasms	Malignant neoplasms	Accidents	Cerebrovascular diseases	Cerebrovascular diseases
4th	Heart diseases	*Influenza and pneumonia*	Heart diseases	Heart diseases	Heart diseases	Homicides	Accidents	*Influenza and pneumonia*
5th	Homicides	Heart diseases	*Influenza and pneumonia*	*Influenza and pneumonia*	Cerebrovascular diseases	Cerebrovascular diseases	Diabetes *mellitus*	Diabetes *mellitus*

Source: *SIM*.

According to Graph 1, the mortality rate due to homicide nationwide showed slight annual variations between 2001 and 2013, with an increase over the total period of 1.1 deaths per 100,000 inhabitants (varying from 27 to 28.1), although with a sharp rise

between 2011 and 2012, when there was an increase of 1.9 deaths per 100,000 inhabitants (varying from 26.2 to 28.1), continuing with the same rate in 2013. The rates can be seen to rise between 2001 and 2003, followed by a fall between 2003 and 2007, and then rising once more.

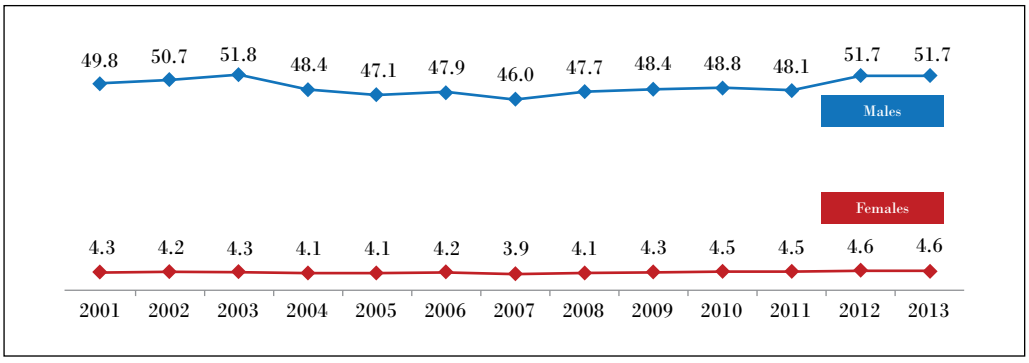
Graph 1 – Standardized mortality rate due to homicide – Brazil, 2001-2013



Source: *SIM*.

Regarding the mortality rate by sex, over the thirteen years period, the rate was stable among females but rose among males, more so between 2011 and 2012, and continuing the same in 2013 (Graph 2).

Graph 2 – Standardized mortality rate due to homicide, by sex – Brazil, 2001-2013



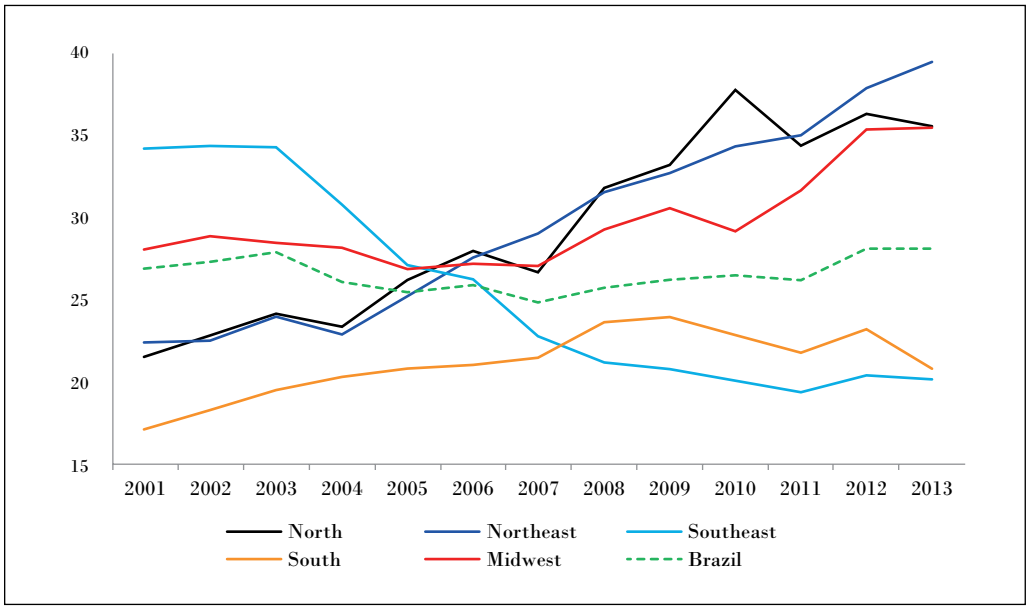
Source: *SIM*.

In relation to geographic region, over the period between 2001 and 2013 there was a sharp fall in the mortality rate due to homicide in the Southeast Region, from 34.2 deaths per 100,000 inhabitants in 2001 to 20.2 in 2013. In the Southern Region the mortality rate due to homicide increased between 2001 and 2009 and then decreased. Between 2001 and

2007 the Southern Region had the lowest rate among the country's five regions, but from 2008 the Southeast Region became the region with the lowest homicide rate (Graph 3).

From 2004, there was a sharp rise in the mortality rate due to homicide in the Northeast Region and then in the Northern Region. In the Midwest Region the sharpest growth began in 2008 and by 2013 it was in third place among the regions with the highest mortality rate due to homicide (35.5 deaths per 100,000 inhabitants), being very close to the Northern Region which had a rate of 35.9 deaths per 100,000 inhabitants.

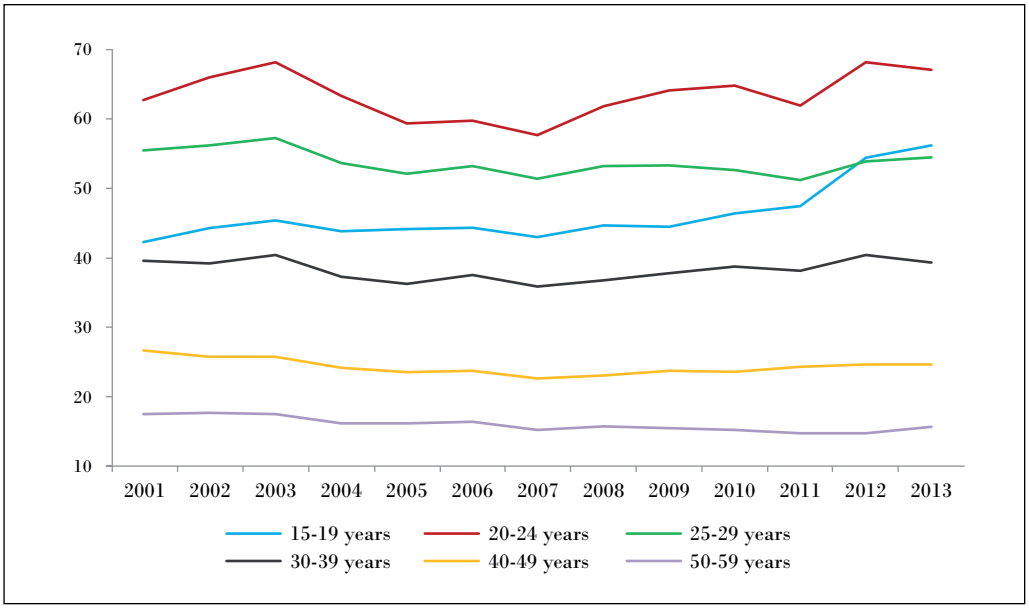
Graph 3 – Standardized mortality rate due to homicide, by geographic region – Brazil, 2001-2013



Source: *SIM*.

Graph 4 shows the evolution of mortality rates due to homicide by age. In the thirteen year period, the 20-24 age group was the most affected and from 2012 people aged 15-19 became the second most affected age group.

Graph 4 – Standardized mortality rate due to homicide, by main age groups – Brazil, 2001-2013



Source: *SIM*.

Regarding the mortality rate due to homicide in medium and large sized cities, as shown in Figure 1, a greater concentration can be seen in 2001 in cities in the states of São Paulo, Rio de Janeiro, Espírito Santo and Pernambuco, and that highest concentrations in the states are around the capital cities. In 2013 there is a reduction in the rates in the municipalities of the state of São Paulo and an increase in the municipalities in the rest of Brazil's regions, especially in the states of the Northeast Region and also the states of Pará and Goiás and the Federal District (Figure 1).

In relation to the ranking of the 30 municipalities with more than 100,000 inhabitants and the highest mortality rates due to homicide, they are concentrated mainly in the state of Bahia (eight municipalities), the state of Pará (six municipalities) and the state of Goiás (four municipalities). The majority of municipalities with high rates of death due to homicide have a higher mortality rate than their respective state capital.

Figure 1 – Spatial distribution of the standardized mortality rate due to homicide in Brazilian municipalities with more than 100,000 inhabitants in 2001, 2007 and 2013

Discussion

Analysis of the 13-year time series (2001-2013) shows that over time the mortality rate due to homicide in Brazil underwent slight variations whereby the period ended with an increase of 1.1 deaths per 100,000 inhabitants. A study found that the fall in the rate between 2004 and 2007 was associated with the Disarmament Statute brought into force through Federal Law No. 10826, dated December 22nd 2003.[10]

A relevant figure to be considered in the comparative analysis of the time series is the abrupt increase in one year (2011-2012) by 1.9 deaths per 100,000 inhabitants, when the rate jumped from 26.2 to 28.1 deaths per 100,000 inhabitant, the highest rate in a year over the 13-year period studied. It is noteworthy that the rate of 28.1 deaths per 100,000 inhabitants in 2012 was repeated in 2013 (Graph 1).

The phenomenon of rapid growth in homicides calls for further studies. Hypotheses such as the real increase in violence and reduction in underreporting need to be enlightened.

Homicide is practically a gender-related issue, as can be seen in the data for the year 2013. Homicides occurred overwhelmingly among males (91.7%) and there was a large difference between male rates and female rates. The ratio between male and female homicide rates was 11.2 : 1.

Regarding legal intervention, 99% of deaths occurred in men and the frequency ratio in men was 81.9 times the one in women.

Analysis of the data indicates that homicide is a social evil strongly linked to the male. The literature has drawn attention to aggressive and risky male behaviour explaining the greater occurrence of male deaths due to homicide when compared to women. Moura[11] highlights that studies which differentiate between gender are essential for the creation of strategies aimed at reducing inequality and the rate of deaths due to homicide in general.

Another important aspect to be stressed is the process of the migration of the place where homicide occurs, into the inner regions of the states. High homicide rates have

both moved from the metropolitan regions to inner state municipalities, and also from the South and Southeast Regions to the North, Northeast and Midwest Regions, showing linear growth which corroborates studies associating homicides with geopolitical and social causes.

In 2013 the Northeast Region had the highest mortality rate due to homicide, reaching 39.6 deaths per 100,000 inhabitants, whilst the overall rate for Brazil was 28.1. The homicide death rate in the Northeast Region corresponded to almost double the rates of the South and Southeast Regions.

Waiselfisz[12] indicates as causes of this change the appearance of economic centres which, lacking organized policies enabling the population to be concentrated, have favoured increased criminality; the 1999 National Public Security Plan and the 2001 National Security Fund, which ensured resources for improving public security in the state capitals and metropolitan regions; and the reduction in underreporting in several of the country's regions, especially the North and Northeast.

The issue of most concern in relation to homicide is the fact that it is increasingly affecting younger age groups, ruining childhood and adolescence. In 2013 homicides were the main cause of death in the 15-39 age groups, i.e. youth and young adults. People aged 15 to 29 are considered youth in Brazil[13] and the country has some 50 million people in this age range. The largest increase in homicides occurred precisely in this group.

The highest rate among young people occurred in the 20-24 age group. Notwithstanding, the rate grew most among the 15-19 age group over the 13 year period and between 2011 and 2013 increased by 18.6 %, from 47.5 to 56.3 deaths per 100,000 inhabitants, thus being the second highest rate. Homicide is the second cause of death after accidents in the 10-14 age group.

This tendency of increasing homicide rates in younger age groups has been indicated in various publications. The disproportional impact of homicide on young people is a consistent pattern at all income levels. Nevertheless, it is much more pronounced in low--income countries than in middle and high-income countries. Moreover, the effects of a country's income on homicide rates differ by age group. Campos states that as these victims are of working age, their deaths directly affect the economy and the family budget.[14]

The figures disclose shortfalls in policies aimed at youth which should broaden their universe through social inclusion and mental pleasure through art, culture, sport; through learning that makes sense and frees young people from ignorance.

An achievement in 2013 was the sanctioning of the law that brought the Youth Statute into force, guaranteeing that young people have more access to educational and cultural activities, as well as basic rights such as justice, education, health, leisure, public transport, sport, freedom of expression and work. It opens the possibility of reducing ignorance, increasing the level of knowledge and broadening horizons of interest beyond harming others. Russell says that education is essential for self-esteem:[15]

> But if it must be admitted that highly educated people are sometimes cruel, I think there can be no doubt that they are less often so than people whose minds have lain fallow. (2002, p. 42) The bully in a school is seldom a boy whose proficiency in learning is up to the average. When a lynching takes place, the ring-leaders are almost invariably very ignorant men. This is not because mental refinement produces positive humanitarian feelings, though it may do so, but rather because it gives other interests than the ill-treatment of neighbours, and other sources of self-respect than the assertion of domination. The two things most universally desired are power and admiration. Ignorant men can, as a rule, only achieve either by brutal means, involving the acquisition of physical mastery. Culture gives a man less harmful forms of power and more deserving ways of making himself admired. Galileo did more than any monarch has done to change the world, and his power immeasurably exceeded that of his persecutors. He had therefore no need to aim at becoming a persecutor in his turn.[15]

Firearms were the most used form of assault in 2013, accounting for 70.8% of deaths (72.8% among males). Studies indicate that homicides due to firearms are concentrated among young men.[3]

Differently to other external causes related to violence, homicide, in general, is not accidental or manslaughter. Data on homicide shows the existence of the intention to cause harm.

Living in society requires norms and rules which are not always acceptable to everybody, and which cover both public and private spaces, including: personal relationships, family relationships, relationships between work colleagues, relationships between business partners, among others. Conflict of differentiated interests is therefore an issue inherent to living in society; but social violence that results in the death of others relates to a great extent to the privation of fundamental rights, given that when a man is deprived of his rights, he is prone to practicing violence, because he is not able to recognize the rights of others.

Intervening in the causes that lead to homicide requires encouraging, building and maintaining integrated public policies, partnerships, agreements, spaces and dialogue between Federative organs (municipalities, states and the Union) in the areas of health, public security, education, social work, sport, culture, labour and employment. It requires the formation of intersectoral social protection networks, of diverse sizes and formats, which see people not as beneficiaries, users, unemployed, insured or students, but rather as citizens with needs. It requires community participation. In a nutshell, intervention requires bringing the State closer to communities and families.

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4 Domestic violence in Brazil: analysis of cases reported on the Violence and Accidents Surveillance System, by life course

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Abstract

Introduction: Violence is one of society's biggest problems and causes much harm (physical and psychological) in human, social and economic terms. The main victims of domestic violence are women, children, adolescents, the elderly and people with disabilities. It is a social, political, economic and health problem. Tackling violence demands joint action by diverse sectors, such as Health, Education and Public Security.

Objectives: To describe the situation of domestic violence in Brazil, by life course, based on data from reported cases of violence.

Methods: This is a descriptive epidemiological study of Reported Cases of Interpersonal and Self-Inflicted Violence and Domestic Violence recorded on the Violence and Accidents Surveillance System (*Viva/Sinan*) between 2009 and 2014, according to the characteristics of the victims, events, probable perpetrators of the violence and victim evolution/referral.

Results: Reported cases of domestic violence increased between 2009 and 2014. Among females the main victims were adult women and adolescent girls. Among males the main victims were boys and adult men. The main perpetrator of violence against children was their mother (70.9%), whilst among adolescents it was their father/stepfather (40.2%) and among adults it was their intimate partner (85.2%). In 65.9% of cases of domestic violence against the elderly, the perpetrator was their son or daughter. The states with the highest coefficients of reported cases are Mato Grosso do Sul (148,9), followed by Paraná (88.1) and Acre (76.2). The states with the lowest coefficients are Ceará (8.4), Rondônia (9.7) and Alagoas (10.2).

Conclusion: Despite the increase in reported cases of domestic violence, cases are known to be underreported. Investing in the training of professionals to ensure violence is reported and improve the quality of reporting is an important step in the formulation of public policies aimed at curbing domestic violence in Brazil.

Keywords: Violence. Domestic violence. Violence against women. Child health. Adolescent health. Men's health. Elderly health.

Introduction

With effect from the 1980s the accelerated and significant increase in morbidity and mortality due to external causes (accidents and violence) has been an important aspect of epidemiological transition in Brazil.[1] According to the International Classification of Diseases, external causes cover: accidents (transport accidents and accidental injuries), assaults and intentional self-harm.

Accidents and violence are classified by the World Health Organization (WHO) as being intentional or unintentional, whereby accidents are unintentional and violence is intentional. WHO defines violence as

> the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation[2].

WHO further divides violence into three main categories, depending on the characteristics of who commits it: self-directed violence (self-inflicted); interpersonal violence and collective violence.

This Chapter will examine domestic violence, which refers to violence occurring between family members and intimate partners, frequently, but not exclusively, at home.

Domestic violence is a phenomenon that has occurred since ancient times and its main victims are women, children, adolescents, the elderly and people with disabilities. The nature of this type of violence can be physical, psychological, sexual, and can involve deprivation or neglect, causing harm to health, economic harm and harm to property. More than one of these forms of violence may happen at the same time.

Owing to its multifaceted nature, domestic violence is a social, political, economic and health problem. Perceiving it and registering it is a challenge for professionals in all areas. Hence the importance of integrating knowledge and services in order to combat this problem.

In most cases, health professionals are the first to attend to victims of domestic violence. However, many of them fail to identify or report it, since when victims seek health care they generally have complaints that are either unspecific or multiple and this conceals the situation of violence owing to other problems or symptoms which, on their own, do not provide elements for diagnosis of violence. Another obstacle to recognizing and approaching situations of violence by health services are difficulties health professionals may have in coping with violence, either because of insecurity in dealing with the issue, or because of not seeing it as a health problem, given that violence is not something that is limited to the area of biomedical knowledge.[3]

People in situations of domestic violence, especially women and children, often feel they are responsible for the violent acts they suffer or are ashamed of their situation and do not tell health professionals the real reason behind their needing medical care. These feelings – guilt and shame – are often perceptions that are reinforced by attitudes present in society.[4]

Fear is also a constant feeling for people in situations of violence. This feeling is made worse by the apparent lack of help, shortage of services or adequate social responses, since a one-off intervention is not an effective way of solving the problem. As such, legal instruments, the protection system and the punishment system have not been able to reduce the incidence of violence or mitigate its effects.

Health services should act as coordinators of a protection network for victims of violence, seeking partnerships with other institutions (from the areas of social security, security and justice) and the community (residents' associations, women's groups, religious groups).

Domestic violence involves all those who come into contact with situations of suffering and risk. Health services and health professionals are close to this problem, as they are in direct contact with the population and the consequences of violence. It is therefore important for them to be sensitive to this issue and to report cases, as this involves the commitment to characterizing the problem and taking appropriate action.

As such, this Chapter seeks to promote discussion in the health sector about domestic violence, based on analysis of the data contained in the records of Reported Cases of Interpersonal and Self-Inflicted Violence,[i] held on the Violence and Accident Surveillance System (*Viva*).

The *Viva* System was implanted by the Ministry of Health in 2006. It is comprised of both contingent and continuous surveillance components. Continuous surveillance corresponds to reported cases of interpersonal and self-inflicted violence. Contingent surveillance refers to the accident and violence survey carried out once every three years in selected state capitals and municipal urgency and emergency services.

The purpose of the System is to map violence and accidents trends and to describe the profile of victims and associated risk factors. It provides more detailed information about cases than other information systems do (the Mortality Information System and the Hospital Information System).

Initially this System was only implemented in selected health centres. In 2009 reported cases of violence began to be registered on the Notifiable Diseases Information System (*Sinan*). In 2011, Health Ministry Ordinance MS/GM 104, dated January 25th of that year, made it compulsory for all public and private health services to report cases of violence.

Methods

This is a descriptive epidemiological study of Reported Cases of Interpersonal and Self-Inflicted Violence and Domestic Violence, registered on the Violence and Accident Surveillance System (*Viva/Sinan*).

A brief analysis was made of all reported cases of violence registered on the *Sinan* System. This was followed by a more in-depth analysis of domestic violence.

The *Viva/Sinan* System reported cases database was stratified to obtain cases of domestic violence. The criterion used to identify domestic violence was the relationship between the perpetrator and the victim. As such, in the case of children (0-9 years old) all cases were selected in which the perpetrator had any of the following relationships characterizing domestic violence: father, stepfather, mother, stepmother, brother/sister and carer. In the case of adolescents, adults and elderly people the following additional relationships were also considered: spouse, ex-spouse, boyfriend/girlfriend, ex- boyfriend/girlfriend and son/daughter. Cases in which the sex of the victim was not informed were excluded.

[i] The notification record form, previously referred to as the domestic violence, sexual violence and other forms of violence record form, is currently called the Interpersonal and Self-Inflicted Violence record form.

The 2009-2014 time series was used with the aim of showing the evolution of reported cases in that period. The last year for which consolidated data was available (2013) was used in order to obtain a more in-depth analysis of reported cases by life cycle of the victims of violence (children, adolescents, adults and the elderly).

The data were analyzed according to characteristics of the victims (sex, life cycle, ethnicity/color, schooling), characteristics of the events (type of violence, place of occurrence, repeated violence, geographic region in which the case was reported), characteristics of the likely perpetrator (perpetrator and suspected use of alcohol) and evolution/referral of the victim. In relation to the perpetrator the following relationships were included in the intimate partner category: spouse, ex-spouse, boyfriend/girlfriend, ex- boyfriend/girlfriend. The "not informed" category refers to fields filled in using the term unknown or fields left in blank.

The coefficient of reported domestic violence per Federative Unit was also calculated. In order to calculate this coefficient, all reported cases of domestic violence per Federative Unit were taken and then divided by the population of each Federative Unit, per 100,000 inhabitants. The population used to do this calculation was obtained from the "projection of the population of the Federative Units by sex and age group", available on the National Health System Information Technology Department (*DATASUS*) website.

Results

Interpersonal and Self-Inflicted Violence

Data for the year 2013[ii] was considered for this analysis. There were 188,728 reported cases. 104 cases with no information about the sex of the victims were excluded, resulting in a total of 188,624 valid reported cases. 29.9% occurred among males and 70.1% among females (Table 1).

With regard to age group, 29,784 cases were recorded among children aged 0-9 years old, 50,634 cases occurred in adolescents aged 10-19, 96,667 cases involved adults aged 20-59, 11,378 cases occurred among elderly people aged 60 or over and the age of 161 cases was not informed. The highest proportions of reported cases were found among adolescents and adults, in both sexes. In males the 20-59 age group was the most affected (34.7%), followed by the 10-19 age group (31.7%). Among females, the highest proportion of violence was found in adult women aged 20-59 (58.4%), followed by adolescents aged 10-19 (24.8%) (Table 1).

With regard to ethnicity/ skin color, people with white skin accounted for 40.1% of cases, followed by people with brown skin (33.9%). 15.4% of all victims had between five and eight years of schooling and 13.2% had between zero and four years of schooling. A

[ii] Interpersonal and self-inflicted violence database updated after exclusion of duplicated records and inconsistencies.

high proportion of missing information was found for the variables ethnicity/ skin color (16.8%) and schooling (34.8%) (Table 1).

More than half the victims suffered violence at home (59.4%), followed by violence in the street (15.8%). Most health care was provided to cases of physical violence (65.7%), psychological/moral violence (27%) and sexual violence (13.9%). Physical assault (65.5 %) and neglect/abandonment (22.3%) accounted for the highest proportions among males, while physical violence (65.7%), psychological/moral violence (32.6%) and sexual violence (17.3%) had the highest proportions among females (Table 1).

With regard to the data on the likely perpetrator of violence, in most cases it was a person who had a close relationship with the victim. Among male victims the main perpetrator was their mother/stepmother (16.4%), followed by their father/stepfather (12.8%) and friends/acquaintances (12.8%). Among females, violence was committed by intimate partners (33.4%) or friends/acquaintances (11.7%). The high proportion of self-inflicted violence stands out in both sexes (11.6%) (Table 1).

Suspected intake of alcoholic beverage by the aggressor was reported in 23.6% of cases, with a higher proportion among females (25,8%). The majority (76.9%) of victims were discharged from health services after receiving care and 1.8% died as a result of violence. In this case the proportion was higher among males (4%) (Table 1).

Table 1 – Characterization of victims of interpersonal and self-inflicted violence, by sex – Brazil, 2013

Characteristics	Male (n = 56,447)		Female (n = 132,177)		Total (n = 188,624)	
	n	%	n	%	n	%
Age group (years)						
0-9	13,867	24.6	15,917	12.0	29,784	15.8
10-19	17,886	31.7	32,748	24.8	50,634	26.8
20-59	19,565	34.7	77,102	58.4	96,667	51.2
60 and over	5,054	9.0	6,324	4.8	11,378	6.0
Ethnicity/ skin color						
White	21,080	37.3	54,585	41.3	75,665	40.1
Black	4,184	7.4	10,457	7.9	14,641	7.8
Yellow	343	0.6	960	0.7	1,303	0.7
Brown	19,185	34.0	44,691	33.8	63,876	33.9
Indigenous	488	0.9	1,010	0.8	1,498	0.8
Not informed	11,167	19.8	20,474	15.5	31,641	16.8
Schooling (years)[a]						
0-4	8,142	14.4	16,726	12.7	24,868	13.2
5-8	7,392	13.1	21,572	16.3	28,964	15.4
9-11	4,988	8.8	18,810	14.2	23,798	12.6
12 and over	3,385	6.0	18,731	14.2	22,116	11.7

continues

conclusion

Characteristics	Male (n = 56,447)		Female (n = 132,177)		Total (n = 188,624)	
	n	%	n	%	n	%
Not applicable	10,943	19.4	12,347	9.3	23,290	12.3
Not informed	21,597	38.3	43,991	33.3	65,588	34.8
Place where violence occurred						
Home	27,036	47.9	84,981	64.3	112,017	59.4
Street	11,848	21.0	17,953	13.6	29,801	15.8
Other	3,516	6.2	6,779	5.1	21,574	11.4
Not informed	9,492	16.8	15,740	11.9	25,232	13.4
Nature of violence[b]						
Physical	36,968	65.5	86,868	65.7	123,836	65.7
Psychological/ moral	7,736	13.7	43,117	32.6	50,853	27.0
Neglect/ abandonment	12,583	22.3	12,677	9.6	25,260	13.4
Sexual	3,366	6.0	22,914	17.3	26,280	13.9
Other	7,192	12.7	17,105	12.9	24,297	12.9
Perpetrator of violence[b]						
Father/ Stepfather	7,252	12.8	10,589	8.0	17,841	9.5
Mother/ Stepmother	9,271	16.4	9,422	7.1	18,693	9.9
Intimate partner	3,402	6.0	44,092	33.4	47,494	25.2
Friends/ acquaintances	7,224	12.8	15,422	11.7	22,646	12.0
Unknown	6,662	11.8	11,463	8.7	18,125	9.6
Self-inflicted	7,649	13.6	14,285	10.8	21,934	11.6
Other	8,751	15.5	20,061	15.2	28,812	15.3
Suspected alcohol use						
Yes	10,542	18.7	33,981	25.7	44,523	23.6
Case evolution						
Discharge	40,294	71.4	104,775	79.3	145,069	76.9
Self-discharge/ escape	1,633	2.9	2,796	2.1	4,429	2.3
Death from violence	2,256	4.0	1,055	0.8	3,311	1.8
Death from other causes	177	0.3	128	0.1	305	0.2
Not informed	12,087	21.4	23,423	17.7	35,510	18.8

Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).
[a] Not applicable refers to people aged under 6 or with mental disabilities
[b] Does not total 100%, since it is a multiple-choice question.

Domestic violence

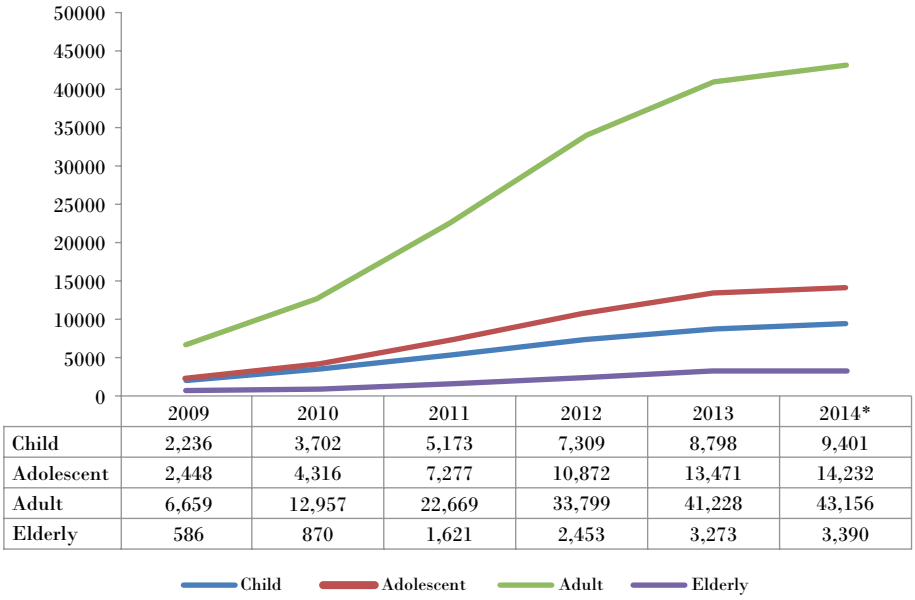
Figure 1 shows the evolution of reported cases of domestic violence in Brazil by municipalities in which cases were reported. An increase can be seen between 2011 and 2013 in the number of municipalities reporting cases of domestic violence on the Violence and Accident Surveillance System (*Viva/Sinan*), increasing from 1,797 municipalities in 2011 to 2,916 municipalities in 2013 (62.3% increase). Green municipalities on the map are those which reported violence, ranging from 1 reported case to 5,321 reported cases in just one municipality. White municipalities on the map are those that did not report any cases of violence. The year 2011 was chosen as the base year for this analysis as it was the year in which reporting of violence became compulsory nationwide.

Figure 1 – Evolution of the Number of Reported Cases of Domestic Violence, by reporting municipality – Brazil, 2011 and 2013

Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).

An increase in reported cases of domestic violence against females can be seen between 2009 and 2014: adult women (aged 20-59) were the main victims of domestic violence, followed by adolescent girls (aged 10-19), children (aged 0-9) and elderly women (aged 60 and over) (Graph 1). In 2014, 43,156 cases of domestic violence against adult women were reported, whilst there were 14,232 against female adolescents, 9,401 against girls and 3,390 against elderly women. The data for the year 2014 is preliminary and is subject to alteration.

Graph 1 – Evolution of Reported Cases of Domestic Violence among females, by life course – Brazil, 2009-2014*

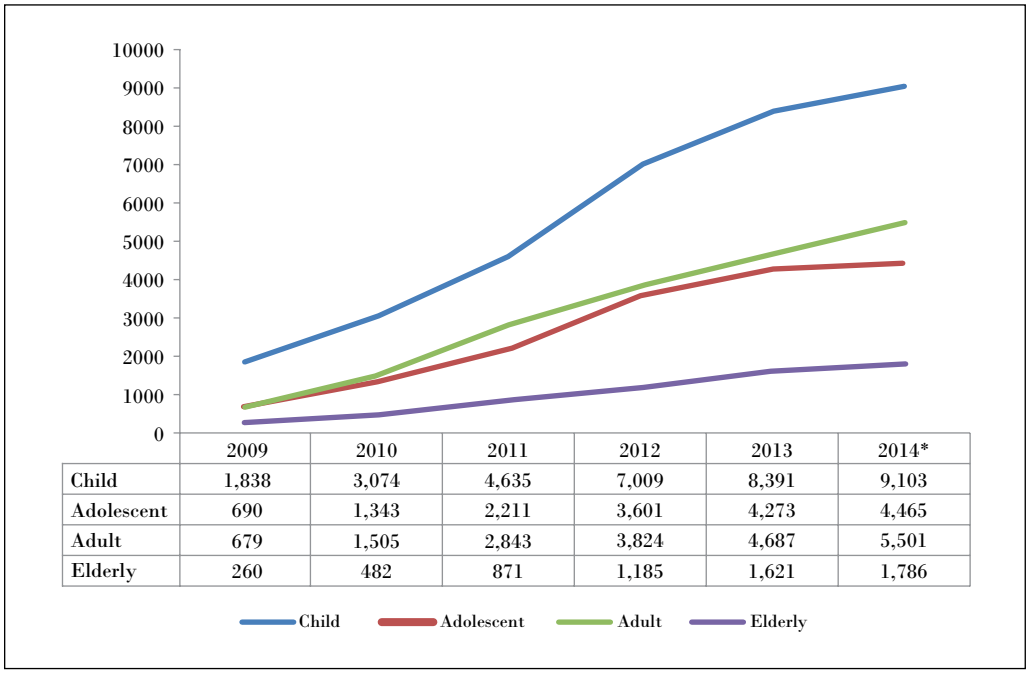


	2009	2010	2011	2012	2013	2014*
Child	2,236	3,702	5,173	7,309	8,798	9,401
Adolescent	2,448	4,316	7,277	10,872	13,471	14,232
Adult	6,659	12,957	22,669	33,799	41,228	43,156
Elderly	586	870	1,621	2,453	3,273	3,390

Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).
* Note: The data for the year 2014 are preliminary and subject to alteration.

In the same period there was also an increase in reported cases of domestic violence among males. However, the profile of reported cases per life course is different: the main victims are boys aged 0-9 years, followed by adult men, male adolescents and elderly men (Graph 2). In 2014, 9,103 cases of domestic violence against boys, 5,501 against adult men, 4,465 against male adolescents and 1,786 against elderly men were reported.

Graph 2 – Evolution of Reported Cases of Domestic Violence among males, by life course – Brazil, 2009-2014*



	2009	2010	2011	2012	2013	2014*
Child	1,838	3,074	4,635	7,009	8,391	9,103
Adolescent	690	1,343	2,211	3,601	4,273	4,465
Adult	679	1,505	2,843	3,824	4,687	5,501
Elderly	260	482	871	1,185	1,621	1,786

Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).
* Note: The data for the year 2014 are preliminary and subject to alteration.

Children (0-9 years)

17,268 cases of domestic violence against children aged 0-9 years were reported in 2013. Seventy-nine were excluded because their sex was not informed. This left a total of 17,189 cases, of which 8,391(48.8%) referred to boys and 8,798 (51.2%) to girls. With regard to ethnicity/ skin color, those with white skin accounted for 44.3%, followed by those with brown skin (29%) and black skin (5.9%). Yellow skin color accounted for 0.4% of reported cases and indigenous people accounted for 0.6%. These proportions remained very similar when analyzing reported cases by sex. There is a high proportion of cases where the victim's ethnicity/ skin color is not informed (19.8%) (Table 2).

The South Region has the highest proportion of reported cases (36%), followed by the Southeast (32.2%), Midwest (13.9%), Northeast (12.3%) and North (5.6%). The highest proportion of reported cases among boys as compared to girls was found in the South Region (38.7%) and the lowest was found in the North Region (4.2%). Domestic violence took place mainly at home (73.2%), followed by other places (15.2%) and streets (3.9%). The place where violence occurred was not informed in 7.6% of cases.

The main forms of domestic violence were neglect/abandonment (64,8%), physical violence (27%), psychological/moral violence (17,1%) sexual violence (16,7%). Among boys the main forms of domestic violence were neglect/abandonment (71.9%) and physical violence (28.4%), whilst among girls they were neglect/abandonment (58%), sexual violence (26%) and physical violence (25,6%). In 28.2% of cases there had already been a violent event (repeated violence). Care needs to be taken when analyzing this field, since this information is missing for 38.6% of cases (Table 2).

With regard to the likely perpetrator of the violence, 70.9% of cases were perpetrated by the child's mother/stepmother, 53.6% by its father/stepfather, 3.8% by its brother/sister and 2.7% by a carer. Among boys the highest proportion of cases were due to their mother/stepmother (77.9%), whilst among girls, although their mother/stepmother was the main perpetrator (64.1%), their father/stepfather had a higher proportion (56.3%) when compared to boys. There was suspected use of alcoholic beverage by the perpetrator in 13.7% of cases. Nevertheless, this variable was not informed in 44.6% of reported cases (Table 2).

Adolescents (10-19 years)

17,745 cases of domestic violence against adolescents aged 10-19 were reported. One case was excluded because the victim's sex was not informed. This left a total of 17,744 cases, 4,273 (24.1%) of which were male and 13,471 (75.9%) were female (Table 2). With regard to the victims' ethnicity/ skin color, those with white skin accounted for 39.6%, followed by brown skin (37%) and black skin (8%). Yellow skin color and indigenous people corresponded to the lowest proportions (0.8% and 0.9%, respectively). Ethnicity/ skin color is not informed in 18.2% of male cases and 12.3% of female cases (Table 2).

With regard to the victims' schooling, 21.9 % of male adolescents had between 0 and 4 years of schooling and 10.1% had between 9 and 11 years of schooling. 11.8% of female adolescents had between 0 and 4 years of schooling and 18.6% had between 9 and 11 years of schooling (Table 2).

The Southeast Region had the highest proportion of reported cases (39%), followed by the South (26.9%), Northeast (14.2%), North (10.6%) and Midwest (9.3%). There was a high proportion of reported male adolescent cases in the Southern Region (36.4%) and a low proportion in the Northern Region (3.7%). Domestic violence occurred most at home (72.4%), followed by streets (11.1%) and other places (8.7%). 7.8% of cases had no information for this variable.

The main forms of domestic violence among male adolescents were neglect/abandonment (51.1%), physical violence (49.4%), psychological/moral violence (23.4%) and sexual violence (4,5%). Among female adolescents the main forms of domestic violence were physical violence (57.3%), psychological/moral violence (34.4%), sexual violence (30.1%) and neglect/abandonment (17.3%) (Table 2).

46.9% of cases reported already having suffered violence. The occurrence of repeated violence varied between 40.2% among male adolescents and 49.1% among female adolescents. 24.6% of reported cases had no information for this variable (Table 2).

In the case of male victims, the main perpetrators of violence were their father/stepfather (58.7%), followed by their mother/stepmother (58.5%), brother/sister (10.4%) and intimate partner – spouse, ex-spouse, girlfriend/boyfriend, ex-girlfriend/boyfriend (4.8%). The main perpetrators of violence against female victims were intimate partners (48.8%), father/stepfather (34.3%), mother/stepmother (22.5%) and brother/sister (6.8%). Suspected alcohol consumption by the perpetrator was reported in 22.8% of cases, varying between 20.4% in male victims of violence and 23.6% in females who suffered violence. 35.1% of cases had no information about alcohol use by the perpetrator of the violence (Table 2).

Table 2 – Number and proportion of cases of domestic violence among children and adolescents, according to characteristics of the victim, the event and the perpetrator – Brazil, 2013

Characteristics	Children (0-9 years)						Adolescents (10-19 years)					
	Male (8,391)		Female (8,798)		Total (17,189)		Male (4,273)		Female (13,471)		Total (17,744)	
	n	%	n	%	n	%	n	%	n	%	N	%
Victim's ethnicity / skin color												
White	3,755	44.8	3,856	43.8	7,611	44.3	1,679	39.3	5,350	39.7	7,029	39.6
Black	461	5.5	559	6.4	1.020	5.9	353	8.3	1,064	7.9	1,417	8.0
Yellow	30	0.4	41	0.5	71	0.4	25	0.6	113	0.8	138	0.8
Brown	2,415	28.8	2,567	29.2	4,982	29.0	1,419	33.2	5,145	38.2	6,564	37.0
Indigenous	41	0.5	62	0.7	103	0.6	20	0.5	139	1.0	159	0.9
Not informed	1,689	20.1	1,713	19.5	3,402	19.8	777	18.2	1,660	12.3	2,437	13.7
Victim's schooling[a]												
0-4 years	1,179	14.1	1,200	13.6	2,379	13.8	935	21.9	1,585	11.8	2,520	14.2
5-8 years	61	0.7	124	1.4	185	1.1	1,569	36.7	5,514	40.9	7,083	39.9
9-11 years	-	-	-	-	-	-	432	10.1	2,507	18.6	2,939	16.6
12 years and over	-	-	-	-	-	-	11	0.3	103	0.8	114	0.6
Not applicable	6,709	80.0	6,945	78.9	13,654	79.4	11	0.3	10	0.1	21	0.1
Not informed	442	5.3	529	6.0	971	5.6	1,326	31.0	3,762	27.9	5,088	28.7
Region case reported												
North	349	4.2	605	6.9	954	5.6	156	3.7	1,724	12.8	1,880	10.6
Northeast	1,003	12.0	1,116	12.7	2,119	12.3	509	11.9	2,002	14.9	2,511	14.2
Southeast	2,640	31.5	2,897	32.9	5,537	32.2	1,572	36.8	5,355	39.8	6,927	39.0
South	3,245	38.7	2,945	33.5	6,190	36.0	1,557	36.4	3,220	23.9	4,777	26.9
Midwest	1,154	13.8	1,235	14.0	2,389	13.9	479	11.2	1,170	8.7	1,649	9.3

continues

conclusion

Characteristics	Children (0-9 years)						Adolescents (10-19 years)					
	Male (8,391)		Female (8,798)		Total (17,189)		Male (4,273)		Female (13,471)		Total (17,744)	
	n	%	n	%	n	%	n	%	n	%	N	%
Place where violence occurred												
Home	5,998	71.5	6,592	74.9	12,590	73.2	2.866	67.1	9,976	74.1	12,842	72.4
Street	382	4.6	288	3.3	670	3.9	694	16.2	1,283	9.5	1,977	11.1
Other	1,405	16.7	1,210	13.8	2,615	15.2	481	11.3	1,065	7.9	1,546	8.7
Not informed	606	7.2	708	8.0	1,314	7.6	232	5.4	1,147	8.5	1,379	7.8
Nature of violence[b]												
Physical	2,387	28.4	2,256	25.6	4,643	27.0	2,112	49.4	7,723	57.3	9,835	55.4
Psychological/ moral	1,239	14.8	1,702	19.3	2,941	17.1	999	23.4	4,633	34.4	5,632	31.7
Sexual	588	7.0	2,286	26.0	2,874	16.7	192	4.5	4,059	30.1	4,251	24.0
Neglect/ abandonment	6,033	71.9	5,107	58.0	11,140	64.8	2,182	51.1	2,327	17.3	4,509	25.4
Torture	138	1.6	150	1.8	288	1.7	82	1.0	439	5.2	521	2.9
Other	281	3.3	245	2.9	526	3.1	297	3.5	488	5.8	785	4.4
Repeated violence												
Yes	2,196	26.2	2,648	30.1	4,844	28.2	1,718	40.2	6,609	49.1	8,327	46.9
Perpetrator of violence[b]												
Father/ stepfather	4,266	50.8	4,949	56.3	9,215	53.6	2,508	58.7	4,622	34.3	7,130	40.2
Mother/ stepmother	6,537	77.9	5,643	64.1	12,180	70.9	2,499	58.5	3,035	22.5	5,534	31.2
Brother/sister	271	3.2	382	4.3	653	3.8	446	10.4	913	6.8	1,359	7.7
Intimate partner	-	-	-	-	-	-	205	4.8	6,570	48.8	6,775	38.2
Son/daughter	-	-	-	-	-	-	31	0.7	58	0.4	89	0.5
Carer	200	2.4	271	3.1	471	2.7	36	0.8	76	0.6	112	0.6
Suspected use of alcohol												
Yes	1,070	12.8	1,287	14.6	2,357	13.7	870	20.4	3,174	23.6	4,044	22.8

Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).
[a] Not applicable refers to people aged under 6 or with mental disabilities.
[b] Does not total 100%, since it is a multiple-choice question.

Adults (20-59 years)

45,926 cases of domestic violence against adults were reported. Eleven were excluded because the sex of the victims was not informed. This left a total of 45,915 valid reported cases, 4,687 (10.2%) of which occurred in males and 41,228 (89.8%) in females (Table 3).

With regard to ethnicity/ skin color, those with white skin accounted for 44.3%, followed by those with brown skin (33.7%), black skin (9.7%), yellow skin (0.9%) and indigenous people (0.8%). In relation to the victims' schooling, males were found to have less schooling than females. Among males, 17.3% had 0-4 years of schooling, 17.7% had

9-11 years of schooling and 3.1% had 12 years or more of schooling. Among females, 13.5% had up to 4 years of schooling, 25.2% had between 9 and 11 years of schooling and 5.3% had studied for 12 years or more (Table 3).

The Southeast Region had the highest proportion (54.1%) of reported cases of domestic violence, followed by the South (18.9%), Northeast (14,7%), Midwest (6,7%) and North (5,6%) (Table 3).

Violence occurred mainly at home (79.4%), followed by the street (9.6%) and other places (5.5%). 55.2% of cases reported having been victims of repeated violence: among males this proportion was 38.7% and among females it was 57.1. 18% of cases had no information about this variable (Table 3).

The main forms of violence reported among males were physical violence (93.3%), psychological/moral violence (19.9%) and neglect/abandonment (4.5%). Among females the main form of violence was physical violence (84.7%), followed by psychological/moral violence (49.9%), torture (4.5%), sexual violence (3.4%) and financial violence (3.3%) (Table 3).

The main perpetrator of domestic violence against males was their intimate partner (59.7%), followed by their brother/sister (21%), son/daughter (10%) and father/stepfather (9.1%); among females the main perpetrator was also their intimate partner (88.1%), followed by their brother/sister (5%), son/daughter (4.5%) and father/stepfather (2,4%). The perpetrator was suspected of having consumed alcohol in 42% of cases: among males this proportion was 36.2%, whilst among females it was 42.7%. 24.46% of reported cases had no information for this variable (Table 3).

The elderly (60 years and over)

4,894 cases of domestic violence against elderly people were reported in 2013, of which 1,621 (33.1%) occurred in males and 3,273 (66.9%) in females. Among elderly males those with white skin color accounted for 48.6%, followed by those with brown skin (26.7%) and black skin (8.8%). White elderly females accounted for 54%, followed by those with brown skin color (23.3%) and black skin color (8.6%) (Table 3).

38.3% of elderly men had between 0 and 4 years of schooling, 7.6% had between 5 and 8 years of schooling, 2.6% had between 9 and 11 years of schooling and 1.6% had 12 years or more of schooling. Among women, 37.9% had between 0 and 4 years of schooling, 10.3% had between 5 and 8 years of schooling, 4.7% had between 9 and 11 years of schooling and 1.6% had 12 years or more of schooling. A high proportion of cases had no information about schooling: 49.8% in males and 45.5% in females (Table 3).

The Southeast Region had the highest proportion of reported cases (42.9%), followed by the South (26.9%), Midwest (15.1%), Northeast (12.5%) and North (2.6%). Violence occurred mainly at home (88.9%), followed by other places (4.7%) and the street (2%). 4.4% of cases had no information about the place where violence occurred.

Forms of violence against elderly men were neglect/abandonment (49.4%), physical violence (48.9%), psychological/moral violence (26.8%) and financial violence (10.8%). The most frequent forms of violence among elderly women were physical violence (52.6%), psychological/moral violence (46.4%), neglect/abandonment (37.5%) and financial violence (12.6%). Violence had occurred previously in 57% of cases. Among males this proportion was 51.9% and among females it was 59.5%. 24.3% of reported cases had no information for this variable (Table 3).

Among male victims, 70% of cases were perpetrated by their sons/daughters, 20.5% by their intimate partner, 8.5% by their carer and 7.8% by their brother/sister. Among female victims, in 63.9% of cases the perpetrator was their son/daughter, 26.2% were perpetrated by their intimate partners, 7,8% by their carer and 5.4% by their brother/sister. Use of alcoholic drink by the perpetrator was suspected in 29.5% of cases and 29.9% of cases had no information for this variable (Table 3).

Table 3 – Number and proportion of cases of domestic violence among adults and the elderly, according to characteristics of the victim, the event and the perpetrator – Brazil, 2013

Characteristics	Adult (20-59 years)						Elderly (60 years and over)					
	Male (4,687)		Female (41,228)		Total (45,915)		Male (1,621)		Female (3,273)		Total (4,894)	
	N	%	n	%	n	%	n	%	n	%	n	%
Victim's ethnicity/ skin color												
White	1,994	42.5	18,365	44.5	20,359	44.3	787	48.6	1,766	54.0	2,553	52.2
Black	492	10.5	3,967	9.6	4,459	9.7	143	8.8	281	8.6	424	8.7
Yellow	51	1.1	343	0.8	394	0.9	15	0.9	21	0.6	36	0.7
Brown	1,516	32.3	13,965	33.9	15,481	33.7	432	26.7	761	23.3	1,193	24.4
Indigenous	65	1.4	318	0.8	383	0.8	8	0.5	11	0.3	19	0.4
Not informed	569	12.1	4,270	10.4	4,839	10.5	236	14.6	433	13.2	669	13.7
Victim's schooling[a]												
0-4 years	813	17.3	5,565	13.5	6,378	13.9	621	38.3	1,239	37.9	1,860	38.0
5-8 years	989	21.1	10,232	24.8	11,221	24.4	124	7.6	337	10.3	461	9.4
9-11 years	831	17.7	10,372	25.2	11,203	24.4	42	2.6	155	4.7	197	4.0
12 years and over	146	3.1	2,179	5.3	2,325	5.1	26	1.6	53	1.6	79	1.6
Not applicable	22	0.5	11	0.03	33	0.1	8	0.5	9	0.3	17	0.3
Not informed	1,908	40.7	12,880	31.2	14,788	32.2	808	49.8	1,489	45.5	2,297	46.9
Region case reported												
North	160	3.4	2,398	5.8	2,558	5.6	48	3.0	78	2.4	126	2.6
Northeast	511	10.9	6,239	15.1	6,750	14.7	181	11.2	432	13.2	613	12.5
Southeast	2,849	60.8	21,989	53.3	24,838	54.1	686	42.3	1,413	43.2	2,099	42.9
South	714	15.2	7,980	19.4	8,694	18.9	390	24.1	926	28.3	1,316	26.9

continues

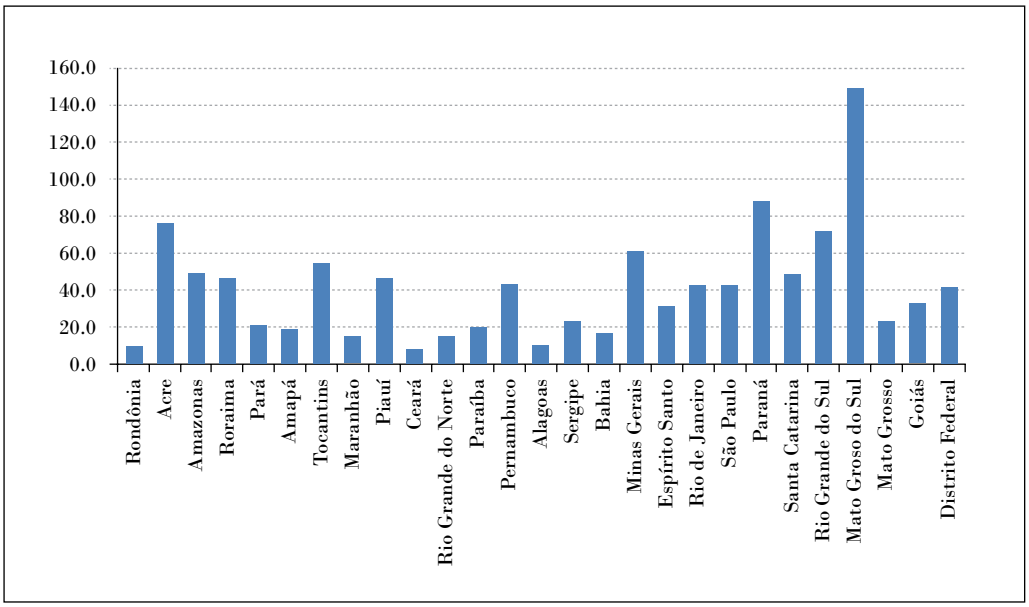
conclusion

Characteristics	Adult (20-59 years)						Elderly (60 years and over)					
	Male (4,687)		Female (41,228)		Total (45,915)		Male (1,621)		Female (3,273)		Total (4,894)	
	N	%	n	%	n	%	n	%	n	%	n	%
Midwest	453	9.7	2,622	6.4	3,075	6.7	316	19.5	424	13.0	740	15.1
Place where violence occurred												
Home	3,575	76.3	32,888	79.8	36,463	79.4	1,403	86.6	2,946	90.0	4,349	88.9
Street	469	10.0	3,929	9.5	4,398	9.6	38	2.3	61	1.9	99	2.0
Other	344	7.3	2,269	5.5	2,613	5.7	106	6.5	125	3.8	231	4.7
Not informed	299	6.4	2,142	5.2	2,441	5.3	74	4.6	141	4.3	215	4.4
Nature of violence[b]												
Physical	4,374	93.3	34,923	84.7	39,297	85.6	793	48.9	1,722	52.6	2,515	51.4
Psychological/ moral	934	19.9	20,578	49.9	21,512	46.9	434	26.8	1,519	46.4	1,953	39.9
Sexual	25	0.5	1,411	3.4	1,436	3.1	3	0.2	51	1.6	54	1.1
Neglect/ abandonment	213	4.5	671	1.6	884	1.9	800	49.4	1,229	37.5	2,029	41.5
Financial	48	1.0	1,340	3.3	1,388	3.0	175	10.8	440	13.4	615	12.6
Torture	68	1.5	1,863	4.5	1,931	4.2	40	2.5	115	3.5	155	3.2
Other	51	1.1	511	1.2	562	1.2	23	1.4	57	1.7	80	1.6
Repeated violence												
Yes	1,814	38.7	23,524	57.1	25,338	55.2	842	51.9	1,948	59.5	2,790	57.0
Perpetrator of violence[b]												
Father/ stepfather	428	9.1	1,002	2.4	1,430	3.1	49	3.0	14	0.4	63	1.3
Mother/ stepmother	221	4.7	666	1.6	887	1.9	13	0.8	75	2.3	88	1.8
Intimate partner	2,799	59.7	36,339	88.1	39,138	85.2	333	20.5	857	26.2	1,190	24.3
Son/daughter	468	10.0	1,853	4.5	2,321	5.1	1,135	70.0	2,090	63.9	3,225	65.9
Brother/sister	982	21.0	2,058	5.0	3,040	6.6	127	7.8	176	5.4	303	6.2
Carer	61	1.3	86	0.2	147	0.3	138	8.5	254	7.8	392	8.0
Suspected use of alcohol												
Yes	1,696	36.2	17.587	42.7	19,283	42.0	423	26.1	1,020	31.2	1,443	29.5

Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).
[a] Not applicable refers to people aged under 6 or with mental disabilities.
[b] Does not total 100%, since it is a multiple-choice question.

Graph 3 shows the coefficient of reported cases of domestic violence by Federative Unit in the year 2013. The state with the highest coefficient is Mato Grosso do Sul (148.9), followed by Paraná (88.1) and Acre (76.2). The states with the lowest coefficients are Ceará (8.4), Rondônia (9.7) and Alagoas (10.2).

Graph 3 – Coefficient of reported cases of domestic violence, by Federative Unit – Brazil, 2013



Source: MS/SVS/Violence and Accident Surveillance System (*Viva*).
Note: Coefficient per 100,000 inhabitants.

Discussion

This Chapter has provided data on reported cases of domestic violence in Brazil. Violence was most frequent at home and among females. The most frequent form was physical violence. The perpetrator was, for the most part, the victim's intimate partner and the use of alcohol by the perpetrator was reported in approximately 25% of cases. This description of reported domestic violence corroborates the findings of other studies.[5,6]

An increase can be seen in reported cases of domestic violence in Brazil, but studies[7,8] show that underreporting of cases cared for in health services continues to occur. This may be explained by the so-called "invisibility of violence" whereby there is a certain refusal to recognize this type of violence as something which appears very frequently in primary health care services.[7]

Among females domestic violence occurs mainly in adulthood, and this positive correlation between increased age and reported violence can be explained by women who live in urban centres having better access to social, legal and health services.[9,10,11] Women are seen to be more vulnerable, principally in relation to lower levels of schooling and income.[10]

The pattern of domestic violence against women reported on the *Viva/Sinan* System did not vary in relation to the data on reported cases of violence against women recorded

in 2011.[12] Violence is for the most part physical, occurs at home, is perpetrated by intimate partners and in more than 50% of cases it was reported as being repeated violence.

Violence perpetrated by intimate partners against women in life cycles following adolescence is noteworthy. The findings unveil gender inequalities and the asymmetrical relations of male strength and domination in relation to women in intimate relationships. These are a consequence of the naturalization by Brazilian society of the gender roles attributed to men and women.

The data presented also corroborate the findings of other studies of reported cases of violence against elderly people and factors associated with domestic violence against them.[13,14] This phenomenon was most frequent among females with up to eight years of schooling, it occurred mostly at home, had already happened before in more than half of the cases and was perpetrated by sons/daughters or partners. Among elderly females, physical violence was the most frequent form, followed by psychological violence, whereas among elderly males the main form of violence was neglect, followed by physical violence, this being different to the pattern found by Mascarenhas et al.[13] This difference can be explained because their study analyzed all reported cases of violence against elderly people, including violence outside the family committed by unknown perpetrators, thereby accounting for the predominance of physical violence.

The high levels of reported physical violence, except among children, need to be problematized, in the view of diverse authors, given that the training received by health care teams is technical and has a functionalist approach that places value on the clinical aspects of health care. Given that women in situations of domestic violence have more health problems and seek health services more frequently, often having diffuse and unspecific complaints, health teams need to be prepared to identify the phenomenon.[15]

Compared to female children, boys are more affected by violence. This finding is in agreement with other studies showing that reported male cases occurred at earlier ages, with a greater proportion of reported cases among boys aged under five, whilst among girls this happened in the 10 to 14 age group.[16, 17]

Reflection as to the absence of information on ethnicity/ skin color, particularly in the 0-9 age group, is pertinent. A variety of authors have categorized the National Health System (*SUS*) health information system as satisfactory with at least 90% of data on ethnicity/ skin color being provided and have recommended the adoption of measures to improve this information, such as permanent monitoring to make sure this variable is being reported and training for those responsible for collecting and inputting data, as well as socializing the debate on ethnic/racial equality within *SUS*.[18]

It is important to highlight that it is not sufficient to make a straightforward comparison between reported case coefficients per Federative Unit, since the process of implanting the Violence and Accident Surveillance System, via reported cases of interpersonal and self-inflicted violence, occurs in a distinct manner between municipalities and states. As such, when a state has a higher number of reported cases this does not necessarily mean

it is a state with more violence, but rather that there is more awareness and that it is at a more advanced stage of implementing the *Viva* System.

Taking the results presented, a limitation of this study can seen to be the quality of the data. Although the database containing reported cases of interpersonal and self-inflicted violence is submitted to a process to check for consistency and double counting, the quality of the data on the *Viva/Sinan* System still needs to be improved. In the case of some variables, such as use of alcohol by the perpetrator of violence and repeated violence, the high percentage of cases with no information is prejudicial to data analysis. A good quality database favours the production of health information capable of informing the formulation of public policies aimed at combating domestic violence and promoting health.

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5 Suicides and attempted suicides reported in Brazil

Table of Contents

Abstract

Introduction: *Suicide* is seen as an intentional act to end one's own life. It is among the ten leading causes of death worldwide and is a large public health problem. Suicide can be prevented and obtaining greater knowledge about its magnitude in Brazil enables better strategies to be designed to tackle it.

Objectives: To describe mortality due to suicide and the magnitude of reported self-inflicted injuries considered to be suicide attempts, with the aim of obtaining more knowledge about it and supporting the design of suicide prevention and health promotion policies.

Methods: This is a descriptive study using both mortality data from the Mortality Information System (*SIM*) for the period 2000-2013 and also data on self-inflicted injuries considered to be suicide attempts reported on the Notifiable Diseases Information System (*Viva/Sinan*) between 2009 and 2014, by sex, age group, ethnicity/skin color and region of residence.

Results: A slight growth in completed suicides and suicide attempts can be seen. The most vulnerable age group among males is 20-39 years, whist among females it is the 40-49 age group. The South Region has the highest mortality rates for males, females and total cases. Suicide attempts are more prevalent among females. Suicide attempts were more numerous among people with white skin color during the period.

Conclusion: Brazilian public health needs to make efforts to design and strengthen effective strategies for health promotion and for preventing risks of suicide and suicide attempts, taking into consideration gender and age specificities and reinforcing the role of primary health care and access to specialized services.

Keywords: Suicide. Suicide attempt. Epidemiological surveillance. Mortality.

Introduction

Suicide is seen as an intentional act to end one's own life. Non-fatal suicidal behaviors appear in the form of *suicidal ideation*, or thoughts that drive the desire to put an end to one's existence, and become exacerbated when accompanied by a *suicide plan* as to the means of self-harm. *Suicide attempts* involve conducts aimed at injuring oneself with the intention of killing oneself. They may result in injury or death. If a suicide attempt results in death, it is defined as suicide. The literature has used the term *suicidal behavior* to refer to a type of conduct exhibited by people who seek to injure or kill themselves. Generally speaking, the borders between *self-neglect, suicidal ideation, suicidal behavior* and *completed suicide* are tenuous, since a suicide attempt may be interrupted and become set as an idea or intention, whereas suicidal thoughts may hatch as a result of overwhelming anguish and anxiety and explode in the form of an act against one's life. On the other hand, not all *thoughts about death* or the desire to die are evidence of risk.[1,2] Suicide is among the ten leading causes of death worldwide. More than 800,000 people die due to suicide every

year and it is the second cause of death among young people aged 15-29. Studies exist which indicate that for each adult who commits suicide, there are a further 20 attempting to kill themselves.[3] The global mortality rate in 2012 was 11.4 per 100,000 inhabitants, and was higher in Asia (17.7/100,000 inhabitants), followed by the European countries (12/100,000 inhabitants). The mortality rate in the Americas was 6.1/100,000 inhabitants.[3]

Brazil is in eighth place worldwide in numbers of suicides. It has 24 suicides a day on average, although this number may by 20% higher, given that many cases are not registered. The number of attempts is between 10 and 20 times higher than the number of deaths.[3]

Suicide attempts are harder to perceive and register. According to the World Health Organization (WHO),[4] there is evidence that only 25% of those who attempt suicide seek or are taken to hospital, and those who do reach hospitals are those who are in a critical condition. Reported cases are the tip of the iceberg and the majority of those who have suicidal behavior remain anonymous. For every self-inflicted death, five or six people on average are affected emotionally, socially and economically. Apart from the negative effects that a suicide event generates for the community and society, its psychological impact is intense even for those who do not have direct links with the person who died. From the point of view of economic cost, millions of dollars are spent as a consequence of completed suicides, suicide attempts and suicidal ideations (similar to the equivalent of 1.8% of total global expenditure on diseases or the operational cost of a war).[4]

Sex, age, culture and ethnicity have important implications for the epidemiology of suicide worldwide. In cases of completed suicide, males outstretch females in a ratio that can be as much as 10:1, depending on the cultural context. On average the ratio is 3:1. Among females fatal cases increase with age, but in Latin America the highest prevalence is found among young adult women.[4] It is important to note that with regard to ethnicity Caucasians have higher and similar rates in various countries worldwide. In relation to age groups, available data show that suicide attempts are more frequent among young people, both in terms of population size and absolute numbers. Among the elderly, there is a closer relationship between suicide attempts and completed suicides.[1]

Various risk factors are known to be associated with distinct causes that interact between each other, including: biological, medical, environmental, psychiatric, psychological, philosophical and existential problems and social motives.

Among the biological factors, there is research showing genetic traits that make people from the same family predisposed to self-destructive behavior. Studies into knowledge on the biological basis of the phenomenon reveal altered levels of serotonin metabolites in the cerebrospinal fluid of people who committed suicide.[5] On the other hand, studies conducted by WHO[4] consider that suicidal behavior may be an inherited psychiatric disorder, leaving to one side the limited explanation of genetic predisposition.

The most common psychiatric and psychological risk factors are: depression, problems relating to bipolar affective and mood swings, schizophrenia, anxiety and personality disorders, alcoholism, despair and loneliness and comorbidities. Depressive illnesses,

with all their varied complexity, aetiology and clinical signs and symptoms, are the most relevant risk factor recognized by specialists.

Intoxication with stimulants such as cocaine, amphetamines or alcohol is a frequent suicide risk factor and is worse when the patient is depressed. Alcohol is the most significant of all these elements. Anticonvulsant medication can also be associated with suicide and suicide attempts, and a wide range of these drugs can be indicated for patients with psychiatric problems, whether or not they have psychiatric comorbidities. In 2008 the United States Food and Drug Administration (FDA)[6] published a meta-analysis which included data from 199 studies of controlled administration of placebos and 11 anticonvulsant drugs and reached the conclusion that patients taking anticonvulsant drugs have double the risk of suicidal ideation and suicidal behavior (0.43 per 100) compared to those who received the placebo (0.22 per 100). Following the study, FDA issued a new alert about the association of the various anticonvulsant drugs with suicidal behaviour. Furthermore, suicide may also be a person's response to the suffering caused by disabling and very painful severe diseases.

The most important micro-social factors that can unleash suicidal ideations, suicide attempts and completed suicide include events in life which affect people emotionally: personal losses, violence, social isolation, interpersonal conflicts, broken or problematic relationships, legal problems and problems at work. During childhood and adolescence physical and sexual abuse and problems with sexual orientation play an important role. Among young people, authors indicate difficulties in the relationship with parents, fights with girlfriends/boyfriends and loneliness as risk factors. Among elderly people who committed or attempted suicide, Duberstein at al.,[7] for example, found personality traits related to being hypochondriac, closed, shy or excessively dependent.

In his classic book *Suicide* published in 1897, Durkheim[8] highlights the social motives behind this act. For Durkheim suicide is a symptom of social illness and social disintegration. This phenomenon exists in all societies, although it differs from country to country, from one moment in history to another and from the urban environment to the rural environment.

WHO[4] divides environmental factors associated with suicide into three categories: (1) life stressors: interpersonal conflicts, separations, rejections, losses, financial problems and problems at work, and shame of something society disapproves of; (2) easy access to means which enable hanging, drowning, jumping from heights, use of firearms, abuse of medication and poison; and (3) exposure to spectacular cases, via neighbors or the media.

In the light of all this, the purpose of this Chapter is to describe mortality due to suicide, and the magnitude of reported suicide attempts, with the aim of obtaining more knowledge about it and supporting the design of suicide prevention and health promotion policies.

Methods

This is a descriptive study using data on mortality due to suicide and reported suicide attempts in Brazil. The data used to analyse mortality due to suicide was taken from the Mortality Information System (*SIM*) for the period 2000-2013. This System's source of data are Death Certificates. The deaths selected were those having as their underlying cause codes X60 to X84 (intentional self-harm) of the International Classification of Diseases – 10th Revision (ICD-10) for the years 2000-2013.

The records of reported self-inflicted injuries considered to be suicide attempts were extracted from the Violence and Accident Surveillance System/Notifiable Diseases Information System (*Viva*/*Sinan*) for the period 2009-2014 (2014 data are preliminary). Reported cases of self-inflicted injury were then selected. Population data was obtained for the National Health System Department of Information Technology (DATASUS) website.

Mortality data was analysed according to the following variables: sex, age groups, ethnicity/ skin color and Brazilian regions. Frequencies and relative frequencies were calculated, as were mortality rates (per 100,000 inhabitants) and rate ratio between the sexes. Reported case data was analysed according to sex, ethnicity/ skin color, age group, region where the case was reported, whether there had been previous attempts, suspected alcohol use, place of occurrence and suicide means. Once again, frequencies and relative frequencies were calculated.

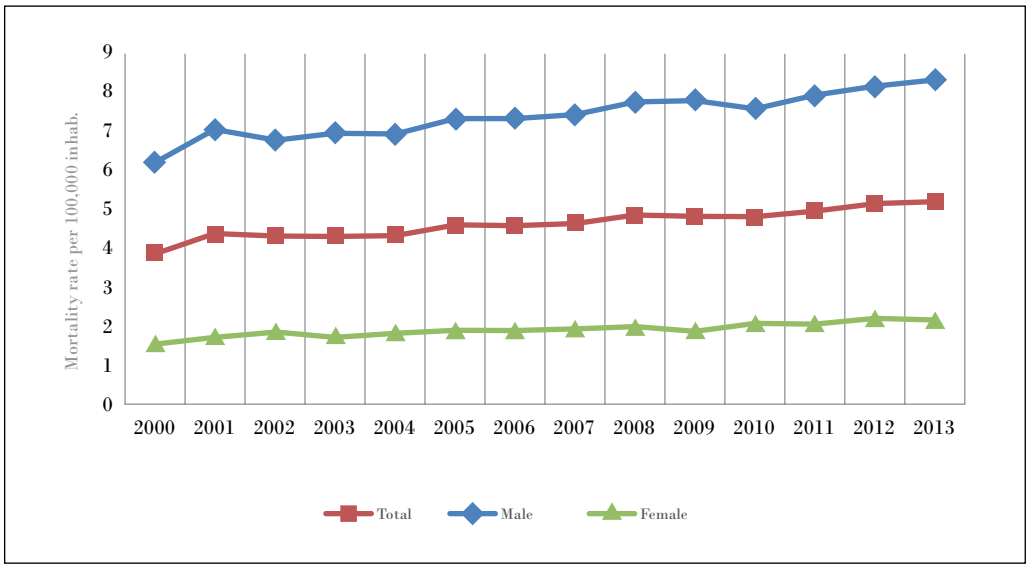
All data analysed can be accessed by the public via the DATASUS website, whereby patients' identification is omitted in accordance with the ethical principles of research involving human beings, in compliance with National Health Council Resolution 466, dated December 12, 2012.

Results

Deaths due to suicide

The mortality rate due to suicide had a slight but persistent increase from 3.9 deaths per 100,000 inhabitants in the year 2000 to 5.2 in the year 2013, this being the equivalent of a 34% variation. With regard to rates by sex, the male rate was higher than the female rate over the entire period and was even higher than the overall national rate (Graph 1).

Graph 1 – Mortality rate due to suicide, by sex and year – Brazil, 2000-2013



Source: *SIM/MS*.

Table 1 shows that in 2013 there were 10,533 deaths due to suicide in Brazil. This is equivalent to a mortality rate of 5.2/100,000 inhabitants. 8,309 (78.9%) of these were male deaths and the risk of death due to suicide was 3.8 times higher in males than in females.

Highest prevalence of deaths due to suicide was found in the 30-39 age group in males (1,890 cases or 22.7%). The most affected age group among females was the 40-49 age group with 478 cases (21.5%). Males also stood out in relation to females in the 20-39 and the 70+ age groups. Analysis of the mortality rates shows that they are highest among males in the 80+ age group and also in the total population in the same age group (17.7 and 8.5 deaths/100,000 inhabitants, respectively). The risk of death among males in this age group is 6.1 times higher (M/F ratio= 6.1).

The Southeast Region had the highest proportion of deaths due to suicide in both sexes. When compared to females, the risk of death was higher for males in all the country's regions. The South Region had the highest mortality rates for males, females and total cases (8.2 deaths/10,000 inhabitants) (Table 1).

Table 1 – Number, proportion and mortality rate due to suicide (per 100,000 inhabitants), by sex, age group, and region – Brazil, 2013

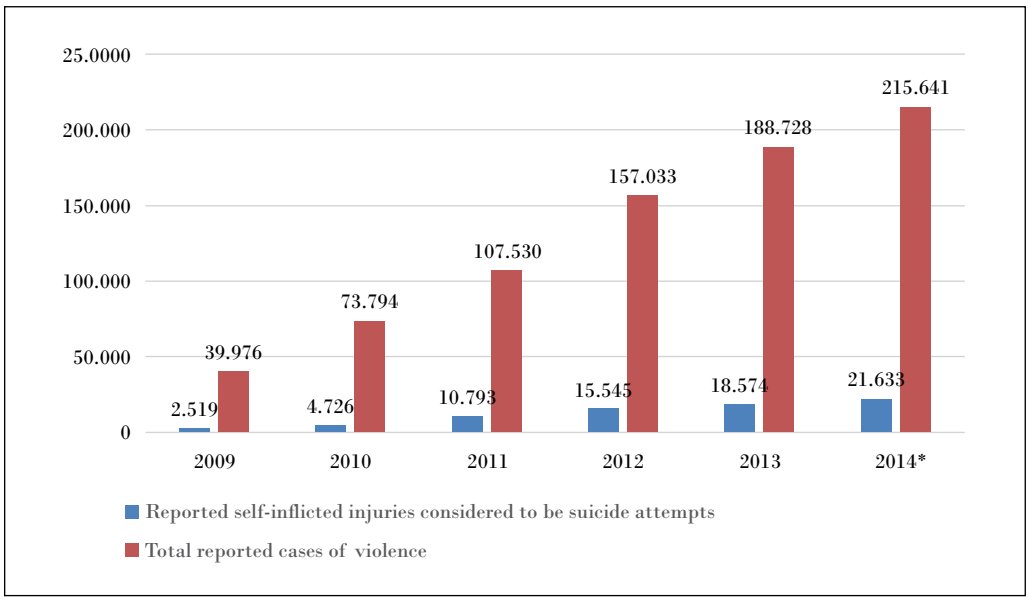
	Male			Female			Total			Ratio M/F
	n	%	Rate	n	%	Rate	n	%	Rate	
Total	8,309	78.9	8.4	2,223	21.1	2.2	10,533	100	5.2	3.8
Ethnicity/ Skin olor										
White	4,044	48.7	-	1,197	53.8	-	5,241	49.8	-	-
Black	432	5.2	-	97	4.4	-	529	5.0	-	-
Yellow	1	0.0	-	-	-	-	1	0.0	-	-
Brown	414	5.0	-	95	4.3	-	509	4.8	-	-
Indigenous	85	1.0	-	28	1.3	-	113	1.1	-	-
Age Group										
0-9	2	0.0	0.0	1	0.0	0.0	3	0.0	0.0	1.9
10-19	555	6.7	3.2	230	10.3	1.4	785	7.5	2.3	2.3
20-29	1,816	21.9	10.4	390	17.5	2.3	2,206	20.9	6.4	4.6
30-39	1,890	22.7	11.7	398	17.9	2.5	2,288	21.7	7.1	4.8
40-49	1,546	18.6	12.1	478	21.5	3.6	2,024	19.2	7.8	3.4
50-59	1,155	13.9	11.8	357	16.1	3.4	1,512	14.4	7.4	3.5
60-69	693	8.3	12.0	211	9.5	3.1	904	8.6	7.2	3.8
70-79	428	5.2	15.2	100	4.5	2.7	528	5.0	8.1	5.7
80 and over	203	2.4	17.7	55	2.5	2.9	258	2.4	8.5	6.1
Region Reported										
North	613	7.4	7.1	146	6.6	1.7	759	7.2	4.5	4.1
Northeast	2,000	24.1	7.3	494	22.2	1.7	2,494	23.7	4.5	4.2
Southeast	3,082	37.1	7.4	876	39.4	2.0	3,959	37.6	4.7	3.6
South	1,868	22.5	13.1	497	22.4	3.4	2,365	22.5	8.2	3.8
Midwest	746	9	10.0	210	9	2.8	956	9	6.4	3.6

Source: *SIM*/*MS*.

Suicide attempts reported on the *Sinan* System

Between 2009 and 2014 a total of 73,790 cases of self-inflicted injuries considered to be suicide attempts were reported in Brazil. 2,519 (6,3%) cases were reported in 2009 and 21,633 (10%) were reported in 2014, this being the equivalent of a relative variance of 59.2% (Graph 2).

Graph 2 – Distribution of the number of reported self-inflicted injuries considered to be suicide attempts and total number of cases of violence reported on the *Sinan* System, by year reported – Brazil, 2009-2014



Source: *Viva Sinan/MS*.
*Preliminary data.

Throughout the entire period reported suicide attempts mainly involved females, corresponding to 1,595 cases (63.3%) in 2009, and 14,333 (66.3%) in 2014. In 2014, 50% of reported attempts related to individuals in the 10-29 age group. It is important to highlight that in 2009 and 2010 cases were reported in the first age group (0-9 years). Reported suicide attempts among elderly people aged 70-79 increased in the period, varying from 4 (0.2%) in 2009 to 256 (1.2%) in 2014. People with white skin color had the highest proportions of suicide attempts over the entire period. The Southeast Region concentrated the highest number of reported cases (11,011 – 50.9%) in 2014 (Table 2).

Table 2 – Proportional distribution of suicide attempts reported on the *Sinan* System – Brazil, 2009-2014

	Year Reported											
	2009		2010		2011		2012		2013		2014*	
	n	%	n	%	n	%	n	%	n	%	n	%
Total	2,519	100	4,726	100	10,793	100	15,545	100	18,574	100	21,633	100
Sex												
Male	924	36.7	1,710	36.2	3,730	34.6	5,259	33.8	6,320	34.0	7,296	33.7
Female	1,595	63.3	3,016	63.8	7,063	65.4	10,286	66.2	12,254	66.0	14,333	66.3

continues

conclusion

	Year Reported											
	2009		2010		2011		2012		2013		2014*	
	n	%	n	%	n	%	n	%	n	%	n	%
Ethnicity/ skin color												
Unknown/ blank	685	27.2	894	18.9	1,960	18.2	1,890	12.2	2,490	13.4	2,741	12.7
White	1,057	42.0	2,381	50.4	5,685	52.7	8,434	54.3	9,912	53.4	11,560	53.4
Black	104	4.1	263	5.6	608	5.6	1,000	6.4	1,070	5.8	1,267	5.9
Yellow	20	0.8	39	0.8	71	0.7	110	0.7	71	0.4	133	0.6
Brown	649	25.8	1,125	23.8	2,438	22.6	4,073	26.2	4,919	26.5	5,827	26.9
Indigenous	4	0.2	24	0.5	31	0.3	38	0.2	112	0.6	105	0.5
Age Group												
0-9	51	2.0	7	0.1	-	-	-	-	-	-	-	-
10-19	613	24.3	1,064	22.5	2,505	23.2	3,584	23.1	4,480	24.1	4,930	22.8
20-29	796	31.6	1,428	30.2	3,181	29.5	4,343	27.9	5,141	27.7	5,884	27.2
30-39	555	22.0	1,033	21.9	2,469	22.9	3,536	22.7	4,110	22.1	5,045	23.3
40-49	305	12.1	708	15.0	1,519	14.1	2,335	15.0	2,721	14.6	3,222	14.9
50-59	125	5.0	307	6.5	711	6.6	1,089	7.0	1,359	7.3	1,618	7.5
60-69	57	2.3	103	2.2	242	2.2	390	2.5	467	2.5	595	2.8
70-79	4	0.2	47	1.0	119	1.1	180	1.2	199	1.1	256	1.2
80 and over	12	0.5	28	0.6	47	0.4	88	0.6	97	0.5	82	0.4
Region Reported												
North	127	5.0	216	4.6	303	2.8	379	2.4	626	3.4	690	3.2
Northeast	632	25.1	857	18.1	1,431	13.3	1,761	11.3	2,478	13.3	2,351	10.9
Southeast	1,103	43.8	2,041	43.2	5,383	49.9	7,893	50.8	8,682	46.7	11,011	50.9
South	205	8.1	1,077	22.8	2,797	25.9	4,403	28.3	5,483	29.5	6,288	29.1
Midwest	452	17.9	535	11.3	879	8.1	1,109	7.1	1,305	7.0	1,293	6.0

Source: *Viva Sinan*/*MS*.
*Preliminary data.
Note: from 2011, the *Sinan* System took the self-inflicted injury variable to be "no" in cases in which reported individuals were aged under 10.

In 2014, self-inflicted injuries considered to be suicide attempts had occurred previously in 6,068 (28%) of cases. In the same year alcohol use was suspected in 3,112 cases (14.4%). Suicide attempts occurred most frequently at home, with 18,516 (85.6%) attempts in 2014; followed by the street, with 734 cases (3.4%) in the same year. The most frequent suicide attempt means was poisoning, followed by sharp objects and hanging, with 11,437 (52.9%), 1,942 (9%) and 1,819 (8.4%) cases respectively in 2014 (Table 3).

Table 3 – Proportional distribution of reported suicide attempts, by previous attempts, suspected alcohol use, place of occurrence and means – Brazil, 2009-2014

	Year Reported											
	2009		2010		2011		2012		2013		2014*	
	N	%	n	%	n	%	n	%	n	%	n	%
Previous attempts												
Unknown/ blank	992	39.4	1,483	31.4	3,244	30.1	4,188	26.9	5,083	27.4	5,752	26.6
Yes	561	22.3	1,099	23.3	2,621	24.3	4,132	26.6	4,957	26.7	6,068	28.0
No	966	38.3	2,144	45.4	4,928	45.7	7,225	46.5	8,534	45.9	9,813	45.4
Suspected use of alcohol												
Unknown/ blank	1,018	40.4	1,602	33.9	3,627	33.6	5,312	34.2	6,331	34.1	7,071	32.7
Yes	397	15.8	761	16.1	1,574	14.6	2,388	15.4	2,792	15.0	3,112	14.4
No	1,104	43.8	2,363	50.0	5,592	51.8	7,845	50.5	9,451	50.9	11,450	52.9
Place of occurrence												
Home	1,923	76.3	3,752	79.4	8,819	81.7	12,992	83.6	15,515	83.5	18,516	85.6
Shared housing	10	0.4	26	0.6	49	0.5	62	0.4	87	0.5	88	0.4
School	5	0.2	8	0.2	37	0.3	48	0.3	63	0.3	82	0.4
Sports facility	3	0.1	4	0.1	10	0.1	21	0.1	15	0.1	15	0.1
Bar or similar	8	0.3	28	0.6	35	0.3	45	0.3	63	0.3	56	0.3
Street	90	3.6	166	3.5	385	3.6	621	4.0	715	3.8	734	3.4
Commerce/ services	6	0.2	22	0.5	60	0.6	103	0.7	98	0.5	117	0.5
Industry/ construction	5	0.2	7	0.1	11	0.1	5	0.0	24	0.1	24	0.1
Other	66	2.6	149	3.2	301	2.8	408	2.6	524	2.8	594	2.7
Means												
Body weight	38	1.5	70	1.5	127	1.2	174	1.1	257	1.4	288	1.3
Hanging	161	6.4	348	7.4	787	7.3	1,175	7.6	1,414	7.6	1,819	8.4
Blunt object	33	1.3	44	0.9	107	1.0	102	0.7	143	0.8	164	0.8
Sharp object	244	9.7	379	8.0	926	8.6	1,351	8.7	1,663	9.0	1,942	9.0
Hot substance/ object	52	2.1	114	2.4	207	1.9	261	1.7	324	1.7	318	1.5
Poisoning	1,370	54.4	2,393	50.6	5,468	50.7	8,046	51.8	9,652	52.0	11,437	52.9
Firearm	31	1.2	80	1.7	151	1.4	221	1.4	238	1.3	293	1.4
Threat	7	0.3	26	0.6	66	0.6	89	0.6	97	0.5	159	0.7
Other	574	22.8	1,207	25.5	2,847	26.4	4,212	27.1	4,849	26.1	5,421	25.1

Source: *Viva Sinan/MS*.
*Preliminary data.

Discussion

The results presented in this Chapter show the magnitude of suicidal behavior in Brazil. The data shows some similarities with other countries, such as the higher number of completed suicides among males and the prevalence of suicide attempts among females.[1] Underreporting of completed suicides and suicide attempts is also recognized worldwide, principally because of religious taboos and family wishes that this phenomenon involves. Nevertheless, it can be seen from the *Sinan* System data that information is tending to increase year by year and this may help to obtain a more faithful analysis of this form of self-violence in Brazil.

Taking a more strategic and comprehensive approach to these phenomena, specialists highlight that both with relation to suicide attempts and completed suicides, attention needs to be paid to: (1) the complexity of suicide which involves social, micro-social, psychological, medical and environmental factors; (2) predisposing factors: severe and degenerative diseases, physical dependence, mental disorders and suffering, severe depression, presence of violence and social isolation; and (3) the differentiation of risk factors by gender and age.

Within this context it is opportune to reflect on some of the specificities related to suicide in the different stages of the life cycle, especially since they provide clues as to the design of health sector prevention and care strategies.

In *childhood*, suicidal behaviour is rare in most societies. According to the World Health Organization, the mortality rate per 100,000 inhabitants among boys aged 5-14 was 1.7, and 2 per 100,000 inhabitants among girls aged 5-14 in the year 2000.[1] Although occurrence is low, the social dimension underlying the motives that lead people who are growing up and at such an early age to seek death is impacting. Some associated factors are of particular importance: marital problems between parents or partners, deaths, separations, living in a violent environment and environments where communication and the expression of feelings is lacking, social isolation, experiencing mental problems, living in a domestic environment where there is alcohol and drug abuse, suffering corporal punishment at home and at school – even if it is with the intention of "educating". In general children are protected when they live in a communicative and affectionate family and community environment, where their rights and feelings are respected and where they have the support of adults who are a reference for them.[9]

In *adolescence*, completed suicide and suicide attempts increase significantly in relation to childhood, especially with effect from 15 years of age. The main risk factors for both suicide attempts and self-inflicted death are: suffering physical violence and sexual abuse; being threatened by colleagues or other people; being depressed; having gender identity problems; experiencing unrequited love; becoming socially isolated; having problems with performance at school and in communicating with teachers and colleagues; suffering emotional, family, social or cultural frustration; having contact with cases of family members, neighbours and colleagues who killed themselves.[10, 11, 12] In general taking an

overdose of medication is the most common suicide attempt means and risk is highest at 14 years of age.

Among *adults* there are 22 deaths a day from completed suicides in Brazil. The proportion among men (79.79%) is much higher than among women. Younger adult age groups are more vulnerable. The most important risk factors for women are: conjugal violence, sexual violence and unwanted pregnancy, depression and mental disorders.[13, 14] Among men the greatest risks are associated with the world of work, alcoholism, loneliness, isolation and mental problems.[15] Suicide cases related to work activities include poisoning due to pesticides among farm workers;[16] poisoning due to medication among doctors and medical students;[17] policemen committing suicide using firearms[18] and suicide among bank employees using a variety of means.[19]

Among the *elderly,* there were almost five deaths per day in 2013. There is significant underreporting of suicide in this stage of life. An example of this is that the data for suicide attempts are lower than those for completed suicide in the same year. According to national and international studies, there are at least four suicides attempts for every completed suicide at this stage of life.[20] As a general rule, associated factors cited by authors include, severe depression, social isolation, life losing its meaning, loss of children and spouses, presence of severe and degenerative diseases, economic deprivation and deprivation of affection, inactivity and having experienced violence in the past and at the present moment in life.[21, 22, 23]

As a way of addressing the problem of suicide and suicide attempts in Brazil, with effect from 2005 the Ministry of Health began a series of actions aimed at reducing the number of deaths, suicide attempts and harm associated with this phenomenon, driven by guidelines issued by WHO, which since 1990 has been committed to reducing suicides numbers worldwide. Standing out among the initiatives is the National Suicide Prevention Strategy (*ENPS*), brought into force by Ordinance No. 1876, dated August 14th 2006. Its guidelines follow the recommendations of the WHO publication entitled Multisite Intervention Study on Suicidal Behaviours (SUPRE-MISS) intended for health professionals [i].

The main WHO[24] recommendations for managing suicidal people include: (1) establish a relationship of trust and listen with empathy; (2) treat with respect, respect feelings and ensure confidentiality; recognize signs (insinuation of intention, ambivalent feelings, signs of tiredness and despair, and previous attempts); (3) identify people at risk, i.e., with a family history of suicide, previous attempts, psychiatric disorders, depression, alcoholism; (4) talk with the person at risk about the problem; and (5) understand low, medium and high levels of risks.

WHO also highlights what should not be done in the event of a suicide attempt, such as: ignore the situation and signs of the attempt; demonstrate shock or panic; say that everything will be alright and make the problem appear trivial; challenge the person to get on with it; make false promises; swear secrecy and leave the person at high risk on their own.

[i] available at: <http://whqlibdoc.who.int/publications/2000/WHO_MNH_MBD_00.4_por.pdf>

The document on the "National Suicide Prevention Strategy" (*ENPS*)[ii] recommends: (1) increased information and social awareness about the problem; (2) training for health services, with emphasis on primary care, mental health, urgency and emergency, and those who work in general hospitals; (3) increase the access of people at greater risk to SUS health services; (4) encourage studies and research on the subject; (5) enhance reporting of mortality due to suicide and suicide attempts; (6) foster and support local primary and secondary prevention programmes; and (7) reduce access to suicide means.

The Ministry of Health also encourages and supports civil society initiatives aimed at protecting against and preventing suicide, such as those undertaken by the Centro de Valorização da Vida (*CVV*). CVV has been working since 1962 offering support to people who are suffering via the 141 telephone service and its website[iii]

Given the delicate nature of the problem and the taboos that surround it, the protection network for people at risk of suicide needs to be constantly acting and to be constantly trained, since national and international research shows that at least two thirds or people who attempted or committed suicide had communicated, in some way, their intention to do so to friends, family members, acquaintances or health professionals.

A variety of guidance materials exist for all kinds of professionals to contribute to suicide prevention[iv].

Finally it is important to highlight that even though various types of guidance are available, when evaluating health services it can be seen that in practice health professionals are still ill-prepared to work effectively to prevent suicidal behaviour and thus avoid so many deaths from self-inflicted injuries. It is therefore very important to invest in staff training and in the due organization of primary health care, mental health care and specialized services.

[ii] <http://www.portaldasaude.pt/NR/rdonlyres/BCA196AB-74F4-472B-B21E>

[iii] <www.cvv.org.br>.

[iv] *Some of them are cited below, in addition to the two already mentioned. All of them follow WHO guidelines*: (1) the Ministry of Health's (MoH) National Suicide Prevention Plan <6386D4C7A9CB/0/i018789.pdf>; (2) Manual for mental health professionals MoH/PAHO/Unicamp <http://bvsms.saude.gov.br/bvs/publicacoes/manual_editoracao.pdf>; (3) Manual for teachers and educators (WHO) translated to Portuguese; <www.who.int/mental_health/prevention/suicide/en/suicideprev_educ_port.pdf>; (4) Manual for general physicians, translated to Portuguese <www.who.int/mental_health/prevention/suicide/en/suicideprev_gp_port.pdf>; (5) Guidance manual for the media, translated to Portuguese <www.who.int/mental_health/prevention/suicide/en/suicideprev_media_port.pdf>; (6) Manual for elderly suicide prevention <www.ensp.fiocruz.br/portal-ensp/informe/site/materia/detalhe/30879>

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6 Road Traffic Injuries - Profile and Trends - Brasil, 2004 - 2013

Table of Contents

Abstract

Introduction: Road Traffic Accidents (RTA) are responsible for 1.3 million deaths worldwide, particularly in middle and low-income countries. Brazil is among the highest ranking countries in terms of numbers of deaths.

Objective: To present the RTA morbidity and mortality profile and trend in Brazil between 2004 and 2013.

Methods: This is a descriptive study of the profile and trend of mortality and hospitalization due to RTA. It is also an ecological study of RTA mortality time series in Brazil as a whole and in the country's Federative Units.

Results: There was a trend of average annual growth in mortality rates due to RTA in Brazil as a whole (0.98%; 95%CI: 0.11; 1.86), motorcycle riders (7.98%: 95%CI: 5.71; 10.29) and vehicle occupants (1.34%; 95%CI: 0.12; 2.58). There was a reduction in pedestrian mortality rates (-4.83%; 95%CI: -6.06; -3.58). In the Federative Units overall there was an upward trend for RTA and for motorcycle riders. There was a downward or stable trend for pedestrians and a stable trend for vehicle occupants. There was an upward percentage change in hospitalizations in Brazil as a whole between 2004 and 2013, with an upward percentage of change of 55.5% for RTA, 3.7% for pedestrians and 198.7% for motorcycle riders. There was a downward percentage change of -6.8% for vehicle occupants.

Conclusion: The tendency of increased mortality due to RTA is a serious health problem, caused for the most part by increased risk of death among motorcycle riders. Actions to prevent and reduce deaths and injuries among motorcycle riders need to be implemented to reduce traffic morbidity and mortality in Brazil.

Keywords: Road Traffic accidents. Mortality. Epidemiology. Health information systems.

Introduction

Road Traffic Accidents (RTA) are a serious public health problem owing to their impact on morbidity and mortality, especially among young people and males. According to World Health Organization (WHO) estimates, 1.24 million people worldwide die every year due to road traffic accidents. This represents 3,400 deaths a day.[1] Globally some 20 to 50 million people are injured each year.[2]

According to the Global Status Report on Road Safety, in the Americas RTA are the second cause of death among young people aged 15-24.[3] Current trends suggest that, by 2030, road traffic deaths will be the fifth leading cause of death if effective prevention measures are not adopted.[1]

Recent mortality statistics show that higher income countries have less risk of death due to RTA. Canada had 6.8 deaths per 100,000 inhabitants, whilst the mortality rate in Japan and Germany was 5.2 and 4.7 deaths per 100,000 inhabitants, respectively. In middle and low-income countries, however, risk of death from this cause is higher. Deaths per

100,000 inhabitants reached 22.5 in Brazil, 20.5 in China, 18.9 in India, 18.6 in Russia and 11.4 in the USA.[1]

Brazil is in third place among countries with the highest number of traffic deaths, after India and China. However, among the group of countries with similar economic development and populations (Brazil, India, China, Russia and the United States), Brazil has the highest risk of death, with 22.5 deaths per 100,000 inhabitants.[1]

The descriptive analysis of the trends of morbidity and mortality caused by traffic accidents in Brazil and in its 27 Federative Units is important for understanding trend patterns and regional inequalities in relation to the different modes of transport, whilst also having the potential to guide road safety interventions focused on the problems of each Federative Unit.

The aim of this Chapter is to present the profile and trend of mortality and hospital morbidity due to Road Traffic Accidents in Brazil between 2004 and 2013, with emphasis on pedestrians, vehicle occupants and motorcycle riders.

Methods

This is a descriptive study of the profile and trend of mortality and hospital morbidity due to RTA in Brazil and its 27 Federative Units. It is also an ecological study of RTA mortality time series in Brazil as a whole and in the 27 country's Federative Units between 2004 and 2013.

The Death Certificates were used as the source of data. These are the basic documents used to compile the Mortality Information System (*SIM*). Deaths due to RTA were selected according to codes V01-V89 of the International Statistical Classification of Diseases and Related Health Problems – Tenth Revision (ICD-10) in order to analyse RTA deaths as a whole. Following this, they were subdivided into the following categories according to the victim type: Pedestrian (V01-V09), Motorcyclist (V20-V29), Vehicle Occupant (V40-V79) and Other (V10-V19, V30-V39, V80-V88). Deaths due to external causes of undetermined intent and unspecified cause codes (V89, V99, Y32, Y33, Y34) were redistributed (proportionally) to specified RTA.

Population data were taken from the Brazilian Institute of Geography and Statistics' (*IBGE*) population projection for the country's Federative Units by sex and age for the period 2000-2030.[4]

The independent variables used to describe deaths were sex (female and male), age group in years (0-19, 20-39, 40-59 and 60+) and Federative Unit (*FU*).

Frequencies and relative frequencies were calculated, as were specific and standardized mortality rates (per 100,000 inhabitants) and the rate ratio between the sexes (male/female). Rate standardization was done by age (direct method). The standard population used was the *IBGE* Brazilian population projection for the year 2013.[4]

The standardized rates are presented for all the Federative Units for the years 2004, 2009 and 2013, these being the first, middle and final years of the period, respectively.

Percentage of change in deaths between 2004 and 2013 was also calculated. The standardized rate and the percentage of change were calculated for total RTA deaths, as well as for motorcyclist, vehicle occupant and pedestrian deaths.

The data was analyzed with the aid of Tabwin, Microsoft Excel®, Access and Stata 11®.

With regard to the analysis of the mortality rate time series from 2004 to 2013, the Prais-Winsten Linear Regression method was used to control serial correlation. The years of the series were used as independent variables and the mortality rate logarithm base 10 was used as a dependent variable. When analyzing trends, the average annual increase rates of the mortality rates for all RTA and for pedestrians, motorcycle riders and vehicle occupants were estimated. The respective 95% confidence intervals (95%CI) of the average annual increase rates were estimated.[5] The regression coefficient t-test and analysis of the lower and upper limits of the 95%CI of the annual average increase rate were used to interpret time series trends. Upward trends were defined as being when the lower and upper limits of the 95%CI were positive. Downward trends were taken to be when the two limits were negative and stable trends when zero came between the lower and upper limits of the 95%CI.

For hospital morbidity analysis, the Inpatient Hospital Authorization (*AIH*) of the Hospital Information System (*SIH*), available at Datasus website, was used as data source. In order to calculate the hospitalization rates between 2004 and 2013, the year of 2008 was excluded from the analysis, because there was some data loss in that year, due to an update in the system.

All the databases used can be accessed by the public via the National Health System Department of Information Technology (*DATASUS*) website, whereby patients' identification is omitted in accordance with the ethical principles of research involving human beings, in compliance with National Health Council Resolution 466, dated December 12, 2012.

Results

Mortality

Between 2004 and 2013 there were 424,358 deaths due to Road Traffic Accidents in Brazil. On average there were 42,436 deaths per annum. There were 345,869 (81.5%) male deaths and 78,490 (18.5%) female deaths. With regard to the victim's mode of transport status, pedestrians accounted for 131,755 (31%) deaths, motorcycle riders 123,621 (29.1%), vehicle occupants 132,849 (31.3%) and other modes of transport (bicycles, tricycles and other motorized land vehicles) 36,134 (8.5%).

Table 1 shows the number of RTA deaths in 2004, by sex, selected characteristics and by Federative Unit. In that year there were 37,971 deaths due to RTA in Brazil. Deaths occurred most in the 20-39 age group which accounted for 42.8% of total deaths. The highest percentage of deaths occurred among males (80.9%), mostly among the 20-39 age group. Pedestrians accounted for the highest percentage (40.2%) of deaths due to RTA per

victim type. The highest percentage of male deaths was found among motorcycle riders (91%), followed by vehicle occupants and users of other modes of transport (87.5%). The Federative Units with the highest percentage of male deaths were Roraima (90.0%) and Ceará (85.7%), and the lowest percentages of male deaths were found in Acre (69.8%) and Tocantins (77.7%).

In 2013 there were 45,099 deaths due to RTA, representing an increase of 7,128 deaths between 2004 and 2013. Most deaths occurred in the 20-39 age group. Male deaths accounted for 81.8% of total deaths. In the 20-39 age group male deaths accounted for 86.2%. The main victims were motorcycle riders (35.3%) and vehicle occupants (32.2%), whilst pedestrians accounted for 24.7%. This was opposite to the situation in 2004 when pedestrians accounted for the highest percentage. The highest percentage of male victims (89.4%) was found among motorcycle riders (Table 2).

The Federative Units with the highest percentages of male deaths were Amapá (92.9%), Paraíba (87.3%) and Piauí (87.0%), whilst those with the lowest percentages were Rio Grande do Sul, Mato Grosso do Sul and Rio de Janeiro, each with 78.2% of male deaths (Table 2).

Table 1 – Absolute number of deaths due to Road Traffic Accdients according to sex, by age group, victim type and Federative Unit – Brazil, 2004*

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
0-19	4,245	70.2	1,800	29.8	6,046	100.0
20-39	13,972	86.0	2,268	14.0	16,240	100.0
40-59	8,494	83.5	1,680	16.5	10,173	100.0
60 and over	4,018	72.9	1,494	27.1	5,512	100.0
Total	30,729	80.9	7,242	19.1	37,971	100.0
Mode of transport						
Pedestrian	11,683	76.6	3,578	23.4	15,261	100.0
Motorcyclist	6,715	91.0	662	9.0	7,377	100.0
Vehicle occupant	9,487	78.5	2,595	21.5	12,082	100.0
Other	2,844	87.5	407	12.5	3,251	100.0
All transport	30,729	80.9	7,242	19.1	37,971	100.0
Federative Unit						
Rondônia	327	78.3	91	21.7	417	100.0
Acre	61	69.8	26	30.2	87	100.0
Amazonas	284	79.0	75	21.0	360	100.0
Roraima	88	90.0	10	10.0	98	100.0
Pará	769	82.8	159	17.2	928	100.0
Amapá	94	79.2	25	20.8	119	100.0
Tocantins	432	77.7	124	22.3	556	100.0
Maranhão	694	78.5	190	21.5	884	100.0

continues

conclusion

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
Piauí	443	82.1	97	17.9	540	100.0
Ceará	1,462	85.7	244	14.3	1,706	100.0
Rio Grande do Norte	426	84.1	81	15.9	507	100.0
Paraíba	556	84.5	102	15.5	658	100.0
Pernambuco	1,223	82.4	262	17.6	1,485	100.0
Alagoas	470	83.6	92	16.4	561	100.0
Sergipe	380	80.8	90	19.2	470	100.0
Bahia	1,330	81.5	301	18.5	1,631	100.0
Minas Gerais	2,927	80.5	707	19.5	3634	100.0
Espírito Santo	729	83.1	148	16.9	876	100.0
Rio de Janeiro	2,519	79.6	644	20.4	3,163	100.0
São Paulo	6,436	78.8	1,730	21.2	8,166	100.0
Paraná	2,592	82.0	570	18.0	3,162	100.0
Santa Catarina	1,568	81.1	364	18.9	1,932	100.0
Rio Grande do Sul	1,823	81.2	423	18.8	2,246	100.0
Mato Grosso do Sul	548	79.6	140	20.4	689	100.0
Mato Grosso	773	84.8	138	15.2	912	100.0
Goiás	1,351	80.6	326	19.4	1,677	100.0
Federal District	426	84.0	81	16.0	507	100.0
Brazil	30,729	80.9	7,242	19.1	37,971	100.0

Source: *MS/SVS/CGIAE-SIM*.
* The displayed number of deaths in the Table has been corrected for garbage codes, according to the method described before.

Table 2 – Absolute number of deaths due to Road Traffic Accidents according to sex, by age group, victim type and Federative Unit – Brazil, 2013

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
0-19	4,122	74.2	1,433	25.8	5,555	100.0
20-39	16,922	86.2	2,715	13.8	19,636	100.0
40-59	10,554	83.4	2,102	16.6	12,655	100.0
60 and over	5,299	73.1	1,953	26.9	7,253	100.0
Total	36,896	81.8	8,203	18.2	45,099	100.0
Mode of transport						
Pedestrian	8,267	74.3	2,852	25.7	11,119	100.0
Motorcyclist	14,222	89.4	1,678	10.6	15,900	100.0
Vehicle occupant	11,287	77.7	3,242	22.3	14,529	100.0
Other	3,120	87.9	431	12.1	3,551	100.0

continues

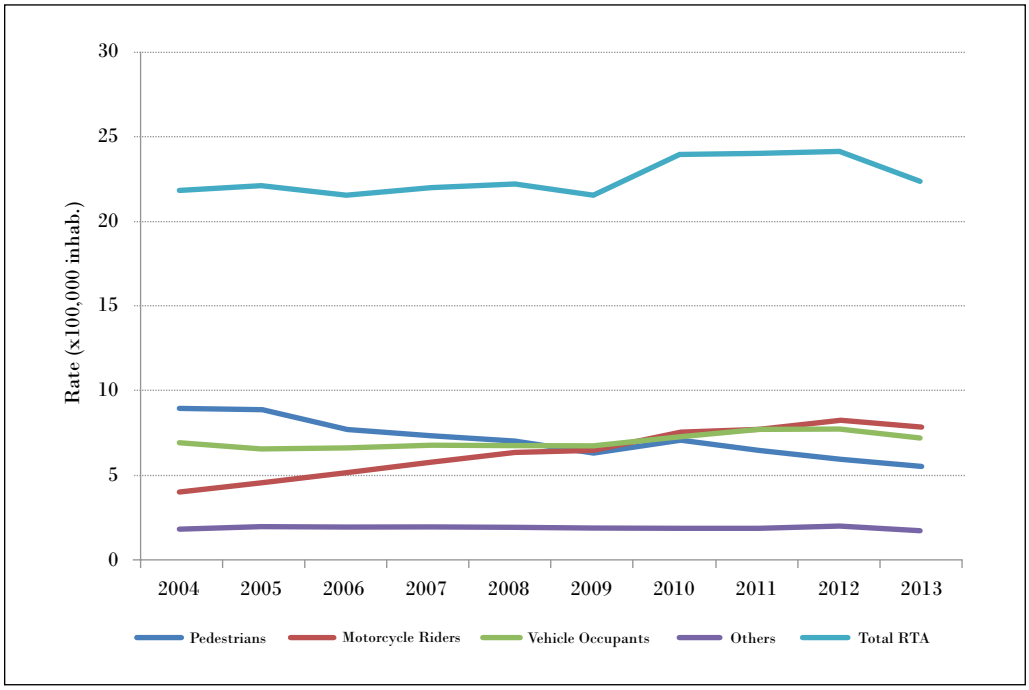
conclusion

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
All transport	36,896	81.8	8,203	18.2	45,099	100.0
Federative Unit						
Rondônia	440	79.5	113	20.5	553	100.0
Acre	107	80.0	27	20.0	134	100.0
Amazonas	361	79.0	96	21.0	457	100.0
Roraima	129	78.6	35	21.4	164	100.0
Pará	1,408	83.0	289	17.0	1,698	100.0
Amapá	118	92.9	9	7.1	127	100.0
Tocantins	430	83.9	83	16.1	513	100.0
Maranhão	1,384	83.5	274	16.5	1,658	100.0
Piauí	987	87.0	147	13.0	1,134	100.0
Ceará	2,164	85.5	368	14.5	2,532	100.0
Rio Grande do Norte	545	84.4	100	15.6	646	100.0
Paraíba	890	87.3	129	12.7	1,019	100.0
Pernambuco	1,728	83.4	344	16.6	2,072	100.0
Alagoas	640	82.2	138	17.8	778	100.0
Sergipe	569	84.1	107	15.9	676	100.0
Bahia	2,572	84.4	474	15.6	3,046	100.0
Minas Gerais	3,805	81.5	862	18.5	4,667	100.0
Espírito Santo	956	85.5	162	14.5	1,117	100.0
Rio de Janeiro	2,472	78.2	690	21.8	3,162	100.0
São Paulo	5,942	81.2	1,373	18.8	7,315	100.0
Paraná	2,564	81.0	600	19.0	3,164	100.0
Santa Catarina	1,367	79.0	362	21.0	1,729	100.0
Rio Grande do Sul	1,690	78.2	472	21.8	2,162	100.0
Mato Grosso do Sul	643	78.2	179	21.8	822	100.0
Mato Grosso	978	81.5	222	18.5	1,200	100.0
Goiás	1,586	78.3	440	21.7	2,026	100.0
Federal District	422	79.5	108	20.5	530	100.0
Brazil	36,896	81.8	8,203	18.2	45,099	100.0

Source: *MS/SVS/CGIAE-SIM*.

Graph 1 shows the evolution of the mortality rate due to RTA and the types of victims. The overall RTA mortality rate remained stable between 2004 and 2009, rising between 2009 and 2010 and falling between 2012 and 2013. The rates for motorcycle riders rose continually between 2004 and 2012, and reached the highest rate among all types of victims in 2010. Pedestrian rates went down throughout the entire period and vehicle occupant rates were stable until 2009 and then increased until 2012.

Graph 1 – Standardized mortality rate due to road traffic accident (RTA), by mode of transport – Brazil, 2004-2013



Source: *MS/SVS/CGIAE-SIM* and *IBGE*.

The analysis of standardized mortality rates due to RTA, by mode of transport in 2004, 2009 and 2013 is presented in Tables 3 and 4.

The highest risk of mortality due to RTA among all modes of transport in 2004 was found in the following Federative Units: Tocantins, Mato Grosso, Santa Catarina, Mato Grosso do Sul and Roraima. Lowest risk was found in Bahia, Amazonas, Acre, Pará and Maranhão. In 2013 highest risk was found in the following Federative Units (*UF*): Mato Grosso, Piauí, Tocantins, Rondônia and Roraima. Lowest risk was found in Amazonas, São Paulo, Rio Grande do Sul, Rio de Janeiro, Acre and the Federal District. The rate ratio between the *UF* with the highest rate and the *UF* with the lowest rate in 2004 and 2013 was 39 and 2.6, respectively. A reduction occurred in the differentials between *UF*s between 2004 and 2013 (Table 4).

The highest risk for pedestrians in 2004 was found in Amapá, Mato Grosso do Sul, Alagoas, São Paulo and Rio de Janeiro. Lowest risk occurred in Bahia, Roraima, Rondônia, Rio Grande do Norte and Piauí. In 2013 highest risk was found in Amapá, Pará, Ceará, Alagoas and Rio de Janeiro, whilst lowest risk occurred in Rio Grande do Norte, Acre, Minas Gerais, Paraíba and Santa Catarina. The rate ratio between the *UF* with the highest rate and the *UF* with the lowest rate in 2004 was 5.5, whilst in 2013 it was 3.1.

With regard to motorcycle riders, highest risk in 2004 was found in Tocantins, Rondônia, Roraima, Piauí and Santa Catarina, whilst lowest risk occurred in Bahia, the Federal District, Amapá, Acre and Rio de Janeiro. In 2013 highest risk was found in Piauí, Roraima, Tocantins, Mato Grosso and Sergipe, whilst lowest risk occurred in the Federal District, Amazonas, Amapá, Rio de Janeiro and Rio Grande do Sul. The rate ratio between the *UF* with the highest rate and the *UF* with the lowest rate was 8.2 in 2004 and 6.2 in 2013.

In relation to vehicle occupants, highest risk of death in 2004 was found in Roraima, Mato Grosso, Tocantins, Paraná and Santa Catarina, whilst lowest risk occurred in Amazonas, Acre, Piauí, Pará and Amapá. In 2013, highest risk was found in Mato Grosso, Mato Grosso do Sul, Espírito Santo, Goiás and Paraná, whilst lowest risk occurred in Amazonas, Acre, Amapá, Pará and Alagoas. The rate ratio between the *UF* with the highest rate and the *UF* with the lowest rate was 9.1 and 5.8 in 2004 and 2013, respectively.

Table 3 – Mortality rates* due to RTA in the Federative Units (*UF*), for pedestrians and motorcycle riders, and percentage of change between 2004-2013 – Brazil, 2004, 2009 and 2013

	Pedestrian				Motorcyclist			
UF	2004	2009	2013	Change (%)	2004	2009	2013	Change (%)
Rondônia	4.4	6.9	5.0	14.3	13.7	15.7	14.3	4.7
Acre	9.8	6.9	3.7	-62.1	2.1	4.9	9.5	361.4
Amazonas	9.3	6.3	7.2	-22.0	3.4	3.9	4.6	34.7
Roraima	4.3	7.1	4.8	11.2	9.9	15.2	17.8	80.2
Pará	8.2	7.3	9.4	14.7	3.5	4.9	9.2	164.6
Amapá	19.4	1.5	10.2	-47.6	1.8	8.5	4.8	169.7
Tocantins	6.8	5.8	4.8	-28.6	13.9	13.7	17.4	25.2
Maranhão	6.2	5.1	4.9	-20.1	3.6	7.9	14.1	292.6
Piauí	5.8	6.0	4.8	-17.0	9.6	15.8	23.4	143.0
Ceará	9.1	7.3	8.4	-8.1	7.0	7.6	12.1	74.5
Rio Grande do Norte	5.2	3.1	3.3	-36.9	4.6	9.6	10.9	139.9
Paraíba	7.5	3.8	4.2	-43.5	5.7	11.2	14.5	156.2
Pernambuco	8.8	7.9	5.7	-35.6	4.0	7.7	11.0	178.1
Alagoas	11.9	10.3	7.8	-34.8	4.3	7.2	12.7	193.4
Sergipe	10.3	6.7	5.6	-45.3	6.5	12.3	16.4	152.1
Bahia	3.5	3.5	4.4	24.4	1.7	3.4	6.4	275.1
Minas Gerais	6.6	5.6	4.1	-38.6	2.9	4.9	5.5	90.6
Espírito Santo	9.2	7.5	5.9	-36.1	5.0	9.1	9.7	93.0
Rio de Janeiro	11.0	8.2	7.5	-31.8	2.7	5.2	4.8	78.2
São Paulo	11.8	6.6	5.1	-56.7	3.0	4.9	4.9	65.2
Paraná	10.8	8.3	6.4	-40.4	5.1	7.4	7.9	54.4
Santa Catarina	8.6	6.5	4.2	-50.7	8.4	10.6	8.8	4.4

continues

conclusion

UF	Pedestrian				Motorcyclist			
	2004	2009	2013	Change (%)	2004	2009	2013	Change (%)
Rio Grande do Sul	8.4	5.6	4.2	-50.3	3.7	5.0	4.8	29.4
Mato Grosso do Sul	11.9	5.0	4.4	-63.4	5.1	9.8	11.9	132.3
Mato Grosso	7.9	7.0	5.3	-33.4	7.7	15.2	16.4	112.1
Goiás	9.6	7.2	6.9	-27.9	7.4	9.9	10.4	39.7
Federal District	10.0	7.3	5.4	-45.8	1.7	3.9	3.8	127.1
Brazil	9.0	6.5	5.5	-38.7	4.1	6.5	7.9	94.2

Source: *MS/SVS/CGIAE-SIM* and *IBGE*.
*Rates standardized per 100,000 inhabitants.

Table 4 – Mortality rates* due to RTA in the Federative Units (*UF*), for vehicle occupants and all victims of RTA, and percentage of change between 2004-2013 – Brazil, 2004, 2009 and 2013

UF	Vehicle Occupant				RTA (all victims)			
	2004	2009	2013	Change (%)	2004	2009	2013	Change (%)
Rondônia	9.9	7.6	10.3	3.9	30.5	35.5	33.9	11.4
Acre	1.8	5.4	2.3	26.6	15.5	17.9	19.0	23.0
Amazonas	1.8	2.4	2.3	27.3	14.9	12.8	14.6	-1.8
Roraima	16.4	11.5	7.2	-56.2	32.5	39.2	33.6	3.6
Pará	3.0	2.4	2.6	-13.6	16.0	16.1	23.0	44.0
Amapá	3.7	6.1	2.3	-36.7	26.3	18.4	21.4	-18.6
Tocantins	15.2	18.5	10.9	-28.7	49.3	50.7	36.8	-25.3
Maranhão	5.3	4.9	4.8	-9.0	16.8	20.9	26.9	60.2
Piauí	2.4	3.9	6.6	175.9	20.0	28.3	37.0	85.4
Ceará	6.2	5.0	4.6	-26.0	23.4	21.1	29.8	27.4
Rio Grande do Norte	7.2	4.3	3.8	-47.6	18.0	17.7	19.4	7.7
Paraíba	5.2	5.3	6.4	21.8	19.4	22.1	26.4	35.8
Pernambuco	4.8	5.1	5.4	12.1	18.8	22.2	23.0	22.4
Alagoas	3.8	3.1	3.7	-4.1	21.0	22.5	25.3	20.5
Sergipe	8.0	5.4	8.5	6.0	26.3	26.8	32.1	22.2
Bahia	6.8	7.6	8.9	29.9	12.5	15.1	20.7	64.7
Minas Gerais	8.3	9.9	11.1	33.2	19.7	22.0	22.2	12.7
Espírito Santo	11.0	9.6	12.1	10.0	27.1	27.3	28.8	6.3
Rio de Janeiro	5.1	4.1	4.9	-3.8	20.6	19.1	18.6	-9.7
São Paulo	4.9	5.2	5.0	2.3	20.9	18.3	16.3	-22.0
Paraná	12.7	11.2	11.8	-7.2	32.4	29.8	28.4	-12.4
Santa Catarina	12.6	9.8	10.6	-15.9	34.0	30.2	25.6	-24.7
Rio Grande do Sul	7.0	7.2	7.9	13.3	21.2	19.4	18.5	-12.6
Mato Grosso do Sul	10.9	11.0	12.6	15.7	33.0	30.1	32.2	-2.6

continues

conclusion

UF	Vehicle Occupant				RTA (all victims)			
	2004	2009	2013	Change (%)	2004	2009	2013	Change (%)
Mato Grosso	16.0	12.4	13.2	-17.4	35.7	38.1	38.6	8.0
Goiás	11.5	10.4	12.0	5.1	32.2	30.4	31.7	-1.4
Federal District	11.6	8.4	8.3	-28.4	24.2	21.4	19.0	-21.5
Brazil	6.9	6.7	7.2	4.4	21.9	21.6	22.4	2.5

Source: *MS/SVS/CGIAE-SIM* and *IBGE*.
*Rates standardized per 100,000 inhabitants.

The percentage of change of mortality rates between 2004 and 2013 for RTA (all victims), showed an increase of more than 5% in 15 Federative Units, in particular Piauí (85.4%), Bahia (64.7%), Maranhão (60.2%), Pará (44%) and Paraíba (35.8%). Percentage of change reduction of more than 5% occurred in eight Federative Units, especially in Tocantins (-25.3%), Santa Catarina (-24.7%), São Paulo (-22%), the Federal District (-21.5%) and Amapá (-18.6%).

With regard to pedestrian victims, only four Federative Units had mortality rates with increased percentage of change: Bahia, Pará, Rondônia and Roraima. The highest percentage of change reduction occurred in Mato Grosso do Sul, Acre, São Paulo, Santa Catarina and Rio Grande do Sul.

In relation to motorcycle riders, all Federative Units had increased percentage of change. In descending order the ten Federative Units with the biggest percentage of change were: Acre, Maranhão, Bahia, Alagoas, Pernambuco, Amapá, Pará, Paraíba, Sergipe and Piauí. Least value occurred in Santa Catarina and Rondônia.

Twelve Federative Units had positive percentage of change for vehicle occupants, whilst thirteen had negative value. The Federative Units with the highest positive percentage of change in mortality rates were Piauí (175.9%), Minas Gerais, Bahia, Amazonas, Acre, Paraíba, Mato Grosso do Sul, Rio Grande do Sul and Pernambuco. Those with the biggest negative values were Roraima, Rio Grande do Norte, Amapá, Tocantins and the Federal District.

The analysis of road traffic mortality rate trends for the period 2004-2008 can be seen in Table 5. There was an upward trend in Brazil as a whole, with an average annual increment rate of 0.98% (95%CI: 0.11; 1.86). Thirteen Federative Units had an upward trend, ten had a stable trend and four had a downward trend in mortality rates over this period of the time series. The upward trend in mortality rates occurred in Piauí, Maranhão, Bahia, Acre, Pará, Espírito Santo, Minas Gerais, Pernambuco, Rondônia, Paraíba, Ceará, Sergipe and Alagoas. The downward trend in mortality rates occurred in Santa Catarina, São Paulo, the Federal District and Rio de Janeiro. The remaining Federative Units had a stable trend.

The trend for pedestrians in Brazil as a whole was downward, with an average annual reduction rate of -4.83 (95%CI: -6.06; -3.58). There was a downward trend in mortality rates in seventeen Federative Units, whilst ten had a stable trend (Table 6).

With regard to motorcycle riders, in Brazil as a whole there was an upward trend with an average annual increase rate of 7.98% (95%CI: 5.71; 10.29). Twenty-five Federative Units had an upward trend and the following had an average annual increase rate greater than 10%: Acre, Amapá, Maranhão, Bahia, Sergipe, Pernambuco, Alagoas, Piauí, Pará, Paraíba and Rio Grande do Norte. The trend was stable in Santa Catarina and Rio de Janeiro.

There was an upward trend in vehicle occupant mortality rates in Brazil as a whole (1.34%; 95%CI: 0.12; 2.58). There was an upward trend in seven Federative Units: Piauí, Bahia, Minas Gerais, Amazonas, Pernambuco, Rio Grande do Sul and Mato Grosso do Sul. There was a downward trend in Rio Grande do Norte and the trend was stable in the remaining Federative Units.

Table 5 – Average annual increment of mortality rates due to road traffic accidents (all victims) – Brazil and Federative Units (*UF*), 2004-2013

UF	b*	Average Annual Increment Rate			Trend
		%	95%CI LL	95%CI UL	
Rondônia	0.013 ł	3.02	0.95	5.14	Upward
Acre	0.019 ł	4.44	2.15	6.78	Upward
Amazonas	0.001	0.33	-2.86	3.63	Stable
Roraima	0.005	1.18	-0.44	2.83	Stable
Pará	0.017 ł	4.04	2.18	5.95	Upward
Amapá	-0.009	-2.10	-7.00	3.05	Stable
Tocantins	-0.003	-0.62	-5.95	5.00	Stable
Maranhão	0.027 ł	6.53	5.48	7.59	Upward
Piauí	0.033 ł	7.86	7.23	8.50	Upward
Ceará	0.014 ł	3.39	0.49	6.37	Upward
Rio Grande do Norte	0.006	1.38	-0.15	2.93	Stable
Paraíba	0.014 ł	3.28	2.42	4.15	Upward
Pernambuco	0.012 ł	2.92	0.43	5.46	Upward
Alagoas	0.015 ł	3.51	1.45	5.62	Upward
Sergipe	0.015 ł	3.48	0.63	6.40	Upward
Bahia	0.026 ł	6.05	3.99	8.16	Upward
Minas Gerais	0.008 ł	1.86	0.45	3.30	Upward
Espírito Santo	0.006 ł	1.44	0.13	2.76	Upward
Rio de Janeiro	-0.005 ł	-1.15	-2.16	-0.12	Downward
São Paulo	-0.010 ł	-2.31	-2.99	-1.62	Downward
Paraná	0.000	0.11	-0.38	0.60	Stable
Santa Catarina	-0.012 ł	-2.62	-3.61	-1.62	Downward
Rio Grande do Sul	-0.004	-0.84	-2.10	0.43	Stable

continues

conclusion

UF	b*	Average Annual Increment Rate			Trend
		%	95%CI LL	95%CI UL	
Mato Grosso do Sul	0.001	0.14	-1.10	1.40	Stable
Mato Grosso	0.007	1.61	-0.30	3.54	Stable
Goiás	0.004	0.91	-0.84	2.68	Stable
Federal District	-0.009 ł	-2.04	-2.71	-1.38	Downward
Brazil	0.004 ł	0.98	0.11	1.86	Upward

Source: *MS/SVS/CGIAE-SIM* and *IBGE*.
*Regression coefficient; ł $p<0.05$.

Table 6 – Average annual increment of mortality rates due to road traffic accidents involving pedestrians – Brazil and Federative Units (*UF*), 2004-2013

UF	b*	Average Annual Increment Rate			Trend
		%	95%CI LL	95%CI UL	
Rondônia	0.010	2.27	-3.03	7.86	Stable
Acre	-0.014	-3.07	-6.31	0.27	Stable
Amazonas	-0.008	-1.83	-6.55	3.14	Stable
Roraima	-0.019	-4.30	-12.19	4.29	Stable
Pará	0.004	0.98	-0.92	2.91	Stable
Amapá	-0.036	-8.01	-30.14	21.13	Stable
Tocantins	-0.014 ł	-3.11	-5.56	-0.60	Downward
Maranhão	-0.005 ł	-1.23	-1.94	-0.52	Downward
Piauí	-0.010 ł	-2.31	-4.38	-0.19	Downward
Ceará	-0.003	-0.73	-3.19	1.80	Stable
Rio Grande do Norte	-0.018	-4.11	-8.51	0.49	Stable
Paraíba	-0.036 ł	-7.88	-10.55	-5.12	Downward
Pernambuco	-0.019 ł	-4.28	-6.90	-1.59	Downward
Alagoas	-0.012	-2.67	-6.11	0.89	Stable
Sergipe	-0.026 ł	-5.81	-9.85	-1.60	Downward
Bahia	0.005	1.12	-3.34	5.80	Stable
Minas Gerais	-0.023 ł	-5.19	-7.29	-3.03	Downward
Espírito Santo	-0.018 ł	-4.02	-7.02	-0.93	Downward
Rio de Janeiro	-0.014 ł	-3.16	-5.69	-0.55	Downward
São Paulo	-0.039 ł	-8.57	-10.77	-6.32	Downward
Paraná	-0.021 ł	-4.81	-6.11	-3.49	Downward
Santa Catarina	-0.032 ł	-7.19	-8.04	-6.33	Downward
Rio Grande do Sul	-0.033 ł	-7.36	-8.83	-5.87	Downward
Mato Grosso do Sul	-0.039 ł	-8.56	-11.32	-5.71	Downward

continues

conclusion

UF	b*	Average Annual Increment Rate			Trend
		%	95%CI LL	95%CI UL	
Mato Grosso	-0.018 ł	-4.02	-6.45	-1.53	Downward
Goiás	-0.011 ł	-2.56	-4.24	-0.85	Downward
Federal District	-0.032 ł	-7.01	-8.62	-5.37	Downward
Brazil	-0.021 ł	-4.83	-6.06	-3.58	Downward

Source: *MS/SVS/CGIAE-SIM and IBGE*.
*Regression coefficient; ł p<0.05.

Table 7 – Average annual increment of mortality rates due to road traffic accidents involving motorcycle riders – Brazil and Federative Units (*UF*), 2004-2013

UF	b*	Average Annual Increment Rate			Trend
		%	95%CI LL	95%CI UL	
Rondônia	0.018 ł	4.34	2.67	6.04	Upward
Acre	0.088 ł	22.52	15.18	30.34	Upward
Amazonas	0.015 ł	3.59	1.43	5.80	Upward
Roraima	0.004 ł	0.94	0.37	1.51	Upward
Pará	0.046 ł	11.15	8.64	13.73	Upward
Amapá	0.080 ł	20.28	0.53	43.92	Upward
Tocantins	0.032 ł	7.70	2.63	13.02	Upward
Maranhão	0.065 ł	16.04	13.88	18.24	Upward
Piauí	0.047 ł	11.50	10.60	12.40	Upward
Ceará	0.034 ł	8.15	3.87	12.60	Upward
Rio Grande do Norte	0.044 ł	10.58	7.48	13.77	Upward
Paraíba	0.044 ł	10.76	6.69	14.99	Upward
Pernambuco	0.055 ł	13.43	9.15	17.88	Upward
Alagoas	0.052 ł	12.74	11.75	13.73	Upward
Sergipe	0.057 ł	13.98	12.60	15.38	Upward
Bahia	0.060 ł	14.79	11.70	17.97	Upward
Minas Gerais	0.033 ł	7.80	3.87	11.87	Upward
Espírito Santo	0.033 ł	7.99	2.33	13.96	Upward
Rio de Janeiro	0.027	6.30	-0.38	13.44	Stable
São Paulo	0.024 ł	5.74	0.72	11.01	Upward
Paraná	0.025 ł	5.92	2.93	9.00	Upward
Santa Catarina	0.002	0.39	-2.69	3.58	Stable
Rio Grande do Sul	0.017 ł	4.04	2.01	6.10	Upward
Mato Grosso do Sul	0.035 ł	8.43	5.22	11.73	Upward
Mato Grosso	0.036 ł	8.65	4.61	12.85	Upward
Goiás	0.020 ł	4.76	2.66	6.89	Upward
Federal District	0.030 ł	7.24	0.67	14.25	Upward
Brazil	0.033 ł	7.98	5.71	10.29	Upward

Source: *MS/SVS/CGIAE-SIM* and *IBGE*.
*Regression coefficient; ł p<0.05.

Table 8 – Average annual increment of mortality rates due to road traffic accidents involving vehicle occupants – Brazil and Federative Units (*UF*), 2004-2013

UF	b*	Average Annual Increment Rate			Trend
		%	95%CI LL	95%CI UL	
Rondônia	0.011	2.53	-3.48	8.91	Stable
Acre	0.002	0.52	-10.18	12.50	Stable
Amazonas	0.017 ł	4.00	0.25	7.90	Upward
Roraima	-0.027	-6.00	-12.46	0.94	Stable
Pará	0.000	0.02	-3.29	3.45	Stable
Amapá	-0.017	-3.91	-25.94	24.66	Stable
Tocantins	-0.008	-1.92	-10.60	7.59	Stable
Maranhão	0.007	1.74	-1.13	4.69	Stable
Piauí	0.067 ł	16.64	14.22	19.12	Upward
Ceará	-0.010	-2.38	-5.67	1.02	Stable
Rio Grande do Norte	-0.029 ł	-6.51	-8.49	-4.49	Downward
Paraíba	0.017	4.08	-0.77	9.18	Stable
Pernambuco	0.009 ł	2.08	0.73	3.46	Upward
Alagoas	0.018	4.28	-1.85	10.79	Stable
Sergipe	0.006	1.34	-2.65	5.50	Stable
Bahia	0.023 ł	5.48	3.44	7.56	Upward
Minas Gerais	0.018 ł	4.28	2.79	5.79	Upward
Espírito Santo	0.006	1.30	-1.25	3.92	Stable
Rio de Janeiro	-0.005	-1.23	-5.87	3.63	Stable
São Paulo	0.003	0.62	-1.70	2.99	Stable
Paraná	0.000	-0.03	-1.96	1.94	Stable
Santa Catarina	-0.007	-1.60	-3.99	0.86	Stable
Rio Grande do Sul	0.009 ł	2.02	0.02	4.06	Upward
Mato Grosso do Sul	0.006 ł	1.35	0.38	2.33	Upward
Mato Grosso	-0.002	-0.45	-4.30	3.57	Stable
Goiás	0.005	1.19	-3.50	6.10	Stable
Federal District	-0.007	-1.68	-5.59	2.40	Stable
Brazil	0.006 ł	1.34	0.12	2.58	Upward

Source: *MS/SVS/CGIAE-SIM* and *IBGE*.
*Regression coefficient; ł $p<0.05$.

Hospitalizations

Between 2004 and 2013, hospitalizations due to road traffic accidents (RTA) totalled 1,662,020 in Brazil, with 882,000 hospitalizations per annum on average. RTA accounted for an average of 18% of total hospitalizations paid for by the Brazilian National Health System (*SUS*) due to external causes nationwide. In the same period the cost of these hospitalizations was BRL 1.9 billion and, on average, each hospitalization cost BRL 1,800.

There were 1,289,881 (77.6%) male hospitalizations and 372,838 (22.4%) female hospitalizations. With regard to RTA mode of transport, 61,483 (26.9%) pedestrians, 128,174 (56.1%) motorcycle riders, 22,517 (9.9%) vehicle occupants and 22,587 (7.1%) users of other modes of transport (bicycles, tricycles and other motorized land vehicles) were hospitalized.

Table 9 shows the number of hospitalizations owing to injuries caused by road traffic accidents in 2004, according to sex and selected characteristics. In that year hospitalizations due to RTA totalled 133,728 in Brazil. The cost was BRL 124.2 million and average hospitalization cost was BRL 929. With regard to age group, 45.8% of total hospitalizations were concentrated in people aged 20-39. The highest percentage (76.8%) occurred in males and was also concentrated in the 20-39 age group. Pedestrians accounted for the highest absolute number (40.5%) of hospitalizations due to RTA. The highest percentage of hospitalizations among males occurred among pedestrians (37.4%), followed by motorcycle riders (32.2%).

Table 9 – Absolute number of hospitalizations due to road traffic accidents according to sex, by age group, victim type and Federative Unit – Brazil, 2004

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
0-19	24,718	72.8	9,246	27.2	33,964	100.0
20-39	50,712	82.9	10,471	17.1	61,184	100.0
40-59	20,231	76.8	6,107	23.2	26,337	100.0
60 and over	6,988	57.1	5,254	42.9	12,242	100.0
Total	102,649	76.8	31,078	23.2	133,728	100,0
Mode of transport						
Pedestrian	38,352	70.9	15,778	29.1	54,130	100.0
Motorcyclist	33,064	84.9	5,867	15.1	38,931	100.0
Vehicle occupant	16,535	75.1	5,487	24.9	22,022	100.0
Other	14,698	78.8	3,946	21.2	18,644	100.0
All transport	102,649	76.8	31,078	23.2	133,728	100.0
Federative Unit						
Rondônia	806	75.4	262	24.6	1,068	100.0
Acre	217	70.9	89	29.1	306	100.0
Amazonas	887	73.2	325	26.8	1,212	100.0
Roraima	378	78.1	106	21.9	484	100.0
Pará	2,420	77.1	719	22.9	3,139	100.0
Amapá	194	73.5	70	26.5	263	100.0
Tocantins	71	75.9	22	24.1	93	100.0
Maranhão	5,112	72.0	1,985	28.0	7,097	100.0
Piauí	1,853	81.7	415	18.3	2,268	100.0
Ceará	8,911	76.0	2,817	24.0	11,727	100.0

continues

conclusion

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
Rio Grande do Norte	1,302	78.5	356	21.5	1,658	100.0
Paraíba	2,286	83.7	447	16.3	2,733	100.0
Pernambuco	2,764	66.8	1,375	33.2	4,139	100.0
Alagoas	1,778	73.1	653	26.9	2,431	100.0
Sergipe	676	83.4	134	16.6	810	100.0
Bahia	4,402	77.5	1,279	22.5	5,681	100.0
Minas Gerais	11,884	76.9	3,580	23.1	15,463	100.0
Espírito Santo	1,551	76.3	482	23.7	2,034	100.0
Rio de Janeiro	7,916	75.5	2,572	24.5	10,488	100.0
São Paulo	25,777	78.6	7,002	21.4	32,779	100.0
Paraná	3,716	79.4	967	20.6	4,683	100.0
Santa Catarina	3,138	77.9	893	22.1	4,030	100.0
Rio Grande do Sul	5,916	72.2	2,273	27.8	8,190	100.0
Mato Grosso do Sul	1,105	74.3	381	25.7	1,487	100.0
Mato Grosso	1,070	77.1	318	22.9	1,388	100.0
Goiás	4,367	76.3	1,358	23.7	5,724	100.0
Federal District	1,129	76.7	344	23.3	1,473	100.0
Brazil	102,651	76.8	31,040	23.2	133,602	100.0

Source: *MS/SAS/SIH/SUS*.

Table 10 shows the number of hospitalizations due to RTA in 2013, according to sex and selected characteristics. In that year hospitalizations due to RTA totalled 228,367 in Brazil. The cost of these hospitalizations was BRL 303,522 million and average cost per hospitalization paid was BRL 1,329. 47.8% of total hospitalizations were concentrated in the 20-39 age group. The highest percentage of hospitalizations occurred among males (77.7%), particularly in the 20-39 age group. The highest absolute number of hospitalizations due to RTA occurred among motorcycle riders (56.1%). The highest percentage of male hospitalizations was found among motorcycle riders (59.7%), followed by pedestrians (23.8)%.

Table 10 – Absolute number of hospitalizations due to road traffic accidents according to sex, by age group, victim type and Federative Unit – Brazil, 2013

Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
0-19	35,164	75.3	11,549	24.7	46,713	100.0
20-39	89,654	82.1	19,591	17.9	109,245	100.0
40-59	40,215	77.4	11,769	22.6	51,985	100.0
60 and over	12,339	60.5	8,040	39.5	20,379	100.0

continues

conclusion

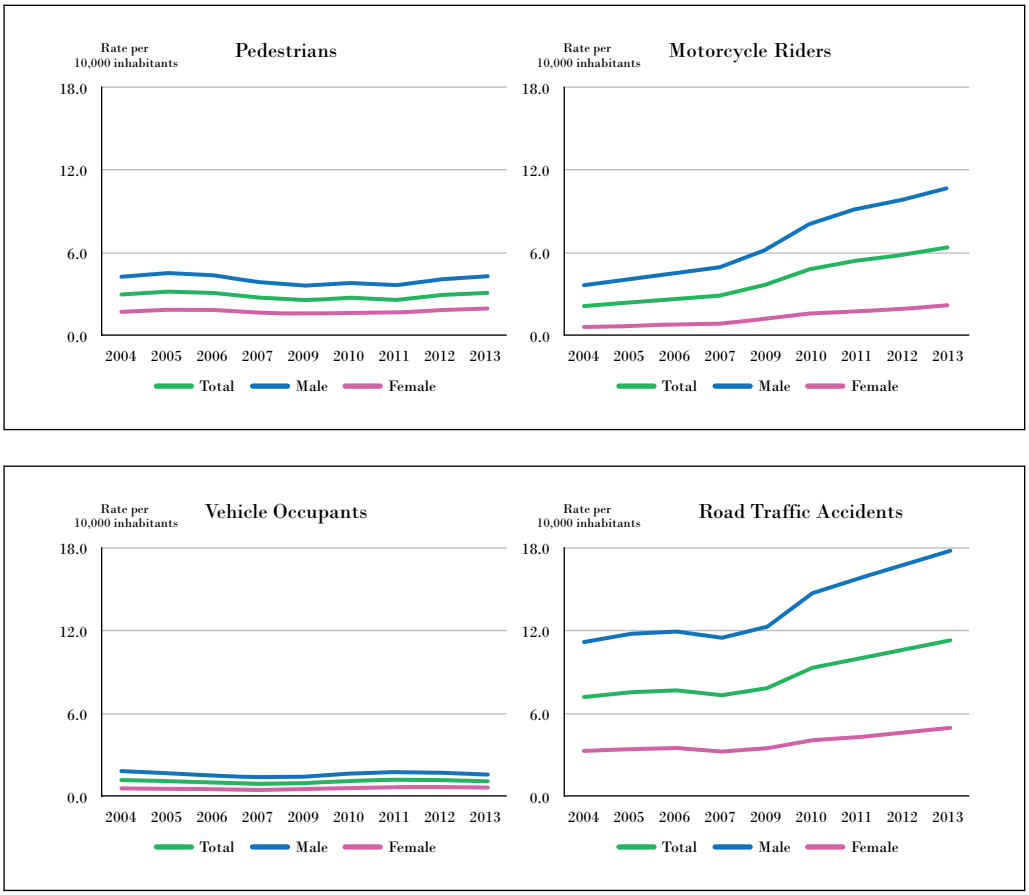
Variable	Male		Female		Total	
Age Group (years)	N	%	N	%	N	%
Total	177,373	77.7	50,949	22.3	228,322	100.0
Mode of transport						
Pedestrian	42,290	68.5	19,453	31.5	61,743	100.0
Motorcyclist	105,941	82.8	21,953	17.2	127,894	100.0
Vehicle occupant	16,069	71.1	6,527	28.9	22,596	100.0
Other	13,073	81.3	3,016	18.7	16,089	100.0
All transport	177,373	77.7	50,949	22.3	228,322	100.0
Federative Unit						
Rondônia	3,771	74.4	1,298	25.6	5,069	100.0
Acre	973	65.3	517	34.7	1,490	100.0
Amazonas	3,431	72.3	1,312	27.7	4,743	100.0
Roraima	868	68.8	393	31.2	1,261	100.0
Pará	6,563	77.1	1,946	22.9	8,509	100.0
Amapá	588	69.6	257	30.4	846	100.0
Tocantins	1,288	77.6	371	22.4	1,659	100.0
Maranhão	9,213	75.4	3,007	24.6	12,220	100.0
Piauí	4,946	80.9	1,171	19.1	6,118	100.0
Ceará	11,163	78.2	3,117	21.8	14,280	100.0
Rio Grande do Norte	2,063	82.4	441	17.6	2,504	100.0
Paraíba	4,168	79.4	1,083	20.6	5,252	100.0
Pernambuco	15,125	79.9	3,807	20.1	18,932	100.0
Alagoas	2,120	78.3	587	21.7	2,707	100.0
Sergipe	1,630	79.7	415	20.3	2,045	100.0
Bahia	9,367	80.5	2,270	19.5	11,637	100.0
Minas Gerais	19,233	79.3	5,005	20.7	24,239	100.0
Espírito Santo	4,344	76.1	1,367	23.9	5,712	100.0
Rio de Janeiro	11,713	76.0	3,696	24.0	15,409	100.0
São Paulo	34,236	78.9	9,163	21.1	43,398	100.0
Paraná	8,460	75.1	2,808	24.9	11,267	100.0
Santa Catarina	5,939	78.2	1,652	21.8	7,591	100.0
Rio Grande do Sul	4,935	73.9	1,739	26.1	6,674	100.0
Mato Grosso do Sul	2,861	75.1	949	24.9	3,810	100.0
Mato Grosso	3,959	79.0	1,054	21.0	5,013	100.0
Goiás	8,063	75.3	2,642	24.7	10,705	100.0
Federal District	1,397	78.7	378	21.3	1,775	100.0
Brazil	177,509	77.7	50,891	22.3	228,400	100.0

Source: *MS/SAS/SIH/SUS*.

Graph 2 shows the evolution of the hospitalization rate due to RTA and the mode of transport, by sex. The total hospitalization rate had an upward trend over the period. Motorcycle riders had the highest increase in hospitalization rates over the period. Males

had the highest rates among all victim types. Vehicle occupants had the lowest rates per victim type and these remained stable over the period. Motorcyclist rates grew continually between 2004 and 2013, whilst pedestrian rates fell throughout the entire period.

Graph 2 – Hospitalization rate (per 10,000 inhabitants) due to RTA, for pedestrians, motorcycle riders, vehicle occupants, road transport accidents and sex (m/f) – Brazil, 2004-2013



Rates per 100,000
Source: SIH/SUS e IBGE.

Graph 3 shows a trend towards stability among pedestrians, with higher hospitalization rates in the 60 and over age group. The trend is upward among motorcycle riders, and greatest risk was found in young adults aged 20-39, with a percentage change of 192% in the rates between 2004 and 2013. Vehicle occupants in all age groups had lower and stable rates. The highest risk of hospitalization due to RTA was found in the 20-39 age group, principally among motorcycle riders. This phenomenon in relation to motorcycle riders can be seen to have higher rates in more recent years with effect from 2009.

Graph 3 – RTA hospitalization rate (per 10,000 inhabitants) for pedestrians, motorcycle riders, vehicle occupants and all mode of transport by age group – Brazil, 2004-2013

Rates per 100,000
Source: *SIH/SUS* and *IBGE*.

In the Federative Units the hospitalization rates for pedestrians in 2013 were higher in Roraima (11.2 per 10,000 inhab.) and Maranhão (10.8 per 10,000 inhab.). The highest positive percentage of change in hospitalization rates due to RTA (pedestrians) between 2004 and 2013 were found in Roraima (4,596%) and Tocantins (812%). For Brazil as a whole, the hospitalization rate for pedestrians in 2013 was 3.1 per 10,000 inhabitants, whilst the percentage of change between 2004 and 2013 was 3.7%. The highest motorcyclist hospitalization rates in 2013 were found in Rondônia (24.3/10,000) and Piauí (17.3/10,000), and the percentage of change of the rates was positive and very high, as well as having an upward trend, in all Federative Units. For Brazil as a whole the percentage of change for motorcycle riders was 198.7% (Table 11).

Table 11 – Hospitalization rates due to Land Transport Accidents in the Federative Units (*UF*), for pedestrians and motorcycle riders and percentage of change between 2004-2013 – Brazil, 2004, 2009 and 2013

	Pedestrian				Motorcyclist			
UF of Residence	2004	2009	2013	Change (%)	2004	2009	2013	Change (%)
Rondônia	0.5	3.7	1.7	229.3	3.7	9.4	24.3	559.8
Acre	0.9	2.7	3.4	300.1	1.4	6.6	11.8	744.2
Amazonas	3.0	0.7	2.3	-23.6	0.5	5.6	8.6	1,747.0
Roraima	0.2	2.2	11.2	4,596.9	8.9	11.7	10.8	21.1
Pará	1.6	0.4	1.1	-30.4	1.9	3.7	8.5	335.8
Amapá	2.9	1.5	6.0	104.6	1.3	3.1	2.8	120.1
Tocantins	0.3	2.5	3.0	812.9	0.2	1.9	5.8	2,834.2
Maranhão	10.8	12.5	10.8	-0.4	0.6	1.1	6.8	1,123.9
Piauí	1.4	1.0	1.4	2.4	4.4	9.7	17.3	290.7
Ceará	3.6	6.0	5.5	51.0	6.5	4.5	9.7	49.1
Rio Grande do Norte	2.9	1.2	1.0	-67.2	2.2	4.6	6.0	177.7
Paraíba	1.6	0.1	2.4	46.9	3.9	1.1	9.6	146.9
Pernambuco	2.4	0.5	9.0	278.6	1.1	4.7	10.0	787.0
Alagoas	6.7	3.1	3.2	-51.6	0.7	2.0	4.2	491.7
Sergipe	0.6	0.7	0.3	-45.0	2.1	2.2	8.6	306.2
Bahia	1.7	0.8	1.2	-29.5	1.3	2.4	5.0	297.6
Minas Gerais	2.6	2.4	3.0	13.2	2.2	3.8	5.9	162.2
Espírito Santo	3.6	2.3	5.5	52.7	1.0	1.7	6.9	561.8
Rio de Janeiro	3.4	3.2	4.5	34.3	1.4	2.0	3.5	144.2
São Paulo	3.0	2.6	2.6	-14.6	2.6	4.5	5.3	102.1
Paraná	1.2	1.5	2.5	111.9	1.2	2.9	5.1	314.5
Santa Catarina	2.6	2.9	2.0	-24.8	2.4	5.1	6.8	179.6
Rio Grande do Sul	3.2	1.2	2.1	-35.2	1.2	1.1	2.1	81.3
Mato Grosso do Sul	0.9	0.6	1.2	31.7	1.7	6.9	9.6	471.7
Mato Grosso	1.8	0.3	1.6	-13.9	1.8	8.2	11.9	564.3
Goiás	1.8	1.1	2.0	16.0	4.7	9.5	12.1	157.3
Federal District	1.6	2.3	2.0	27.1	1.5	2.8	2.7	83.3
Brazil	2.9	2.5	3.1	3.7	2.1	3.7	6.4	198.7

Source: *MS/SAS/SIH/SUS* and *IBGE*.

Vehicle occupant hospitalization rates in 2013 were highest in Santa Catarina (1.8 per 10,000 inhab.) and Paraná (1.7 per 10,000 inhab.). The highest positive percentage of changes occurred in Amapá (1,552%) and Tocantins (965%). For Brazil as a whole, the rate was 1.1 per 10,000 inhabitants and change was negative (-6.8%).

RTA hospitalizations in 2013 were highest in Rondônia (29.3 per 10,000 inhab.) and Roraima (25.8 per 10,000 inhab.). The percentage of change in the rates between 2004

and 2013 in almost all Federative Units were positive and of large magnitude, in addition to having an upward trend in the period. Negative percentage of changes occurred in Rio Grande do Sul (-22.2%) and the Federal District (-1.6%). Positive percentage of changes occurred in the majority of Federative Units, especially in Tocantins where it was 1,443%, whilst in Brazil as a whole the rate was 11.4 per 10,000 inhabitants and the percentage of change was 55.5% (Table 12).

Table 12 – Hospitalization rates due to RTA in the Federative Units (*UF*), for vehicle occupants and all mode of transport and percentage of change between 2004-2013 – Brazil, 2004, 2009 and 2013

	Vehicle Occupant				All mode of transport			
UF of Residence	2004	2009	2013	Change (%)	2004	2009	2013	Change (%)
Rondônia	1.0	0.3	1.5	46.7	7.1	14.8	29.3	316.0
Acre	0.1	0.3	0.9	817.7	4.8	11.6	19.1	303.0
Amazonas	0.2	0.4	0.6	196.4	3.8	7.6	12.4	225.1
Roraima	2.3	2.5	2.3	0.0	12.3	18.1	25.8	109.4
Pará	0.1	0.3	0.4	278.7	4.5	5.0	10.7	135.3
Amapá	0.1	1.6	0.9	1,552.7	4.6	7.2	11.5	152.6
Tocantins	0.1	0.8	1.6	965.7	0.7	5.9	11.2	1,443.7
Maranhão	0.0	0.0	0.1	85.7	11.6	13.6	18.0	55.4
Piauí	0.7	0.5	0.2	-76.5	7.6	11.7	19.2	152.9
Ceará	3.1	0.6	0.6	-81.9	14.6	11.9	16.3	11.6
Rio Grande do Norte	0.0	0.1	0.2	402.3	5.5	6.2	7.4	35.2
Paraíba	1.1	0.1	1.0	-11.1	7.5	1.4	13.4	78.3
Pernambuco	0.4	0.1	0.6	40.8	4.9	6.0	20.5	318.5
Alagoas	0.1	0.4	0.3	224.5	8.0	6.1	8.2	3.2
Sergipe	1.2	0.1	0.1	-93.2	4.1	3.2	9.3	123.3
Bahia	0.8	0.8	1.0	35.3	4.0	4.3	7.8	91.9
Minas Gerais	1.1	1.2	1.6	55.5	8.1	8.6	11.8	44.9
Espírito Santo	0.9	0.3	0.9	-5.9	6.0	5.3	14.9	149.5
Rio de Janeiro	1.2	0.6	0.9	-24.8	6.8	6.1	9.4	37.9
São Paulo	1.5	1.2	1.2	-19.5	8.2	9.3	9.9	20.8
Paraná	1.2	1.3	1.7	36.6	4.6	6.5	10.2	121.5
Santa Catarina	1.3	1.1	1.8	42.7	6.9	9.9	11.4	64.6
Rio Grande do Sul	2.9	2.2	1.5	-50.3	7.7	4.6	6.0	-22.2
Mato Grosso do Sul	0.8	1.0	1.5	76.4	6.5	11.5	14.7	125.1
Mato Grosso	0.2	1.6	1.2	494.7	5.0	11.1	15.8	213.5
Goiás	1.5	1.0	1.7	11.5	10.3	12.6	16.6	60.8
Federal District	2.7	2.2	1.1	-57.9	6.5	8.1	6.4	-1.6
Brazil	1.2	1.0	1.1	-6.8	7.3	7.9	11.4	55.5

Source: *MS/SAS/SIH/SUS* and *IBGE*.

Discussion

The results of the analysis of mortality for Brazil as a whole showed an increase of 7,128 deaths due to RTA in Brazil in the period studied, an increase in the mortality rate with effect from 2009 and a reduction in 2013. With regard to victim profile, there was a predominance of males and those in the 20-39 age group. This pattern is similar to that found by other studies, with a predominance of young people and males aged 20-39. A study conducted by WHO shows an estimate of 43,869 deaths due to RTA in 2010, similar to this study which in the period (2004-2013) found an annual average of 42,436 deaths. Likewise, the mortality rate found by this study was 22.4 and the WHO estimate was 22.5.[1]

The analysis showed a reduction in the percentage of deaths involving pedestrians and an increase in the percentage of motorcycle riders between 2004 and 2013. Motorcycle riders accounted for 35.3% of traffic deaths in Brazil in 2013. Similarly, analysis of the mortality rates in the same period showed a reduction in risk for pedestrians and increased risk for motorcycle riders. These results are in keeping with those published by the World Health Organization for other countries. Motorcycle riders, in addition to pedestrians and cyclists, are the most vulnerable users of public highways, according to the Global Status Report on Road Safety.[1]

In the Americas the number of motorcycles is growing increasingly in cities and is one of the main factors associated with injuries and deaths due to road traffic involving motorcycle riders. Recent analysis of mortality data for the Americas region showed that death rates relating to motorcycle riders increased in all sub-regions between 1998 and 2010, even in those where rates were low.[6]

The Federative Units in Brazil's North, Midwest and South Regions had the highest risk of mortality due to LTA (for all mode of transport) in 2004. In 2013, the state of Piauí (Northeast Region) was included in the group of states with highest risk and Santa Catarina (South Region) was excluded. The same regional profile was found for motorcycle riders and vehicle occupants. A study conducted by Morais Neto et al.[7] found higher rates in the North, Midwest and South Regions in the year 2000 and higher rates in the states of the Northeast Region in 2010, whilst there was a reduction in some states in the South Region in 2010.

Analysis of the time series of the mortality rates due to RTA for the whole of Brazil for the period 2004 to 2013 showed the following trends: upward for total victims motorcycle riders and vehicle occupants; and downward for pedestrians. There was an upward trend for all mode of transport in 13 Federative Units, comprising the nine *UF* of the Northeast Region and Acre, Pará, Minas Gerais and Espírito Santo; there was a downward trend in Rio de Janeiro, São Paulo, Santa Catarina and the Federal District. There was a downward trend in the rates for pedestrians in 17 *UF* and a stable trend in 10 *UF* in the North and Northeast Regions. There was an upward trend in the rates for motorcycle riders in all *UF* except Rio de Janeiro and the Federal District. The upward trend for motorcycle riders was highest in the *UF* of the Northeast Region and two of the North Region (Acre and

Amapá). The rates for vehicle occupants had an upward trend in seven *UF*, especially in Piauí, where the average annual increase rate was 16.6%; there was a downward trend in Rio Grande do Norte; and the trend was stable in the remaining *UF*. A similar trend was found in the studies conducted by Morais Neto, Moura & Cortez-Escalante[8] and Morais Neto et al.[7] In this study the highest risk of death in 2013 was in the state of Piauí, where the mortality rate was 23.4 deaths per 100,000 inhabitants, this being three times the national rate. 18% of all hospitalizations due to external causes in Brazil had RTA as their main diagnosis. The cost of these hospitalizations was BRL 1.9 billion between 2004 and 2013. There was a percentage reduction in hospitalizations of pedestrians and vehicle occupants between 2004 and 2013, whereas the percentage of motorcycle riders increased.

Analysis of the hospitalization rates in the Federative Units showed the following trends: All mode of transport – 25 *UF* had increased percentage change and only reduced in Rio Grande do Sul and the Federal District; pedestrians – 16 *UF* had increased percentage change and 10 had reduced percentage change; motorcycle riders – all *UF* had increased percentage change, especially Tocantins, Amazonas and Maranhão which had percentage of change of more than 1,000%; vehicle occupants, 9 *UF* had reduced percentage of change, 17 had increased hospitalization rates between 2004 and 2013, especially Amapá, Acre and Tocantins.

Joint analysis of mortality and hospital morbidity for all victims of road traffic accidents shows increased mortality and hospitalization rates in the North, Northeast and Midwest Regions, especially in the following *UF*: Piauí, Bahia, Maranhão, Paraíba, Ceará, Pernambuco, Sergipe, Pará and Acre. The scenario with regard to motorcycle accidents is of more concern, with very high average annual increment rates in the period examined. The situation is critical in Acre and Pará in the North Region; Maranhão, Piauí, Bahia, Alagoas and Pernambuco in the Northeast Region; and Espírito Santo in the Southeast Region. With regard to vehicle occupants, highest risk was found in Piauí, Bahia, Paraíba, Pernambuco, Alagoas and Maranhão in the Northeast Region; Amazonas and Amapá in the North Region; Minas Gerais and Espírito Santo in the Southeast Region; and Mato Grosso do Sul in the Midwest Region.

The disturbing situation with regard to the upward trend of motorcyclist deaths and hospitalizations, their determinants and implications for health has been highlighted by several studies.[7,9,10,11,12,13]

The determinants of this phenomenon include: the increased number of motorcycles, the use of motorcycles instead of public transport and their use for job-related activities. Other factors include it being difficult for other motorists to see motorcycle riders, inappropriate driving behavior and factors relating to streets and highways themselves.[7,14]

The number of motorcycles increased 285% in the North Region and 307.3% in the Northeast Region between 2005 and 2013. In Brazil as a whole the increase was 203.3%. Motorcycles are the main vehicle in these two regions. In 2013 motorcycles accounted for 48% of total vehicles in the Northern Region and 43.7% in the Northeast Region, compared to 26.6% nationally (available at: http://www.denatran.gov.br).

A study conducted with a sample of victims of motorcycle accidents in emergency services in the state of Piauí found less use of crash helmets at the time of the accident among motorcycle riders who had consumed alcohol compared with those who had not.[15]

An aspect which deserves special and differentiated attention is the use of motorcycles for work purposes, especially motorcycle delivery services. Interventions aimed at this group should be focused on changes in work processes to reduce the pressure regarding delivery time limits and to reduce working hours.[16]

The limitations of this study include the use of secondary data from the Mortality Information System (*SIM*) as a source of data and the existence of underreported deaths in some regions, such as the North and Northeast. Notwithstanding, studies into the coverage of the *SIM* System have found increase in its coverage. Another limitation is the high percentage of underlying causes of death due to external causes being classified using codes V99, Y-10-Y34. In order to overcome this limitation, these codes were redistributed among specified deaths. The coverage of hospitalizations due to external causes is another limitation, since they do not include information from non-*SUS* hospital units. The year 2008 stands out among the period studied because there was a change to the Hospital Information System (*SIH/SUS*) with the implantation of the *SUS* Unified Chart of Procedures, Medication, Orthoses, Prostheses and Special Materials. This change lead to a reduction in the number of general hospitalization records and this was reflected in the cases studied. Nevertheless, despite the difficulties and limitations, *SIH*/*SUS* records are a tool that enable epidemiological information about hospitalizations due to external causes in Brazil to be generated.

The results of this study indicate trends and delineate scenarios of risk of morbidity and mortality in the Brazilian Federative Units capable of informing interventions regarding determinants and risk factors of deaths and injuries caused by road traffic accidents. Data for the year 2013 is positive in terms of rate reduction, but nevertheless there is an urgent need to increase the mobilization of the various sectors responsible for these interventions so that Brazil can move towards meeting the goal of the Decade of Action for Road Safety proposed by the United Nations in 2011.[17]

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7 Motorcycle-related Injuries: a panorama of Brazil's hospital morbidity and mortality situation

Table of Contents

Abstract

Introduction: Morbidity and mortality of motorcyclists involved in traffic accidents are a huge challenge.

Objectives: To describe hospital morbidity and mortality due to accidents involving motorcyclists in Brazil.

Methods: This is a descriptive study using Brazilian National Health System (*SUS*) Hospital Information System data (*SIH/SUS* – 2009-2013) and Mortality Information System data (*SIM* – 2004-2013). Standardized mortality rates (per 100,000 inhabitants), crude hospitalization rates (per 10,000 inhabitants), death ratio per fleet (per 10,000 motorcycles), percentage of changes, cost and average hospitalization time were calculated.

Results: Between 2004 and 2013, the standardized motorcyclist mortality rate rose from 2.8 to 6 deaths/100,000 inhabitants in Brazil. The correlation between mortality rate and the motorization rate is strong ($R^2 = 0,96$). In 2013, the highest mortality rates occurred in the Midwest (8.5) and Northeast (8.4) Regions, and in the states of Piauí (19.8) and Sergipe (15.4). Of the 88,612 motorcyclists hospitalized, the majority were male (83.5%), and individuals in the 20-29 age group (35.9%). The hospitalization rate was 4.4/10,000 inhabitants. The states of Piauí (15.0), Rondônia (10.7) and Roraima (10.1) had the highest rates. Highest average expenditure occurred in the South Region (BRL 1,603.38). Average hospitalization time was more than six days in the majority of the country's regions.

Conclusion: There was an increase in the number of deaths of motorcyclists involved in traffic accidents, as well as increased mortality and hospitalization rates, mainly in the Northeast and North Regions. Multisectoral actions need to prioritize the prevention of these accidents.

Keywords: Road traffic accidents. Hospitalization. Motorcycles. Mortality. Descriptive epidemiology.

Introduction

Road traffic accidents (RTA) are a serious public health problem worldwide, since they result in high mortality as well as temporary and permanent disabilities. According to the World Health Organization (WHO), RTAs are the eighth leading cause of death globally and the first cause of death among young people aged 15-29. Estimates indicate that if effective prevention measures are not taken to curb increasing trends, by 2030 RTAs will be the fifth leading cause of death.[1] Among RTAs, those involving motorcyclists have become increasingly common in cities.

Fatal accidents involving motorcyclists account for one third of all transport deaths in South Asia and the Western Pacific Region, and mortality is growing in the Americas and in Africa. Serious injuries to motorcyclists mainly involve the head and the neck and can lead to disability and death. Using an adequate and good quality crash helmet can reduce risk of death by 40% and the risk of serious injuries by more than 70%.[2]

Since 1998, the mortality rate involving motorcyclists injured in RTAs has grown constantly in all Brazilian regions, especially in municipalities with smaller populations.[3] In 2012, motorcyclists were the main fatal victims of transport accidents, accounting for 28% of RTA deaths.[4] This is lower than the rate found in some Asiatic countries where motorcyclist deaths account for more than 70% of total traffic accident deaths, such as in Indonesia (35.7%), Cambodia (66.6%), Thailand (73.5%) and Laos (74.4%).[1]

The motorcycle fleet has grown rapidly. This vehicle is widely used for delivering small goods and many authors indicate pressure from employers and clients to provide a rapid service as being an important factor underlying accidents.[5, 6] Due to their being quick, motorcycles are also used for travelling to work or to college and this accounts for 75% of their use.[7] In Brazil the motorcycle fleet grew 247% between 2003 and 2013. This growth occurred in all the country's regions, especially in the North and Northeast, where since 2012 they have been the main vehicle of the national fleet.[i] The fact that motorcycles are easy to buy, the insecurity inherent to this type of vehicle and aggressive driving result in increased deaths, hospitalizations and disabilities among their users.[8]

In 2012, 159,251 hospitalizations due to RTA were recorded in Brazil. 51.2% of these related to accidents involving motorcyclists (81,494), with a hospitalization rate of 4.2 per 10,000 inhabitants. The hospitalization rate was 5.4 times higher among males (7.2 hospitalizations per 10,000 males) in relation to females (1.3 hospitalizations per 10,000 females).[8]

The purpose of this chapter is to describe hospital morbidity and mortality due to accidents involving motorcyclists in Brazil and in the country's Federative Units (*UF*).

Methods

This is a descriptive ecological study using data on hospital morbidity and mortality of motorcyclists due to road traffic accidents (RTA) in Brazil, for the periods 2004-2013 and 2009-2013, respectively.

For analysis purposes, motorcycles were considered to be: mopeds, motorized bicycles, motorcycles and three-wheeled motor vehicles. According to the International Statistical Classification of Diseases and Related Health Problems – Tenth Revision (ICD-10),[ii] a motorcycle is a two-wheeled motor vehicle with one or two riding saddles and sometimes with a third wheel for the support of a sidecar. The sidecar is considered part of the motorcycle. A motorcycle rider is any person riding a motorcycle or in a sidecar or trailer attached to the motorcycle.

The data on mortality was obtained from the Mortality Information System (*SIM*), which uses Death Certificates as its source of data. The data on National Health System

[i] Available at: <www.denatran.gov.br.>.
[ii] ORGANIZAÇÃO MUNDIAL DA SAÚDE. **Classificação Estatística Internacional de Doenças e Problemas relacionados à Saúde**. 10. rev. São Paulo: Editora da Universidade de São Paulo, 1994.

(*SUS*) hospitalizations were retrieved from the Hospital Information System (*SIH*), which uses Inpatient Hospital Authorization (*AIH*) as its source of data.

Deaths and hospitalizations were selected according to ICD-10 codes V20 to V39, covering accidents involving motorcyclists and three-wheeled motor vehicles. Data was extracted using Tabnet[iii] (a public domain generic tabulator), by year of death or hospitalization. The option was taken to use a 10 year period (2004-2013) for mortality, and the period from 2009 to 2013 for hospitalizations, since it is only with effect from 2009 that data were made available with the comment upon the procedures according to the ICD-10 codes defined in Table Procedures, Drugs and OPM SUS.

The denominators used to calculate mortality rates and hospitalization rates were taken from the Brazilian Institute of Geography and Statistics' (*IBGE*) Population Projection for the Federative Units, by sex and age: 2000-2030.[iv] Data on the vehicle, motorcycle were taken from the National Traffic Department (Denatran) website.[v]

The variables used to describe the data were: sex (male and female), age group in years (0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60 and over), ethnicity/skin color (white, black, brown, yellow and indigenous), geographical regions (North, Northeast, Southeast, South and Midwest) and Federative Units. The mortality data was considered by place of residence, whilst hospitalization data was by place of hospitalization.

Crude hospitalization rates (per 10,000 inhabitants), standardized mortality rates (per 100,000 inhabitants) and the relative risk (male/female) were calculated. The total cost of *SUS* hospitalizations (in current currency - BRL) and average hospitalization time (in days) were also calculated.

The mortality rates were standardized by sex and age (direct method), using the Brazilian population as per the 2010 demographic census (*IBGE*) as standard. The standardized mortality rates were calculated for all the country's Federative Units for the years 2004, 2009 and 2013, this being the beginning, middle and end of the period, respectively. The percentage of change of these rates between the years 2004 and 2013 was also calculated.

The Pearson correlation coefficient was used to assess mortality rates from traffic accidents involving motorcyclists and motorization rates (number of motorcycles/population x 100 inhabitants). For correlation, deaths were adjusted with redistribution (proportional) of external causes of undetermined intent and nonspecific codes (V89, V99, Y32, Y33, Y34) for the specified RTA (including motorcyclist deaths).

The data was analysed with the aid of Tabwin, Microsoft Excel® and Access.

All data analyzed can be accessed by the public via the *DATASUS* website, whereby patients' identification is omitted. Data analysis was done as part of health surveillance and in accordance with the ethical principles of research involving human beings, in compliance with National Health Council Resolution 466, dated December 12, 2012.

[iii] Available at: <www2.datasus.gov.br/DATASUS/index.php?area=02>.
[iv] Available at: <www2.datasus.gov.br/DATASUS/index.php?area=0206>.
[v] Available at: <www.denatran.gov.br>.

Results

Mortality due to traffic accidents involving motorcyclists

12,040 deaths due to accidents involving motorcyclists were registered in Brazil in 2013. The main fatal victims were males (89.3%), aged 20-39 (58%) and having brown (53.3%) and white (37.6%) skin color. Most deaths occurred in the Northeast (38.5%) and Southeast (27%) regions (Table 1).

The mortality rate due to accidents involving motorcyclists was 6 deaths per 100,000 inhabitants in 2013. Risk of death among males was 8.3 times that among females (10.8/100,000 males and 1.3/100,000 females). The highest mortality rates were found in adults aged 20-39 (10.4 deaths per 100,000 inhabitants), although the rate of 4.7 deaths per 100,000 inhabitants in the 10-19 age group is a cause for concern. In all age groups risk of death due to accidents involving motorcyclists was higher among males, especially in the 60 and over (RR=11.7) and 40-59 (RR=9.8) age groups.

The highest motorcyclist mortality rates were found in the Midwest (8.5 deaths per 100,000 inhabitants), Northeast (8.4 deaths per 100,000 inhabitants), North (7.2 deaths per 100,000 inhabitants) and South (5.8 deaths per 100,000 inhabitants) regions. The Southeast Region had the lowest mortality rate (3.9). This region also had the highest male/female relative risk (RR=9.6).

Table 1 – Number (N), proportion (%) and specific mortality rate (per 100,000 inhabitants) due to traffic accidents involving motorcyclists, by sex, age group, ethnicity/skin color and geographic region of residence – Brazil, 2013

Characteristics	Total			Male (M)			Female (F)			Relative Risk (M/F)
	N	%	Rate	N	%	Rate	N	%	Rate	
Total motorcyclist deaths	12,040	100.0	6.0	10,755	100.0	10.8	1,285	100.0	1.3	8.3
Age group										
0-9	43	0.4	0.1	21	0.2	0.1	22	1.7	0.1	0.9
10-19	1,628	13.5	4.7	1,365	12.7	7.8	263	20.5	1.6	5.0
20-39	6,985	58.0	10.4	6,314	58.7	18.8	671	52.2	2.0	9.4
40-59	2,737	22.7	5.9	2,472	23.0	11.0	265	20.6	1.1	9.8
60+	635	5.3	2.9	573	5.3	5.9	62	4.8	0.5	11.7
Not informed	12	0.1	-	10	0.1	-	2	0.2	-	-
Ethnicity/skin color										
White	4,528	37.6	-	3,978	37.0	-	550	42.8	-	-
Black	552	4.6	-	514	4.8	-	38	3.0	-	-
Yellow	25	0.2	-	23	0.2	-	2	0.2	-	-
Brown	6,415	53.3	-	5,776	53.7	-	639	49.7	-	-
Indigenous	28	0.2	-	24	0.2	-	4	0.3	-	-

continues

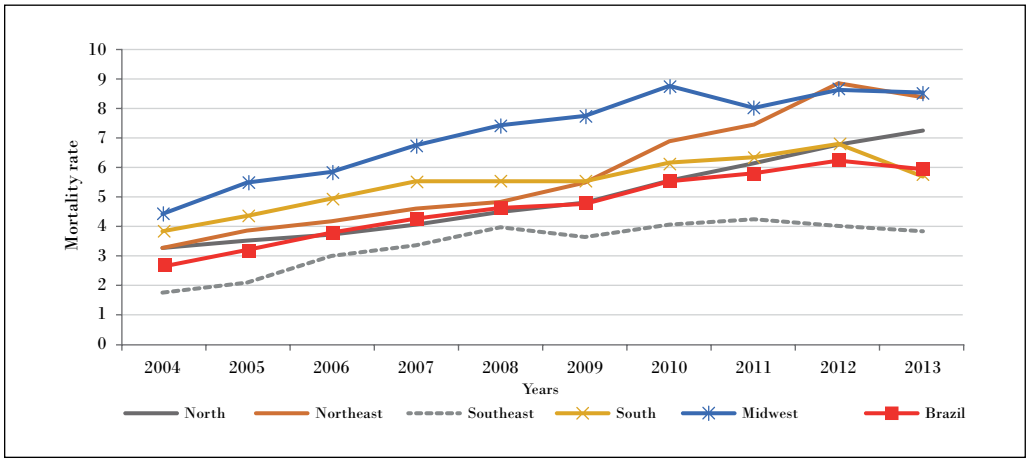
conclusion

Characteristics	Total			Male (M)			Female (F)			Relative Risk (M/F)
	N	%	Rate	N	%	Rate	N	%	Rate	
Not informed	492	4.1	-	440	4.1	-	52	4.0	-	-
Geographic Region										
North	1,181	9.8	7.2	1,011	9.4	11.7	170	13.2	2.0	5.8
Northeast	4,639	38.5	8.4	4,169	38.8	15.2	470	36.6	1.7	9.2
Southeast	3,256	27.0	3.9	2,941	27.3	7.1	315	24.5	0.7	9.6
South	1,648	13.7	5.8	1,474	13.7	10.3	174	13.5	1.2	8.7
Midwest	1,316	10.9	8.5	1,160	10.8	15.5	156	12.1	2.1	7.5

Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

Between 2004 and 2013, the mortality rates due to transport accidents involving motorcyclists in Brazil increased 115.5% (from 2.8 to 6 deaths/100,000 inhabitants). Between 2012 and 2013, however, there was a slight decrease of 5%. The mortality rate percentage change in two regions was lower than the national rate: South (49.1%) and Midwest (92.7%). The percentage change in the country's other regions was higher than the national rate: Northeast (156.5%), Southeast (117.2%) and North (116.9%). Risk of death per 100,000 inhabitants was highest in the Midwest Region (8,5), followed by the Northeast (8.4), North (7.2), South (5.8) and Southeast (3.9) regions (Graph 1).

Graph 1 – Mortality rate due to transport accidents involving motorcyclists (per 100,000 inhabitants) – Brazil and its regions, 2004-2013



Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

The mortality rate due to accidents involving motorcyclists in Brazil was 2.8 deaths per 100,000 inhabitants in 2004. Risk of death above the national level was found in 11 states. In 2009, the mortality rate for Brazil as a whole was 4.8 deaths per 100,000 inhabitants and

the mortality rate in 16 states was higher than this. In 2013, the national mortality rate was 6 deaths per 100,000 inhabitants. Motorcyclists were at greater risk of death among all categories of traffic accident victims. The mortality rate in 17 states was higher than the national rate. The highest rate occurred in the state of Piauí (19.8 deaths per 100,000 inhabitants), where risk of death was three times the national rate. The states of Roraima and Sergipe also had rates of more than 15 deaths per 100,000 inhabitants. Other states where risk of death was above 10 deaths per 100,000 inhabitants were: Tocantins, Mato Grosso, Maranhão, Rondônia and Mato Grosso do Sul. The lowest mortality rates due to accidents involving motorcyclists per 100,000 inhabitants were recorded in Amapá (1.1), Rio de Janeiro (3.1) and the Federal District (3.3) (Table 2).

Table 2 – Mortality rate due to traffic accidents involving motorcyclists, and percentage of change between 2004 and 2013, by Federative Unit – Brazil, 2004, 2009 and 2013

Federative Unit	2004	2009	2013	% Change
Piauí	6.2	12.9	19.8	216.3
Roraima	4.1	7.8	15.7	285.2
Sergipe	5.7	11.3	15.4	170.6
Tocantins	8.6	10.7	14.2	64.8
Mato Grosso	6.3	12.2	13.0	106.6
Maranhão	2.6	5.8	11.1	321.4
Rondônia	4.4	8.8	10.5	140.1
Mato Grosso do Sul	3.4	8.9	10.3	205.1
Paraíba	2.4	5.7	9.2	279.2
Ceará	6.4	6.4	8.7	35.4
Rio Grande do Norte	3.4	7.1	8.4	147.4
Pernambuco	3.2	5.7	8.2	159.7
Goiás	5.2	6.9	8.0	54.1
Espírito Santo	3.6	7.3	7.9	117.3
Santa Catarina	6.1	8.7	7.7	26.2
Pará	2.8	4.1	6.9	144.9
Paraná	4.0	6.1	6.6	64.2
Acre	1.1	0.7	5.7	410.9
Bahia	1.2	2.4	4.6	276.0
Alagoas	2.9	3.9	4.5	54.6
Minas Gerais	1.9	3.4	4.1	114.4
São Paulo	1.4	3.6	3.7	163.8
Amazonas	2.3	2.9	3.7	58.9
Rio Grande do Sul	2.4	3.3	3.6	51.2
Federal District	1.5	3.5	3.3	126.5
Rio de Janeiro	2.2	3.6	3.1	37.8
Amapá	1.6	1.6	1.1	-27.5

continues

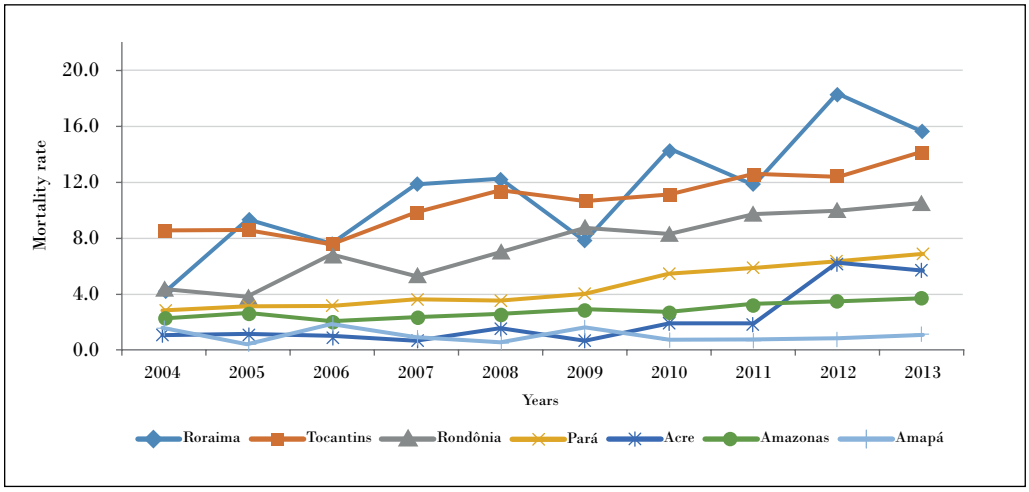
conclusion

Federative Unit	2004	2009	2013	% Change
Brazil	2.8	4.8	6.0	115.5

Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

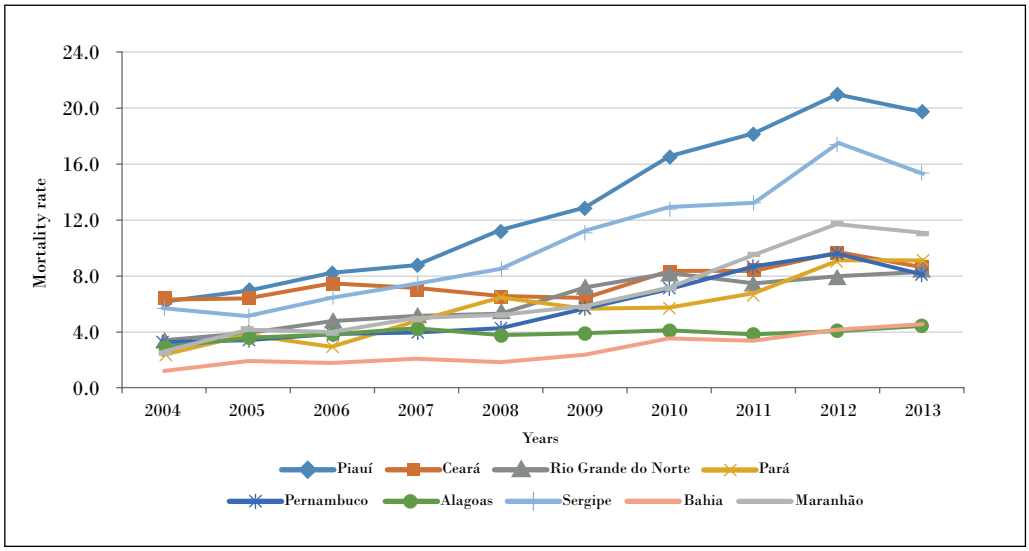
Graph 2 shows mortality in the Federative Units grouped together by region. In the North region, the state with the highest percentage of change between 2004 and 2013 was Acre (410%), although the highest mortality rates per 100,000 inhabitants in 2013 were found in Roraima (15.7), Tocantins (14.2) and Rondônia (10.5). Amapá had the lowest rate in the region, with 1.1 deaths per 100,000 inhabitants. In the Northeast region, the highest percentage of change between 2004 and 2013 was 321% in the state of Maranhão, which in 2013 had the third highest mortality rate per 100,000 inhabitants in the region (11.1), after Sergipe (15.4) and Piauí (19.8). Piauí has the highest risk of death due to traffic accidents involving motorcyclists in Brazil. In the Southeast Region the highest percentage of change in the period as a whole and the highest mortality rate in 2013 occurred in the state of Espírito Santo (117.3% and 7.9 deaths per 100,000 inhabitants). In the South region the highest mortality rate was found in Santa Catarina (7.7) and Paraná (6.6), the latter also having the biggest percentage change (64.2%). In the Midwest region the highest mortality rates occurred in the states of Mato Grosso (13), Mato Grosso do Sul (10.3) and Goiás (8), whilst in the Federal District the rate was 3.3 deaths per 100,000 inhabitants.

Graph 2a – Mortality rate due to transport accidents involving motorcyclists, by states of the North Region – Brazil, 2004-2013



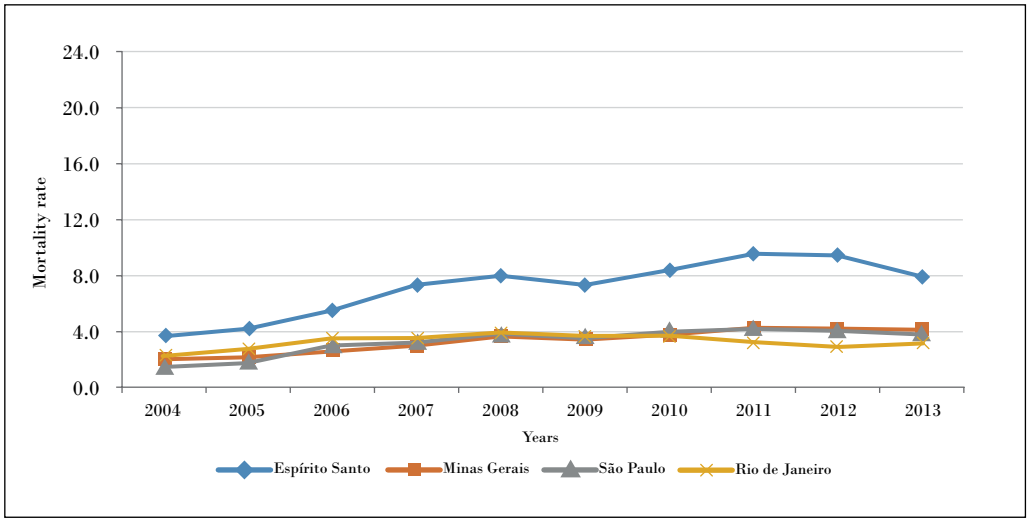
Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

Graph 2b – Mortality rate due to traffic accidents involving motorcyclists, by states of the Northeast Region – Brazil, 2004-2013



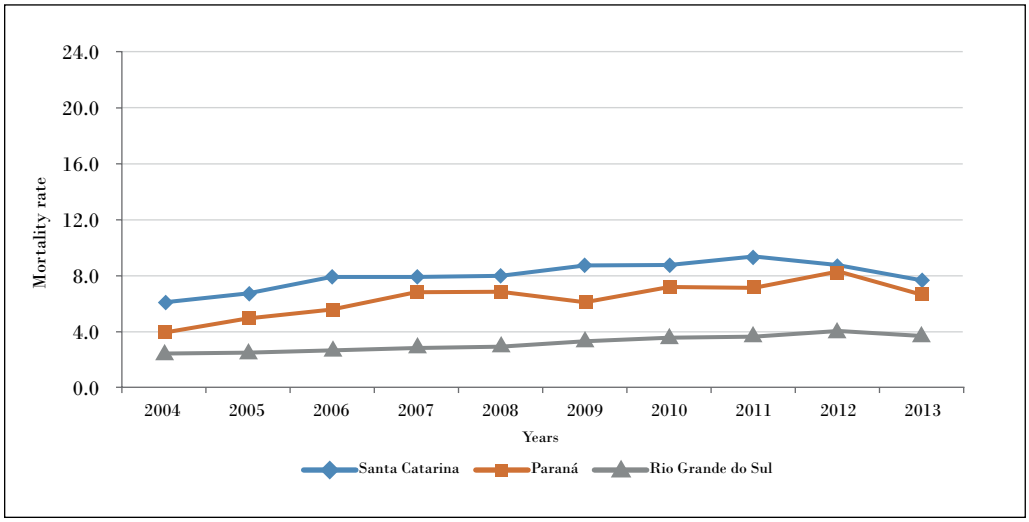
Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

Graph 2c – Mortality rate due to traffic accidents involving motorcyclists, by states of the Southeast Region – Brazil, 2004-2013



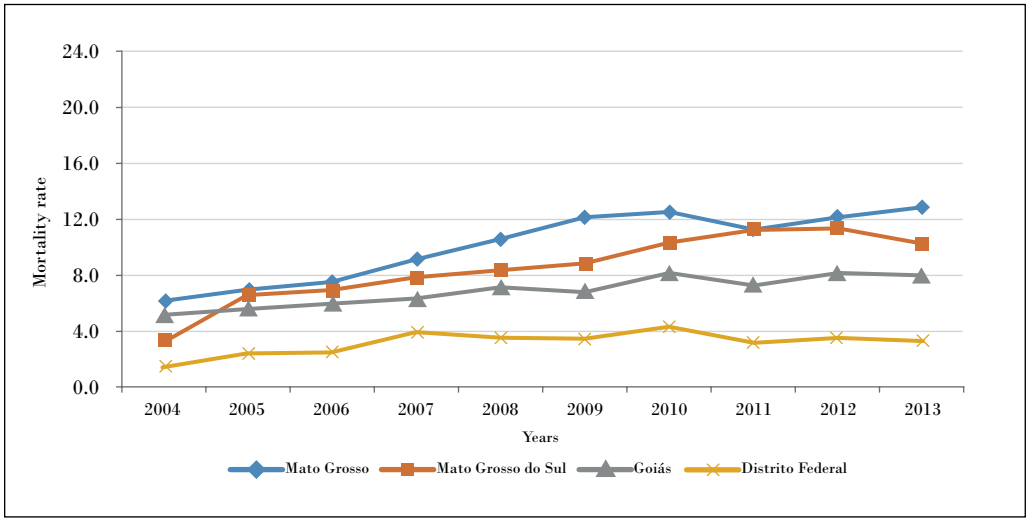
Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

Graph 2d – Mortality rate due to traffic accidents involving motorcyclists, by states of the South Region – Brazil, 2004-2013



Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

Graph 2e – Mortality rate due to traffic accidents involving motorcyclists, by states of the Midwest Region – Brazil, 2004-2013

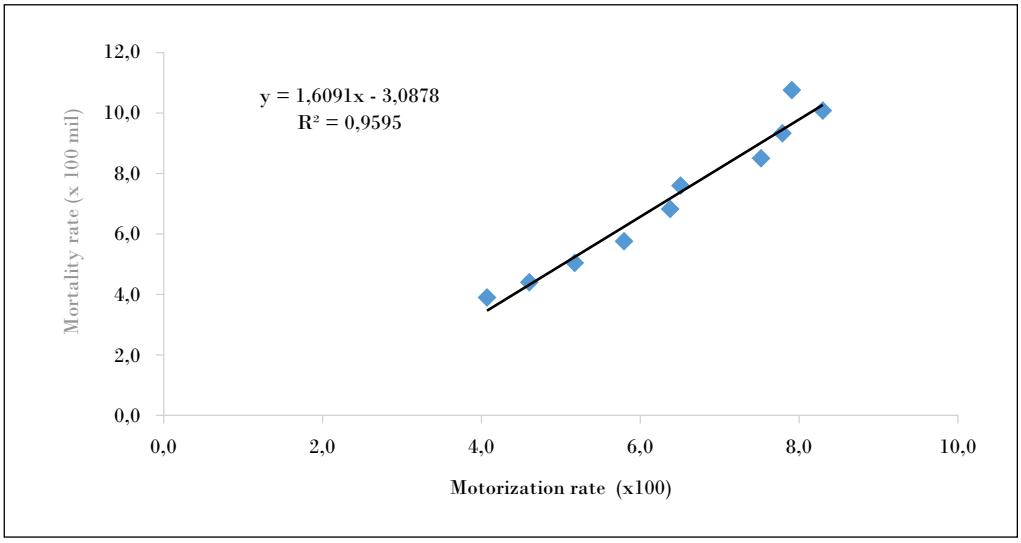


Source: *MS/SVS/CGIAE-SIM* (Mortality Information System) and *IBGE*.

In 2013, 45.3% of deaths due to traffic accidents involving motorcyclists related motorcycle drivers (5,455 deaths). 248 of these were aged under 18 (4.5%) (data not presented).

In 2013 the vehicle fleet totalled 81,089,666 in Brazil, having increased by 107% compared to 2004 when the fleet totalled 39,240,875. Motorcycles accounted for the highest increase, from 7,121,696 (18% of the total fleet) in 2004, to 21,597,261 (27%) in 2013, this being an increase of 203%. The adjusted number of motorcyclist deaths increased by 115%, rising from 7.377 in 2004 to 15.900 in 2013. The motorization rate also increased (176%). In 2004, there were 3.9 motorcycles per 100 inhabitants and in 2013 it rose to 10.7 motorcycles per 100 inhabitants. The variables "mortality rate" and "motorization rate" were strongly correlated (R2 = 0.96). It suggests that the motorization rate may explain part of the observed variation in the standardized mortality rate (Graph 3).

Graph 3 – Linear correlation between the mortality rate of traffic accidents involving motorcyclists and the motorization rate (motorcycles). Brazil 2004-2013.

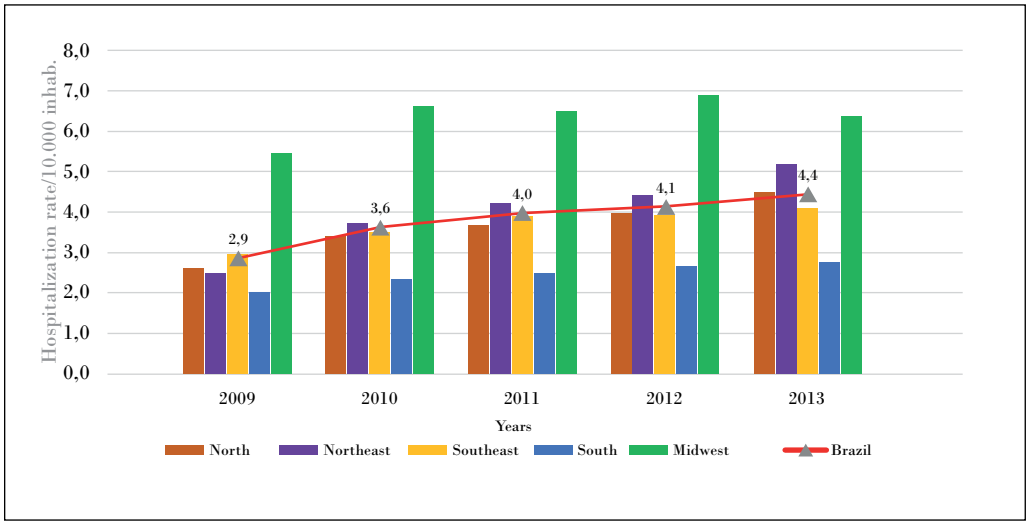


Source: *MS/SVS/CGIAE-SIM* (Mortality Information System), *IBGE* and Cities Ministry/*Denatran*.

Hospital morbidity due to transport accidents involving motorcyclists

Between 2009 and 2013 there were 375,930 hospitalizations related to traffic accidents involving motorcyclists in Brazil. The hospitalization rate doubled between 2009 and 2013, from 2.9 to 4.4 hospitalizations per 10,000 inhabitants, respectively. There was an increase in all the regions during the period. The Midwest Region stands out because the rates were higher than the national rate throughout the entire period (Graph 4).

Graph 4 – Hospitalization rate per transport accidents involving motorcyclists, by region and year of hospitalization – Brazil, 2009-2013



Source: National Hospital Information System (*SIH/SUS*), Ministry of Health.

In 2013, 88,612 hospitalizations due to traffic accidents involving motorcyclists were registered. Hospitalizations occurred most among males (83.5%), people aged 20-29 (35.9%), with brown skin color (30%) and living in the Southeast Region (39.1%).

The hospitalization rate per 10,000 inhabitants was 4.4 in the general population, being 7.5 among males and 1.4 among females (RR=5.2).

The highest hospitalization rates were found among adults aged 20-29, in both sexes (15.6 hospitalizations per 10,000 males and 2.7 hospitalizations per 10,000 females). The risk of hospitalization was higher in all age groups in males, especially in the 20-29 (RR=5.7) and 40-49 (RR=5.6) age groups.

The Midwest Region had the highest rate in both sexes (10.5 hospitalizations per 10,000 males and 2.6 hospitalizations per 10,000 females). The South Region had the lowest rates, also in both sexes (4.7 hospitalizations per 10,000 males and 0.9 hospitalizations per 10,000 females). The Southeast Region had the highest risk of hospitalization due to traffic accidents involving motorcyclists among males when compared to females (RR=6.2) (Table 3).

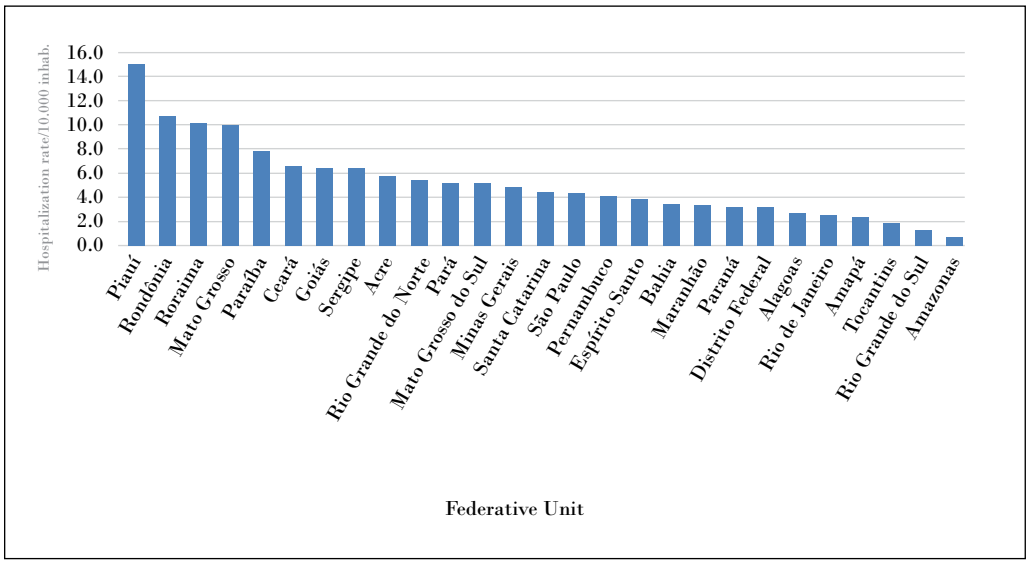
Table 3 – Number, proportion and crude hospitalization rate (per 10,000 inhabitants) due to transport accidents involving motorcyclists, by sex, age group, skin color and geographical region – Brazil, 2013

	Total			Male			Female			Relative Risk (M/F)
	n	%	Rate	n	%	Rate	n	%	Rate	
Motocyclists*	88,682	100	4.4	74,076	83.5	7.5	14,606	16.5	1.4	5.2
Age group										
0-9	1,202	1.4	0.4	788	1.1	0.5	414	2.8	0.3	1.8
10-19	13,642	15.4	4.0	11,123	15.0	6.4	2,519	17.2	1.5	4.3
20-29	31,811	35.9	9.2	27,149	36.7	15.6	4,662	31.9	2.7	5.7
30-39	20,722	23.4	6.4	17,458	23.6	10.8	3,264	22.3	2.0	5.4
40-49	12,043	13.6	4.6	10,152	13.7	7.9	1,891	12.9	1.4	5.6
50-59	5,875	6.6	2.9	4,893	6.6	5.0	982	6.7	0.9	5.4
60 and over	3,387	3.8	1.5	2,513	3.4	2.6	874	6.0	0.7	3.6
Ethnicity/skin color										
White	22,214	25.0	-	18,266	24.7	-	3,948	27.0	-	-
Black	2,031	2.3	-	1,781	2.4	-	250	1.7	-	-
Brown	26,609	30.0	-	22,227	30.0	-	4,382	30.0	-	-
Yellow	145	0.2	-	115	0.2	-	30	0.2	-	-
Indigenous	74	0.1	-	64	0.1	-	10	0.1	-	-
Not informed	37,609	42.4	-	31,623	42.7	-	5,986	41.0	-	-
Region										
North	7,565	8.5	4.5	5,863	7.9	6.8	1,702	11.7	2.0	3.3
Northeast	28,658	32.3	5.1	24,014	32.4	8.8	4,644	31.8	1.6	5.4
Southeast	34,707	39.1	4.1	29,745	40.2	7.2	4,962	34.0	1.2	6.2
South	8,001	9.0	2.8	6,630	9.0	4.7	1,371	9.4	0.9	4.9
Midwest	9,751	11.0	6.5	7,824	10.6	10.5	1,927	13.2	2.6	4.1

Source: National Hospital Information System (*SIH/SUS*), Ministry of Health.

The states with the highest hospitalization rates per 10,000 inhabitants were Piauí (15), Rondônia (10.7), Roraima (10.1) and Mato Grosso (10). Tocantins, Rio Grande do Sul and Amazonas had the lowest rates (1,8; 1,3; and 0,7 hospitalizations per 10,000 inhabitants, respectively) (Graph 5).

Graph 5 – Crude hospitalization rate (per 10,000 inhabitants) due to traffic accidents involving motorcyclists, by Federative Units and the Federal District – Brazil, 2013



Source: National Hospital Information System (*SIH/SUS*), Ministry of Health.

Percentage of change in hospitalization rates between 2009 and 2013 was higher in Tocantins(10,609,1%), Pernambuco (466,5%), Maranhão (391,7%), Sergipe (274,2%) and Espírito Santo (200,6%). The states with the lowest changes in hospitalization rates were São Paulo (16,8%) and Roraima (0,1%) (Table 4).

Table 4 – Hospitalization rate (per 10,000 inhabitants) due to traffic accidents involving motorcyclists, by Federative Unit. Brazil, 2009 and 2013

Federative Unit	2009	2013	% Change
Tocantins	0.1	1.8	1,609.1
Pernambuco	0.7	4.1	466.5
Maranhão	0.7	3.3	391.7
Sergipe	1.7	6.4	274.2
Espírito Santo	1.3	3.8	200.6
Piauí	5.3	15.0	181.4
Ceará	3.2	6.7	111.3
Alagoas	1.3	2.8	105.1
Pará	2.8	5.2	85.9
Rondônia	5.8	10.7	85.9
Bahia	2.0	3.4	73.6
Minas Gerais	2.8	4.8	70.3

continues

conclusion

Federative Unit	2009	2013	% Change
Amazonas	0.4	0.7	62.9
Rio Grande do Sul	0.8	1.3	59.1
Rio de Janeiro	1.6	2.5	58.5
Mato Grosso do Sul	3.3	5.2	58.4
Mato Grosso	6.8	10.0	48.5
Rio Grande do Norte	4.0	5.4	35.0
Paraná	2.4	3.3	34.8
Santa Catarina	3.6	4.5	25.4
Acre	4.9	5.8	18.6
São Paulo	3.8	4.4	16.8
Roraima	10.1	10.1	0.1
Goiás	6.6	6.5	-1.2
Paraíba	8.1	7.9	-2.4
Amapá	2.5	2.4	-5.7
Federal District	3.4	3.1	-9.2

Source: National Hospital Information System (*SIH*/*SUS*), Ministry of Health.

In 2013, motorcycle accident victim hospitalizations cost the National Health System (*SUS*) more than R$ 114 million. Average hospitalization time was 6.1 days and average expenditure was R$ 1,289.48. Highest average expenditure occurred in the South Region (BRL 1,603.38), whilst the lowest occurred in the North Region (BRL 813.78). Average hospitalization time was more than six days in the majority of the regions, except the Northeast Region (5.9 days) (Table 5).

Table 5 – Number of hospitalizations due to traffic accidents involving motorcyclists, total cost, average cost and average hospitalization time in days, by region – Brazil, 2013

Region	Number of hospitalizations	Cost (R$)	Average cost (R$)	Average hospitalization time (days)
North	7,565	6,156,273.23	813.78	6.2
Northeast	28,658	32,530,419.83	1,135.13	5.9
Southeast	34,707	50,835,209.64	1,464.70	6.1
South	8,001	12,828,630.40	1,603.38	6.1
Midwest	9,751	12,002,770.87	1,230.93	6.4
Total	88,682	114,353,303.97	1,289.48	6.1

Source: National Hospital Information System (*SIH*/*SUS*), Ministry of Health.

Discussion

Traffic accidents involving motorcyclists are increasingly frequent in Brazil, as well as in other countries worldwide. The number of serious and fatal injuries involving motorcyclists needs to be highlighted among road traffic accidents as a whole. Motorcyclists, as well as pedestrians and cyclists, are the most vulnerable group among road users.[1]

Motorcycles are becoming an increasingly frequent mode of transport in the Americas, and this is accompanied by growth in the number of accidents. Recent analysis of mortality data for the Americas showed that mortality rates related to motorcycles increased significantly in all sub-regions between 1998 and 2010, even in those where rates were low.[9]

In addition, between 2004 and 2013, millions of people left the poverty bracket and moved up the social and economic ladder, buying their first vehicle, which was often a motorcycle.[10]

In the North and Northeast Regions, motorcycles have been the most common mode of transport since 2012, although there has been a considerable increase in all Brazilian regions.[vi] This can explain the increased risk of hospitalization and death in those regions.

The increase in the number of accidents involving motorcyclists is related to the use of motorcycles as an individual transport option and increasingly as a work tool. In addition, other motorists have difficulty in seeing motorcycles and often motorcyclists display inadequate driving behavior and fail to comply with traffic laws.[7]

Motorcyclists who are victims of traffic accidents are more likely to suffer serious injuries to their heads and upper and lower limbs, resulting in long periods of hospitalization, serious sequelae or even fatal injuries.[11]

National and international studies show that the majority of motorcycle riders who died were the drivers of these vehicles.[10,12,13,14] A study conducted in Brazil's Federal District found that between 1996 and 2007, motorcycle drivers accounted for 67.8% of deaths. 22 of these deaths occurred among people aged under 18, of whom 14 (63.6%) were motorcycle drivers.[6] In the present study, drivers accounted for 50.1% of deaths. In 2013 alone there were 741 deaths among people aged under 18, 248 of whom were drivers (33.5%), even though they did not have a driving license. A study carried out in the South of Brazil suggested that the proportion of people aged under 18 who drive motorcycles may be above 30%.[11] Some authors suggest that this phenomenon of driving vehicles before the legally permitted age may be related to issues of transgression in adolescence. Nevertheless, mortality among adolescent drivers is a complex phenomenon which may include, among its possible explanations, characteristics inherent to this group, such as immaturity, feelings of omnipotence, tendency to overestimate their own abilities, lack of experience, poor driving skills and risk behaviours.[15]

Data on victims of serious and fatal accidents hospitalized via the National Health System (*SUS*) is captured by the Hospital Information System (*SIH*). However, if victims

[vi] Available at: www.denatran.gov.br.

do not reach *SUS* care facilities or are not hospitalized, data about them are not captured by this system and this results in underreporting of these accidents. Notwithstanding, data on hospitalization are important because they reveal the sociodemographic profile of victims cared for by *SUS*, as well as enable the costs of these hospitalizations for local health services to be estimated. *SIH* is, therefore, an important tool for local management, epidemiological surveillance activities and as a base for prevention actions.

In this study the hospitalization profile shows that those most affected were males of working age, and this is in keeping with other studies conducted in states in different Brazilian regions.[16,17,18] The profile obtained was also similar to that for care provided to victims of transport accidents involving motorcyclists recorded on the Violence and Accident Surveillance System in 2011,[19] 61.4% of whom were males.[20]

The reduction of the death ratio in relation to the size of the motorcycle fleet may be related to the rapid increase in the fleet (203%), which is well above the increase in the size of the population (5.6%). In 2011, the ratio was 5.9 deaths per 10,000 motorcycles, and this is similar to the findings of this study: in 2013 there were 5.6 motorcyclist deaths per 10,000 motorcycles.[8]

This study found that Piauí was the state with the highest mortality rate among motorcyclists in 2013. Piauí also had the highest rate among the other Federative Units in 2012 (21.1 deaths per 100,000 inhabitants).[8] The tremendous increase in the motorcycle fleet in the North and Northeast regions, together with improper driving behavior and failure to use safety equipment may explain the high mortality rates in these regions. A study conducted in a public emergence service in Piauí found that 71.2% of motorcyclists who had consumed alcohol did not wear crash helmets, whereas this proportion among those who had not consumed alcohol was 43.3%.[18]

It is important to mention that there is still a large number of deaths due to land traffic accidents without identification of the type of vehicle involved, even though the proportion of these in relation to LTA has reduced by 20%, from 27.2% in 2004 to 21.6% in 2013.[vii] This can adversely affect the analysis of the mortality profile by victim type, given that motorcyclist mortality may be even greater than what has been recorded. Even so, the dissemination of the information available is fundamental for planning measures to prevent deaths due to traffic accidents involving motorcyclists, as well as to encourage better classification of deaths through a reduction in unspecified cases.

Studies like the one conducted by Reichenheim[21] indicate diverse risk factors relating to traffic deaths and injuries, including accidents involving motorcyclists. Standing out among these are: human factors (driving under the effect of alcohol, stress, fatigue and dizziness), factors relating to the road system (poor traffic signing and poor road maintenance, insufficient or inexistent lighting, drainage, lack of hard shoulders and slopes, inadequate retaining walls and bends), factors relating to vehicles (inadequate mainte-

[vii] Available at: <www2.datasus.gov.br/DATASUS/index.php?area=02>.

nance), as well as excess speed. These are factors that the data used in the present study were unable to reveal.

Strategies like the *Life in the Traffic Project* are an alternative for obtaining more detailed knowledge about road traffic accidents (RTA). The Project is a Brazilian Government initiative aiming to respond to the serious situation of traffic accidents and is one of the possible strategies that can be used to reveal the true magnitude of RTAs in general, and thus implement appropriate and successful actions to prevent these accidents. The Project's method involves identifying and linking the different forms of existing information regarding the occurrence of transport accidents and resulting deaths and serious injuries. This enables the production of a single database which calculates deaths over 30 day periods (absolute number, rates per 100,000 inhabitants and per 10,000 vehicles), serious injuries (patients hospitalized for 24 hours or more: absolute number and hospitalization rates). In order for the Project to advance further, more intense focus needs to be placed on enforcement interventions directed towards risk factors that are considered a national priority – "Drink-driving" and "Excessive and inappropriate speed" –, with evidence-based actions and social marketing strategies capable of reaching the population as a whole, and vulnerable system users targeted by the Project in particular.[22]

The current scenario of the population having more income and the rapid increase in the fleet of motorcycles, associated with the growth in the mortality rate due to accidents involving these vehicles, as per the results of this study, demonstrate the complexity of the problem. Isolated efforts are not enough to overcome it. It requires coordinated actions involving different bodies in the Federative Units, articulated with governmental organizations, the private sector, representatives of traffic accident victims and civil society.

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8 Impact of interventions to reduce traffic-related morbidity and mortality in Brazil

Table of Contents

Abstract

Objectives: To describe and investigate the impact of the most recent interventions aimed at reducing morbidity and mortality due to traffic accidents in Brazil – including the "Dry Law" (Law No. 11705, dated June 19th 2008 and Law No. 12760, dated December 20th 2012), and the "Child Car Seat Law" (National Transport Council Resolution No. 277, dated May 28th 2008), the Life in the Traffic Project and Operation *Rodovida*.

Methods: A review was made of documents and pertinent literature. Indicators were also calculated based on data from the Mortality Information System (*SIM*) and the Chronic Disease Risk and Protection Factor Surveillance Telephone Survey (*Vigitel*).

Results: Reductions were found in mortality due to road traffic accidents and in prevalence of reported drink-driving, coinciding the period following the approval of the two versions of the Dry Law. There was a reduction in mortality among children who were vehicle occupants after the Child Car Seat Law came into force. Evaluations of the Life in the Traffic Project carried out in the five state capital cities in which the project was implemented also showed positive results. There was a reduction in the occurrence of serious accidents and deaths on federal highways in the periods after Operation *Rodovida* had been in action.

Conclusion: There has been evident progress with Brazilian legislation in relation to traffic and its impact on morbidity and mortality. Nevertheless challenges remain that need to be addressed and which make clear the need for law enforcement and education, as well as further progress, in order to reduce traffic morbidity and mortality.

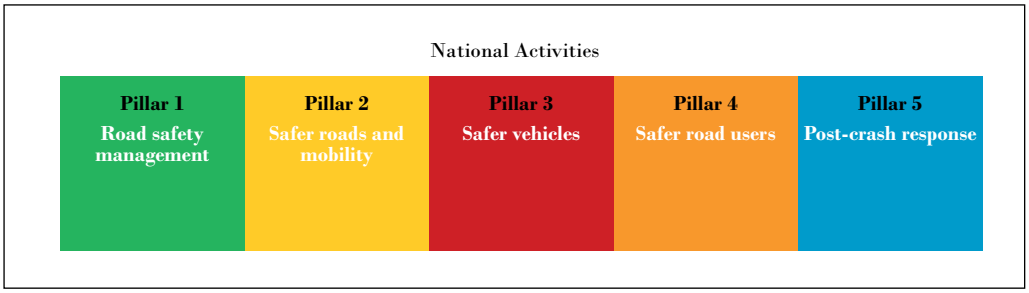
Keywords: Traffic accidents/prevention and control. Evaluation of intervention efficacy and effectiveness. Epidemiological surveillance. Morbidity and mortality indicators.

Introduction

Traffic accidents are significant causes of morbidity and mortality globally. According to the World Health Organization (WHO), some 1.24 million people die every year as a result of traffic accidents. 80% of these deaths are concentrated in middle-income countries, including Brazil, even though they only account for 72% of the global population and 52% of vehicles registered worldwide. This indicates that these countries bear a disproportionately high burden of traffic accidents in relation to the size of their populations and vehicle fleets.[1]

In view of this situation, in 2010 the United Nations General Assembly approved a resolution creating the Decade of Action for Road Safety 2011-2020. The Decade was launched in May 2011 in more than 110 countries with the aim of saving millions of lives. In order to assist the countries in carrying out concrete actions on the national level, the United Nations and WHO proposed a Global Action Plan as a practical tool to help governments and other local actors to develop national and local action plans.[2] To this end it was proposed national activities to be based on five main pillars, as indicated in Figure 1.

Figure 1 – The Five pillars for guiding national plans and activities during the Decade of Action for Road Safety, 2011-2020



Source: Adapted from the WHO Global Status Report on Road Safety, 2013.[1]

Notwithstanding as at 2013, only 28 countries, accounting for 416 million people (or 7% of the global population), had adequate legislation addressing the five main traffic morbidity and mortality risk factors: speeding, drink-driving, failure to use crash helmets, seatbelts and devices for child restraint in vehicles.[1]

Brazil was one of these countries. In addition, part of the activities provided for in the five pillars indicated in the Global Action Plan had already been included in the Brazilian Highway Code (Law No. 9509, dated September 23rd 1997) which has been in force since March 1998.[3] The Code covers speed limits, the mandatory use of crash helmets by motorcycle drivers and passengers, the mandatory use of seatbelts in vehicles and the criminalization of drink-driving.[3]

Sadly the increased strictness of the law has not necessarily been accompanied by a reduction in traffic morbidity and mortality. Between 1998 and 2008, there was a 9% increase in traffic victim hospitalizations (from 108,988 to 123,168) and mortality rates remained stable (around 20 deaths per 100,000 inhabitants). On the other hand, when analyzing mortality and taking the size of the fleet into consideration, there was a reduction from 10 to 6.7 deaths, approximately, per 10,000 vehicles between 2003 and 2008. This can be attributed to the huge increase in the Brazilian fleet.[4]

Between 2000 and 2014, the automobile fleet in Brazil increased from 20 million to 48 million and the motorcycle fleet increased from 3.5 million to 19.2 million. In December 2014 the Brazilian fleet totalled 86.7 million vehicles.[5]

It is important to highlight that in 2012 traffic accidents in Brazil were the leading cause of death in females aged 1-39. In males they were the leading cause of death in the 1-19 age group, and the second highest cause, after assaults (homicides), in the 20-39 age group.[6]

In addition to deaths and injuries, traffic accidents have a heavy economic cost for Brazilian society. Between 1998 and 2006, the cost of accidents involving motorcyclists alone was estimated to be R$ 5.3 billion.[7] A study conducted by the Institute of Applied Economic Research[8] showed that in the period 2004-2005, the total cost of transport ac-

cidents reached R$ 5.3 billion per annum in urban areas and approximately R$ 22 billion on Brazilian highways.

With the aim of addressing morbidity and mortality due to traffic accidents in Brazil, other interventions were implemented after the Brazilian Highway Code, including the Dry Law (Law No. 11705/2008 and Law No. 12760/2012),[9,10] the Child Car Seat Law (National Transport Council Resolution No. 277/2008)[11], the Life in the Traffic Project and Operation *Rodovida*.

The purpose of this chapter is to describe the most recent interventions aimed at reducing morbidity and mortality due to traffic accidents in Brazil and to investigate their impact.

Methods

The process began with a review of documents and pertinent literature. The document review included legal and technical documents relating to traffic mortality prevention programmes and was conducted by means of searches on the websites of Brazilian institutions – such as the National Traffic Council, the Federal Highway Police Department, the Ministry of Health, the Ministry of Transport and the Office of the President of the Republic – as well as international organizations such as the World Health Organization (WHO) and the Pan American Health Organization (PAHO).

The non-systematic literature review included searches in the Lilacs and Medline bibliographic databases for the period 1998-2014 in Portuguese, English and Spanish. Initially the search was conducted using the terms "traffic accidents" and "Brazil". The results were then filtered in order to detect studies on impact and studies on recent interventions aimed at reducing morbidity and mortality due to traffic accidents in Brazil, namely: the Dry Law, the Child Car Seat Law, the Life in the Traffic Project and Operation *Rodovida*.

Mortality rates were also calculated using Mortality Information System (*SIM*) data and data on resident population size as estimated by the Brazilian Institute of Geography and Statistics (*IBGE*) for the period 2000-2013 and available on the National Health System Department of Information Technology (*DATASUS*) website.

Results of the Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (*Vigitel*) were also included for the period 2007-2013 regarding the prevalence of drink-driving.

The *Vigitel* survey has been conducted every year since 2006 by means of telephone interviews with adults aged ≥18, resident in the capital cities of the 26 Brazilian states and the Federal District who had a landline telephone. Participant selection occurs by means of probabilistic selection in two stages: 1) systematic random selection of 5,000 telephone lines in each city, followed by a further random selection of 25 sub-samples of 200 telephone lines; 2) random selection of one adult (≥18 years old) in each household to be interviewed. Each year *Vigitel* has interviewed approximately 2,000 people in each city, totalling 54,000 people overall. Post-stratification techniques are used with the aim

of adjusting the estimates to the sociodemographic profile of the adult population of each city.[6,12] Analysis was performed on the data for the period 2007-2013.

The results are presented in the form of a brief description of the intervention and the main findings of the impact assessments.

Results

Dry Law

Law No. 11705, dated June 19th 2008,[9] known as the "Dry Law", altered the Brazilian Highway Code,[3] as well as Law No. 9294, dated July 15th 1996,[13] which provides for restrictions on the use of alcoholic drink advertisements, with the aim of inhibiting drink-driving. The Dry Law prohibits retail sales or the offering of alcoholic beverages for on-site consumption on the verges of federal highways or on plots of land next to the verge with direct access to highways. The Law also stipulates that driving under the influence of alcohol or any other psychoactive substance causing dependency is a very serious offence, subject to fining, suspension of the right to drive for 12 months and impoundment of the vehicle until such time as a licensed driver comes forward to remove it. Any concentration of alcohol per litre of blood results in the driver being subject to the penalties provided for by the Law.

Four years later the so-called "New Dry Law" was approved (Law No. 12760, dated September 23rd 2012[10]), amending the existing Law. The new Law provides for a higher fine and confiscation of driving license, in addition to the vehicle being impounded. It also provides for other forms of proving the offence of drinking under the influence of alcohol in addition to the breath test and blood samples, such as the use of images, videos and witness evidence. A study conducted using data for the period 2007-2009 compared the standardized mortality rates due to land transport accidents with the year prior to the Dry Law coming into force (July 2007 to June 2008) and the year after (July 2008 to June 2009). A significant reduction (-7.4%) in the risk of death from road traffic accidents was found for Brazil as a whole (from 18.7 to 17.3 deaths per 100,000 inhabitants), as well as a reduction of -11.8% in the state capitals taken as a whole (from 14.1 to 12.4 per 100,000 inhabitants). A reduction was found in 18 of the 27 state capitals, with the largest reduction in the city of Rio de Janeiro (-58.1%). With regard to the country's states, the biggest reductions were found in Rio de Janeiro (-32.5%), Espírito Santo (-18.4%), the Federal District (-17.4%) and Alagoas (-17%)[14].

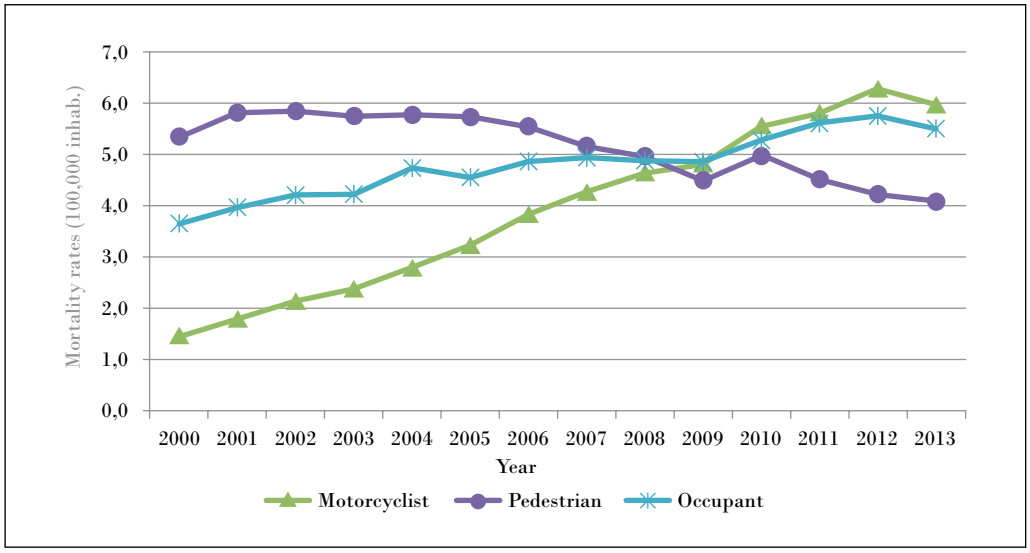
The reduction in mortality was higher among males, -8.3% for Brazil as a whole and -12.6% in the state capitals. On the other hand, significant reductions of risk of death due to road traffic accidents among males were only found in nine of the 27 states.[14]

Greater reduction in mortality in the capital cities can be attributed to more intense enforcement of traffic laws there, owing to enforcement being the responsibility of the government departments based there.[14]

A study conducted in the city of Rio de Janeiro confirmed the fall in mortality mentioned above. The study found a 12.9% reduction in the crude mortality rate due to road traffic accidents, when comparing July 2007 (before the Dry Law) and July 2008 (after the Dry Law).[15]

The time series of the mortality rates due to road traffic accidents in Brazil between 2000 and 2013 confirms the findings described above. A reduction can be seen in pedestrian and vehicle occupant mortality at two different times: firstly between 2007 and 2009, as mentioned above, shortly after the coming into force of the first version of the Dry Law, and then between 2012 and 2013, after the "new" Dry Law came into force. Motorcyclist mortality rates, which rose up until 2012, also went down after that year (Graph 1).

Graph 1 – Mortality rates due to road traffic accidents – motorcyclists, pedestrians and vehicle occupants (per 100,000 inhabitants) – Brazil, 2000-2013

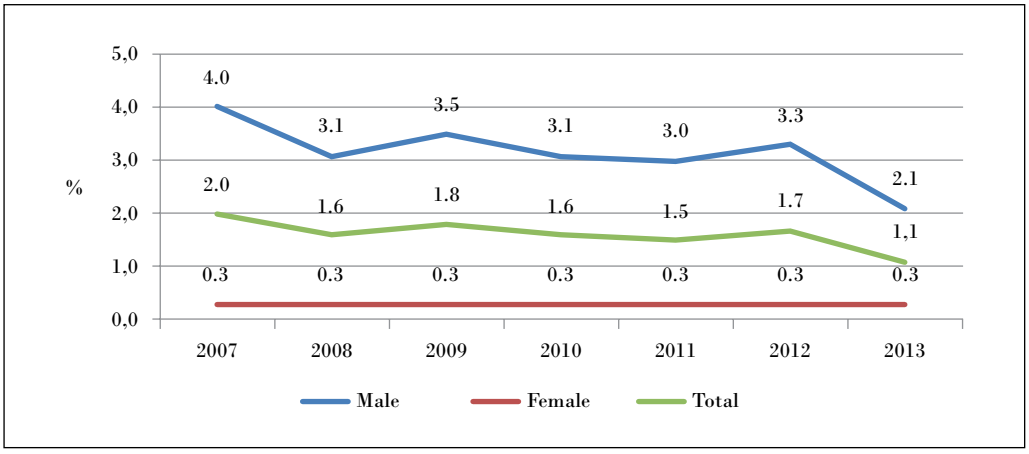


Source: Mortality Information System (*SIM*) – *CGIAE/SVS/MS*.

It is important to highlight the return of the upward trend of the vehicle occupant and pedestrian mortality rates between 2010 and 2012, i.e. between the approval of the two versions of the Dry Law, followed by signs of a new downward trend after the new version of the Law came into force in 2012. This finding can be attributed to improved and more rigorous enforcement of the Law. Nevertheless, mortality rates need to be monitored over the following years as only longer time series will enable more conclusive results to be obtained based on trend analysis.

A study conducted using *Vigitel* data on the prevalence of adults stating they had driven after abusive alcohol consumption[i] found a reduction of 45% between 2007 (2%) and 2013 (1.1%) for the state capitals taken as a whole. Significant decreases were found in the years immediately after the two versions of the Dry Law came into force, between 2007 and 2008, and between 2012 and 2013. Females had stable prevalence of 0.3% throughout the entire period. Prevalence was higher in males, although it decreased from 4% in 2007 to 2.1% in 2013 (Graph 2).

Graph 2 – Prevalence (%) among adults (≥18 years) who reported driving after abusive alcoholic consumption, by sex and total – Brazil, 2007-2013

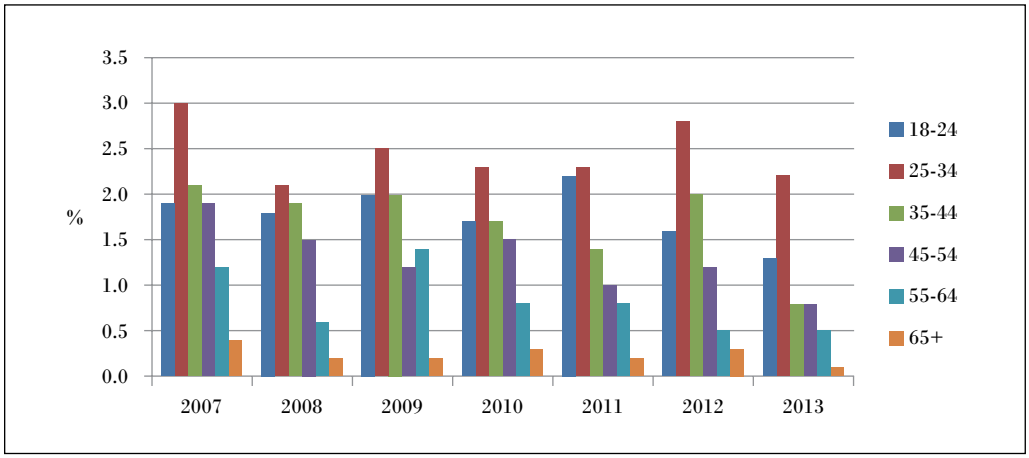


Source: Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (*Vigitel*).
Note: Prevalence weighted and adjusted for the population existing in the year the survey was performed. Adapted from: Malta et al., 2014.[12]

Prevalence of driving after abusive alcohol consumption was higher in the 25-34 age group and decreased as aged increased (Graph 3). No statistically significant reduction was seen between 2007 and 2013, by age group, except in the 35-44 age group between 2012 and 2013.[12]

[i]A question was asked about the abusive consumption of alcoholic beverages (four or more doses for females, or five or more doses for males, on the same occasion, during the 30 days prior to the interview). Those who reported abusive alcohol consumption were asked if they had driven a motor vehicle after drinking.

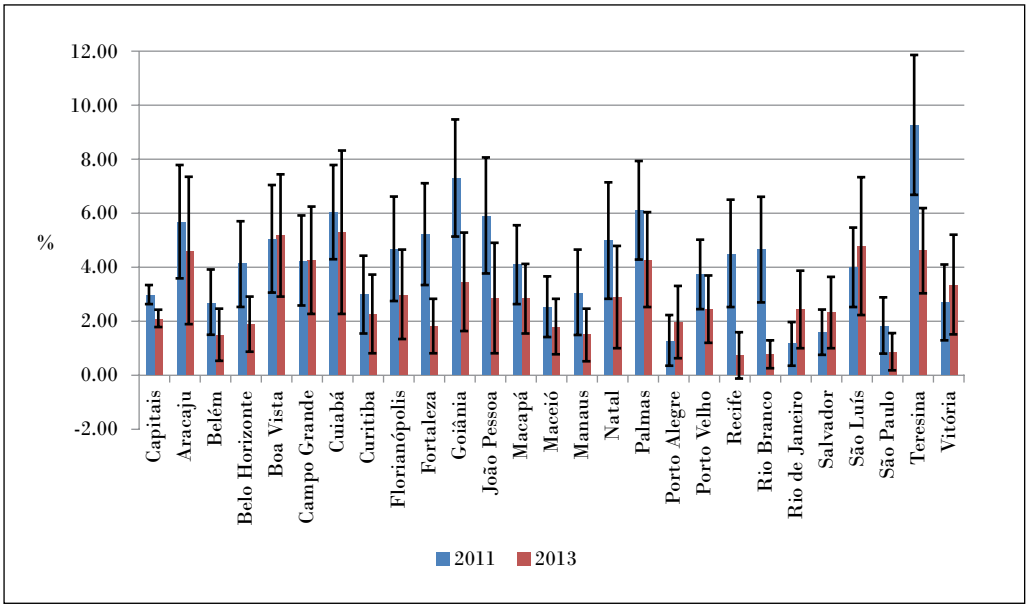
Graph 3 – Prevalence (%) among adults (≥18 years) who reported driving after abusive alcoholic consumption, by age group – Brazil, 2007-2013



Source: Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (*Vigitel*).
Note: Prevalence weighted and adjusted for the population existing in the year the survey was performed. Adapted from: Malta et al., 2014.[12]

Between 2011 and 2013 there was a statistically significant reduction in the prevalence of adults reporting having driven following abusive alcohol consumption for the capital cities taken as a whole, from 2.9% (95%CI 2.6;3.3%) to 2.1% (95%CI 1.7;2.5), as well as in the state capitals of Fortaleza, Recife, Rio Branco and Teresina. The state capital with the highest prevalence in 2011 was Teresina (9.3%; 95%CI 6.72;11.88%), whereas in 2013 it was Cuiabá (5.3%; 95%CI 2.6;8.3%) (Graph 4).

Graph 4 – Prevalence (%) among adults (≥18 years) who reported driving after abusive alcoholic consumption, by state capitals and the Federal District – Brazil, 2011-2013



Source: Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (*Vigitel*).
Note: Prevalence weighted and adjusted for the population existing in the year the survey was performed.

Child Car Seat Law

National Transport Council Resolution No. 277, dated May 28th 2008, known as the "Child Car Seat Law", came into force in Brazil on September 1st 2010.[9] The Resolution makes provision for the transportation of children aged under 10 and the use devices for child restraint in vehicles, with the aim of establishing minimum safety conditions, so as to reduce the risk to vehicle users in cases of collision or sudden breaking.

According to the Resolution, when travelling in motor vehicles all children aged up to 10 must travel in the rear seats and must use individual seatbelts or equivalent restraining devices. Those aged up to 12 months old must use a baby carrier, those aged between 1 and 4 must use a child seat and those aged over 4 and up to 7½ years must use a booster cushion. Children aged 7½ and up to 10 years-old must use a seatbelt.[9]

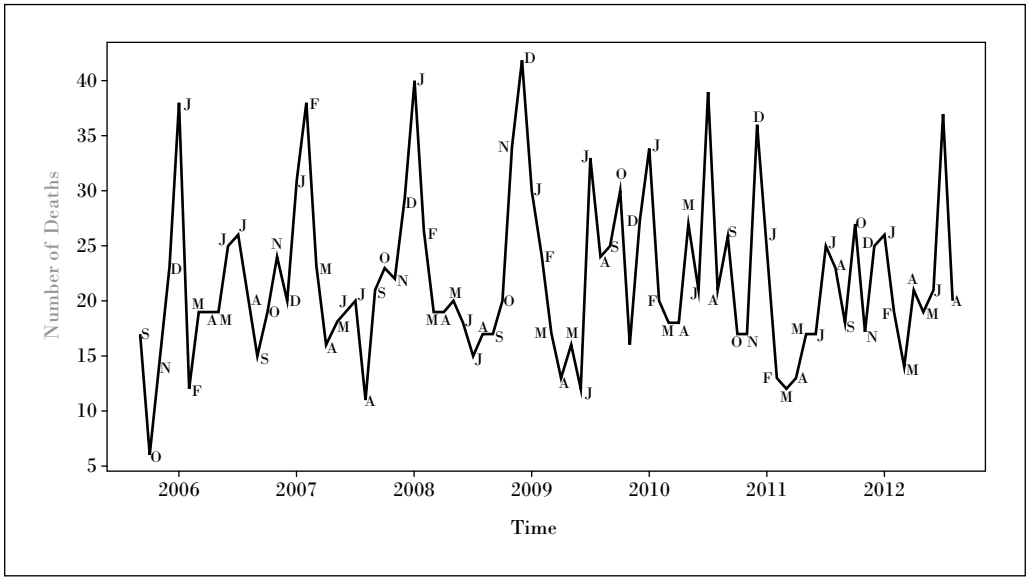
A study conducted in order to obtain a preliminary evaluation of the impact of the Child Car Seat Law on the mortality of children aged under 10 due to transport accidents when they were vehicle occupants, found a reduction of 23% in the absolute number of deaths, compared to the year before and the year after the Law came into effect (296 and 227 deaths, respectively). However, the reduction was not statistically significant, possibly due to the shortness of the post-intervention evaluation period.[16]

The study also found that the main victims were children aged up to 2 years-old (32.1%), and that deaths were more frequent at weekends (42.5%) and in months when there are school holidays – December, January and July.[16]

A more recent study investigating impact two years after the Child Car Seat Law came into force also found a decrease in the absolute annual number of deaths and pointed to a statistically significant reduction in the proportion of deaths per 1 million vehicles, comparing the periods five years before and two years after it came into effect (0.73 and 0.54, $p<0.05$).[17]

The absolute monthly number of deaths between August 2005 and September 2012 is shown in Graph 5.

Graph 5 – Monthly number of deaths in children aged under 10 due to traffic accidents in which they were vehicle occupants, by month of occurrence – Brazil, September 2005 – August 2012



Source: Adapted from: Garcia et al., 2015.[17]

In addition to the obligatory use of child restraint devices, the Child Car Seat Law stipulates that organizations comprising the National Traffic System must hold education campaigns to inform vehicle drivers about the obligatory requirements for transporting children.[9] However, no studies were found investigating the impact of the Child Car Seat Law on adherence to and adequate use of child restraint devices in vehicles, nor about traffic accident-related mortality among children.

A study conducted before the Child Car Seat Law came into force and which estimated the prevalence of seatbelt use among children attending day nurseries in Maringá/PR in 2007, found that 45.4% were transported without any restraining device.[18] Furthermore,

incorrect use found in 42.7% of cases and the odds of incorrect use were greater when there were two or more children in the vehicle (OR=5.10, p=0.007) and when their parents had lower schooling and income (OR=7.00, p=0.003 for average income and schooling; OR=3.40, p=0.03 for low income and schooling).[19]

Life in the Traffic Project

In June 2010, the Brazilian Government, via its Health Ministry, launched its Life in the Traffic Project ("*PVNT*"), with the aim of reducing transport injuries and deaths in five Brazilian state capitals: Palmas, Teresina, Belo Horizonte, Curitiba and Campo Grande.

PVNT is part of the international initiative called Road Safety in Ten Countries (RS 10), funded by Bloomberg Philanthropies. The initiative is coordinated by the World Health Organization (WHO) and is formed by a consortium of institutions: Association for Safe International Road Travel (ASIRT); Centers for Sustainable Transport (EMBARQ) –; Global Road Safety Partnership (GRSP); Johns Hopkins Bloomberg School of Public Health (JHU); and World Bank Global Road Safety Facility (GRSF). RS 10 is taking place in ten countries – Russian Federation, China, Turkey, Egypt, Vietnam, Cambodia, India, Kenya, Mexico and Brazil – which have high traffic morbidity and mortality and were invited to take part in the initiative with the aim of mitigating this scenario.[20]

PVNT is a strategy that forms part of the set of interventions comprising the National Plan for the Decade of Action for Road Safety, in accordance with United Nations recommendations.[21] The purpose of the Brazilian Government's commitment to developing *PVNT* is to address the traffic accident situation in the country, through national, state and municipal-level actions aimed at developing and enhancing successful traffic safety strategies with buy-in at subnational level.

In 2010 Brazil set up a National Interministerial Commission coordinated by the Ministry of Health to accompany *PVNT* implantation and implementation.[22] The Commission prepared a national action plan (2011-2012) based on two risk factors identified as intervention priorities and reflected in its "Drink-driving" and "Speeding" programmes. The five state capitals mentioned above, one in each of the country's five regions, were selected for the implantation of the pilot project.[20]

A study which evaluated the actions of the Life in the Traffic Project (*PVNT*) in the first two years in which it was implanted (2011 and 2012) in the five selected capital cities found positive results. The targets of the "Drink-driving" intervention programme included a reduction in the percentage of tests with positive alcohol results compared to the total amount of breath tests performed, an increase in the percentage number of drivers stopped by breathalyzer blitzes and a reduction in the prevalence of adults reporting having driven after abusive consumption of alcoholic beverages. The targets for the "Speeding" programme included an increase in the number of electronic speed monitoring devices – speed cameras, red light violation detectors and radar speed signs – as well as an increase in traffic engineering interventions – such as speed bumps and

lane narrowing. These programmes had good performance, although less so in terms of law reinforcement. Moreover, between 2010 and 2011, there was a reduction in traffic accident mortality in three of the state capitals: Palmas (-19.2%), Teresina (-11%) and Belo Horizonte (-20%).[20] More recent data for the years 2011 to 2013 corroborate the findings of mortality reduction in the state capitals where *PVNT* was implanted, with the exception of Palmas.

It is important to note that *PNVT* has three main focus areas: (1) good quality data; (2) implementation of interventions aimed at addressing the main risk factors; and (3) providing care to victims. The programme also includes data analysis as a basis for providing feedback on intervention design. Data quality may explain both the increase in the number of deaths registered in Palmas, and also underestimated reduction in the number of deaths in the other four state capitals.

Integrated Operation *Rodovida*

Integrated Operation *Rodovida* is a large-scale Federal Highway Police Department (*PRF*) initiative, involving the federal, state and municipal governments with the aim of reducing traffic accidents and deaths, with emphasis on the Christmas, New Year and Carnival periods as these are the times of year when most traffic accidents occur on federal highways.[23]

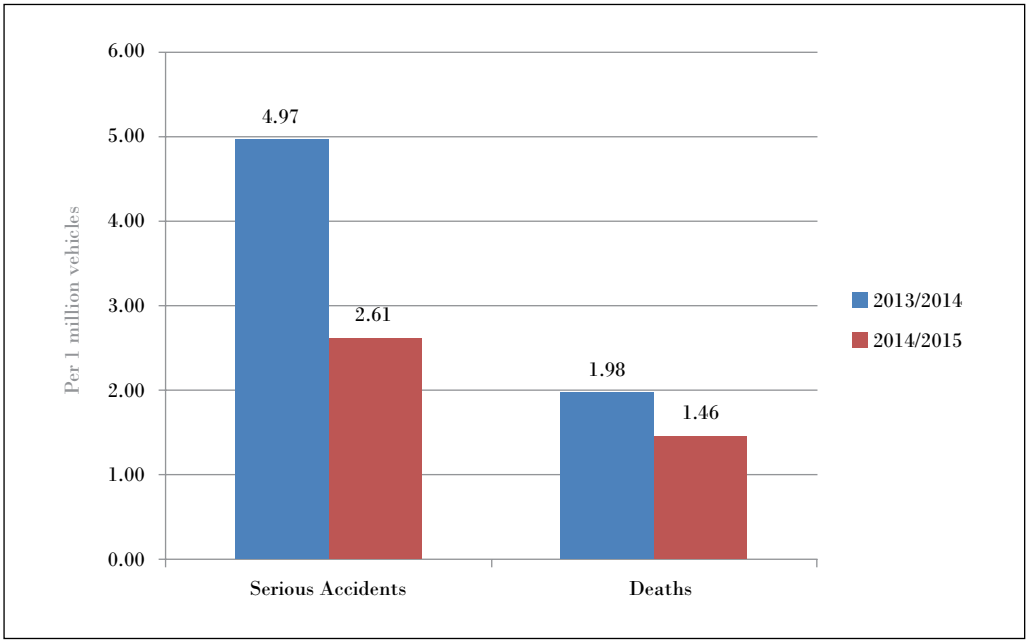
Planning the operation involves studies to inform traffic accident prevention and rescue actions, as well as law enforcement and education campaigns. These studies help to identify stretches of highways considered most critical in national terms with the aim of funnelling integrated and simultaneous actions. This involves the places where the largest volume of accidents resulting in death or serious injury are recorded. Actions in predefined places and times aim to increase the presence and availability of police officers on the highways in order to ensure safety, comfort and good traffic flow. These actions are not restricted to places where joint efforts are made, but also occur throughout the entire federal highway network, with emphasis on preventing dangerous overtaking which could result in head-on collisions.[23]

In addition to dangerous overtaking, enforcement efforts are directed towards curbing speeding, drink-driving and failure to use crash helmets, all of which are associated with fatal accidents. Between August 2013 and July 2014, *PRF* fined 1,088,964 drivers for speeding, 331,000 for overtaking and almost 40,000 for failure to wear crash helmets or improper use thereof.[23]

The new Dry Law also produced positive results on federal highways. During 2012, before the Law was altered, 1 breathalyzed driver in 20 was found to be driving under the influence of alcohol. In 2013, this proportion changed to 1 driver in 39, and in the first six months of 2014 the ratio was 1:43. Deaths due to accidents caused by drink-driving decreased by 11% between 2012 and 2013.[23]

Operations over the 2014/2015 New Year period resulted in a 47% reduction in the occurrence of serious accidents (accidents resulting in at least one seriously injured or dead person) and a 26% reduction in the mortality rate when compared to the previous year (2013/2014) (Graph 6).[24]

Graph 6 – Serious accident and mortality rates (per 1 million vehicles) during Federal Highway Police Department Integrated Operation Rodovida at the New Year, 2013/2014 and 2014/2015



Source: Federal Highway Police Department.[24]

Discussion

Reduction in mortality due to road traffic accidents and reduction in the prevalence of self-reported drink-driving among adults coincided with the periods following the coming into force of the laws aimed at inhibiting drink-driving, thus suggesting the effectiveness of the two versions of the Dry Law. There was also a reduction in child vehicle occupant mortality after the Child Car Seat Law came into force. Evaluations of *PVNT* undertaken in the five state capitals in which the project was implemented found positive results. Furthermore, there was a reduction in the occurrence of serious accidents and mortality on federal highways during the periods when the Federal Highway Police Department headed Operation *Rodovida*. It can therefore be stated more recent interventions aimed at reducing morbidity and mortality due to traffic accidents in Brazil have had positive impact.

However, there is still little evidence available on the impact of non-fatal traffic accident injuries, since for the time being these are not monitored nationally. Brazil has several different information systems on which traffic accidents are recorded and these can be linked in order to obtain a broader panorama of non-fatal injuries. The data obtained by using different systems is validated by *PVNT* and could be extended to the entire Brazilian territory. This form of monitoring is important because for every traffic-related death at least 20 people suffer non-fatal injuries.[25] Studies are also needed regarding adherence to the Child Car Seat Law and the adequate use of child restraint devices in vehicles.

In a relatively short period of time, Brazil, like other countries, has made progress with implementing effective legislation aimed at curbing drink-driving and speeding, as well as increased use of crash helmets by motorcyclists, seatbelts by vehicle occupants and child restraint devices in automobiles. Nevertheless, maintaining high levels of adherence and the population's perception of the importance of this is essential for the success of these legal measures.[25]

As such, constant reinforcement of existing interventions is recommended, as well as new interventions to address persisting challenges. In its report on road safety launched in 2013, the World Health Organization makes a series of recommendations which are presented in Chart 1.

Chart 1 – World Health Organization Road Safety Report recommendations 2013

> Governments urgently need to pass comprehensive legislation that meets best practice on all key risk factors to address this preventable cause of death, injury and disability.
> Governments should invest sufficient financial and human resources in the enforcement of these laws, as an essential component for their success. Raising public awareness can be an important strategy in increasing understanding of and support for such legislative and enforcement measures.
> Concerted effort is needed to make road infrastructure safer for pedestrians and cyclists. The needs of these road users must be taken into consideration earlier, when road safety policy, transport planning and land use decisions are made. In particular, governments need to consider how non-motorized forms of transport can be integrated into more sustainable and safer transport systems.

Source: World Health Organization, 2013.[1]

Both worldwide and in Brazil, motorcyclists, pedestrians and cyclists account for half of all traffic deaths.[25,26] However, encouragement of bicycle use[ii] and the vertiginous increase in the motorcycle fleet have not been accompanied by specific actions to reduce morbidity and mortality among those who use these modes of transport.

[ii] This refers to an initiative known as the Brazilian Bicycle Mobility Progamme, or Brazilian Bicycle Programme, aimed at encouraging the use of bicycles as a means of transport. It was created in 2004 by the Ministry of Cities, through its National Transport and Urban Mobility Department.

Wearing a helmet is not obligatory for cyclists in Brazil, despite evidence that wearing them can reduce the risk of head injuries or brain damage by 63% to 88% and the risk of facial injury by 65%.[27] Moreover, on average 8.8 cyclists died per day in Brazil in 2010 and almost half of those who died had head injuries.[28] It would be important for crash helmet use by cyclists to become obligatory, especially in situations where bicycles share spaces with motor vehicles as this is indicated as the main factor of lack of safety related to the occurrence of accidents.[29]

The wearing of helmets by cyclists could also be encouraged by linking crash helmet sales to bicycle sales, so that all cyclists automatically receive a helmet when they buy a new bicycle. Regulation and enforcement of the adequate quality of helmets is necessary, as is the implementation of education measures.[28]

Another suggestion for increasing cyclists' adherence to wearing helmets using is to relieve the tax burden on these products, so as to reduce their purchase price and make purchasing them more feasible for a larger number of cyclists. This suggestion is also valid for other protection equipment, such as crash helmets for motorcyclists, child car seats and airbag jackets for motorcyclists.

It has been obligatory for motorcyclists to wear crash helmets in Brazil ever since the current Brazilian Highway Code came into force. A bill of law (PLS No. 404/2012) is under discussion aimed at making the use of airbag jackets obligatory and has already been approved by the Senate.[30]

Relief of the tax burden on protection equipment is a measure strongly indicated for increasing adherence to their use by cyclists and motorcyclists. An argument in favour of this is that vehicles are already subject to tax benefits.[iii] Moreover, bills of law have been submitted in the House of Deputies which propose tax exemption for bicycles and accessories (an example is PL No. 4997/2013),[31] as well as for helmets and protective clothing (examples are PL No. 7411/2014 and PL No. 6674/2013).[32,33]

Pedestrians continue to be highly vulnerable. They account for almost a quarter (22%) of fatal traffic accident victims worldwide[25] and have the highest traffic-related lethality rates.[34] The Brazilian Highway Code stipulates that vehicle drivers are responsible for the safety of pedestrians and provides that pedestrians have priority when using pedestrian crossings.[3] However, in many parts of the country respecting pedestrian crossings is not part of the behavior of the majority of drivers. In addition, in some places there is a lack of adequate signs, footpaths, footbridges and sidewalks. In view of pedestrian vulnerability and high mortality there is a clear need for more actions to protect them, including not only traffic engineering interventions, but also pedestrian and driver education, as well as the monitoring of vehicle driver speeding and alcohol consumption.

Alcohol consumption by vehicle drivers places not only their own safety at risk, but also that of all other users of public highways, especially those who are more vulnerable. In the Americas, between 20% and 50% of traffic accident deaths are related to alcohol

[iii] Decree No. 7725, dated May 21st 2012, reduced Tax on Industrialized Products on cars and utility vehicles and was in force between 2012 and 2015.

use.[35] The two versions of the Dry Law have impacted on the reduction of traffic morbidity and mortality in Brazil, and this corroborates the vast amount of literature indicating the importance of legislative measures to prohibit alcohol use by vehicle drivers and ensure enforcement measures.[35]

Despite the severe penalties provided for by the Dry Law and the intensification of law enforcement, the *Vigitel* survey results indicate that drink-driving is still frequent, especially among males. A factor that contributes for the law not being respected is the use of mobile phone applications that show in real time where police traffic blitzes are occurring. Because of this, after having consumed alcoholic beverages drivers can alter their route or the time they travel in order to avoid being stopped by the police. In addition to continuous and rigorous actions, campaigns are also needed to prevent drink-driving, as well as education and awareness raising initiatives, particularly in establishments where alcohol is consumed, and with emphasis on male drivers.

Alcohol has remained a relatively low public policy priority, including health policies, despite the heavy social, health and economic burden that this risk factor causes.[1] Important progress has been made in Brazil with policies to control tobacco smoking, but there has been little progress with policies aimed at reducing harmful alcohol consumption, despite evidence that public policies are the most successful strategy for addressing this problem.

More progress needs to be made with public policies aimed at addressing harmful alcohol use which are socially acceptable and based on free market values. In this way alcohol producing industries find support to defend their business interests, which are often in conflict with public health interests.[36] An example is the fact that Brazilian tax legislation places beer, despite its alcoholic content, in the category of cold drinks, along with other non-alcoholic drinks – such as sports drinks, soft drinks and flavoured water.[37] Another example is that the sale of alcoholic drinks located alongside highways is still permitted in urban areas, even though the prohibition thereof was provided for in the draft versions of the Dry Law.

Reduced alcohol consumption by drivers depends above all on government regulation measures, as well as standing up to the power of alcohol and associated industries. There is solid evidence that alcohol consumption in general can be reduced in a cost effective manner by simple interventions, especially those which make alcohol more expensive and less available.[25] It is important to note that alcohol is a significant risk factor not only for traffic accidents, but is also associated with the cause of more than 200 types of diseases and injuries, including violence, cancer, mental disorders and infectious diseases such as tuberculosis, HIV/AIDS and pneumonia.[38]

Road safety is a priority for the Brazilian Government and its Ministry of Health. The issue was mentioned in the speech made by the President of the Republic – Dilma Rousseff – at the 67th United Nations General Assembly in 2012, and it was discussed at the 68th United Nations General Assembly in 2014, with the participation of the Brazilian Ministry of Health and Ministry of Cities. Moreover, Brazil will host the 2nd High Level Global Conference on Road Safety in November 2015. The 2nd Conference, which will take

place at an opportune moment during the final negotiations of the Post-2015 Development Agenda, will also be an opportunity for the Member States to exchange information and experiences about best traffic safety practices. The aim of the 2015 meeting is to bring together ministers from related areas to analyze progress in implementing the Global Plan for the Decade of Action for Road Safety 2011-2020 and the achievement of its targets. It will be a unique moment for driving the Decade of Action forward even more, given that it will be held at the midpoint of the decade, and will be a time for reaffirming commitments, making global efforts and proposing new goals for the next five years, within a scenario which is being delineated in the light of the Sustainable Development Goals.

The Ministry of Health has played a leadership role in traffic injury and death surveillance and prevention and promotion of a culture of peace since the mid 2000s, through the National Policies on the "Reduction of Morbidity and Mortality due to Accidents and Violence" (Ordinance MS/GM No. 737, dated May 16th de 2001)[39] and "Health Promotion" (Ordinance MS/GM No. 687, dated March 30th 2006).[40] These policies are fostered in the states and municipalities by means of the "National Network for Violence Prevention and Health Promotion" (Ordinance MS/GM No. 936, dated May 18th 2004).[41]

The Ministry of Health is still the main funder of the Mobile Urgent Care Service (*SAMU*),[42] a universal urgency and emergency care programme, organized through the integration of a telephone call centre, ambulances, and hospital urgency and emergency services. Diverse studies show the importance of *SAMU* in providing care to traffic accident victims, whereby the most frequent form of care involves motorcyclists and people who have been run over by vehicles.[43,44]

Despite the progress made in recent decades in Brazil, improvements still need to be made to public transport, as well as investments in alternative and healthy modes of transport – such as bicycles – and encouragement of rational use of cars, with the aim of improving people's quality of life, especially in large cities.[4] Notwithstanding, such improvements should be accompanied by interventions to reduce traffic morbidity and mortality and to protect the most vulnerable users of public highways.

Recent interventions, such as the Child Car Seat Law and Law No. 11910, dated March 18th 2009,[45] which made frontal airbags for drivers and front seat passengers an obligatory protection item in vehicles, are aimed above all at protecting vehicle occupants. National Traffic Council Resolution No. 312, dated April 3rd 2009,[46] provides for the Anti-lock Braking System (ABS) being obligatory for newly manufactured national and imported vehicles. The Resolution set a timeframe for implantation which reached 100% of vehicle production in January 2014. It has high potential for protecting not only vehicle users, but also other highway users, given that by preventing vehicle wheels from locking it can also reduce collisions.

Despite the huge financial and social costs caused by traffic accidents, for many years they were neglected on the global health agenda and funding for intervention was disproportionally low compared to the size of the problem. This occurred despite the fact that

the majority of traffic accidents are avoidable and despite the large amount of evidence on effective interventions.[1]

Clear progress has been made by Brazilian legislation with regard to traffic and its impact on related morbidity and mortality. Nevertheless, there are still great challenges to be overcome by Brazilian society – in particular the vertiginous increase in the vehicle fleet, together with increasing motorcyclist mortality, the scarcity of interventions aimed at pedestrian and cyclist safety, and addressing the harmful consumption of alcohol – that leave clear the need for law enforcement and education actions, as well as more rapid progress with the aim of saving countless lives and preventing a large number of injuries.

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9 Quality of external cause information held on national health information systems in Brazil

Table of Contents

Abstract

Introduction: National Health Information Systems (*SIM*, *SIH/SUS*, *SINAN*) have become very relevant sources of information about health in Brazil. Notwithstanding, the quality of their data needs to be monitored continually, including data on external causes, since accurate and complete records are fundamental for public policy planning and assertive actions.

Objective: To describe the quality of information on external causes held on selected national information systems.

Methods: This is a descriptive study of external causes recorded on the *SIM* and *SIH/SUS* systems between 2009 and 2013, evaluating cases of external causes that were either unspecified or of undetermined intent . Qualified data on violence reported on the *SINAN/VIVA* system in 2013 are also presented.

Results: Between 2009 and 2013, an 9.4% increase in deaths due to external causes was reported in Brazil. In 2013 ill-defined causes accounted for 5.9% of reported deaths, having decreased by 17.2% for the period 2009-2013 as a whole. Deaths with unspecified causes went down by 24.3%. In the same period hospitalizations due to external causes increased by 33.8%, with an increase of 14.3% in unspecified causes and a proportion of ill-defined causes of less than 1.5%. Nationwide on average in 2013, 8.9% of qualified reported cases of violence were excluded, 31.5% of which related to cases of adult males with inconsistent information.

Discussion: The data presented reflects improvements in the quality of information on deaths due to external causes and the need to enhance hospital records of these causes. Monitoring the quality of data on accidents and violence is fundamental for informing health service managers when defining more assertive public policies.

Keywords: External Causes, Violence, Accidents, Mortality, Hospitalization, Health Information Systems, Management of Quality.

Introduction

The implantation of several Health Information Systems in Brazil has increased the use of information in health sector management, in addition to enabling improved health programme monitoring, through the production of indicators.[1]

Some of the most used systems are the Mortality Information System (*SIM*), the Unified Health System's Hospital Information System (*SIH/SUS*), the Notifiable Diseases Information System (*SINAN*) and the Live Birth Information System (*SINASC*), among others.

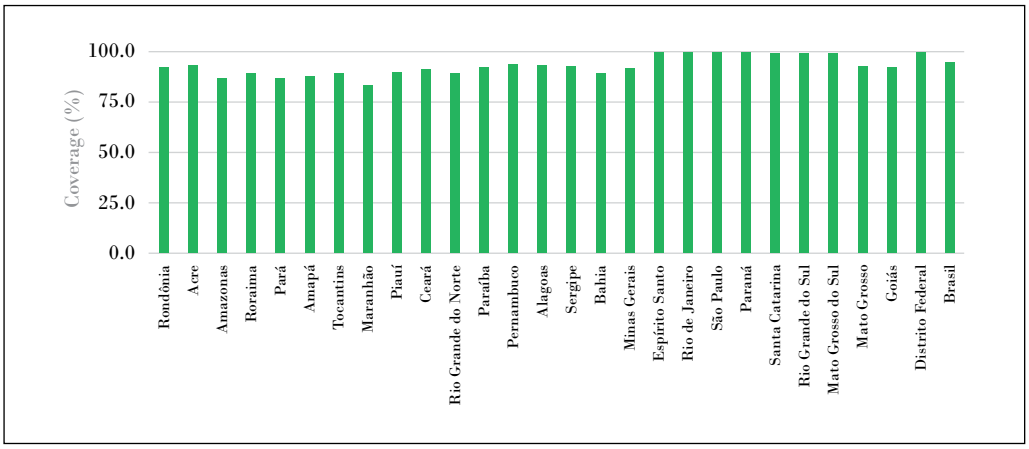
The *SIM* system[1] is used to record data on mortality in Brazil and is considered to be an important management tool, as the data kept on it enables the production of health indicators and information used in epidemiological studies. At the moment, in order to

[1] Mortality data can be accessed at:
<http://portalsaude.saude.gov.br/index.php?option=com_content&view=article&id=10937&Itemid=647>

improve records on deaths on the *SIM* system, the Ministry of Health is using the active tracing method in association with statistical modelling studies in order to adjust for underreported cases.[2]

In 2012 the coverage of the *SIM* system reached levels which were satisfactory in terms of being able to know the pattern of mortality throughout the country, whereby average coverage for Brazil as a whole was 92%, with some Federative Units achieving 100% coverage (Graph 1).

Graph 1 – Proportion (%) of Mortality Information System (*SIM*) coverage of total deaths in 2012, using the Active Tracing method



Source: Ministry of Health, Health Surveillance Secretariat, General Coordination of Epidemiological Information and Analysis, Mortality Information System (*SIM*).[a]

SIH/SUS[2] is a national system holding data on hospital morbidity and mortality. This data enables the evaluation of the magnitude of hospitalizations and the representative differences thereof in each of the country's regions. Nevertheless, this system does not provide universal coverage of all hospitalizations in Brazil since it does not include information on private sector hospitals. In 1998 coverage was estimated as being 75% and has increased every year since then.[3]

There are some 11.5 million hospitalizations per annum in Brazil and one million hospitalizations each month.[b] Accidents and violence are indicated as the causes of morbidity and mortality resulting in a large part of hospitalizations nationwide. These causes generally have a significant impact on public health resources since their cost is high in relation to hospitalizations due to other causes.[4]

One of the Ministry of Health's initiatives for more complete and detailed monitoring and surveillance of external causes occurring in Brazil has been the creation of the Violence

[2] Hospital morbidity and mortality data can be accessed at:
<http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sih/cnv/fruf.def>

and Accident Surveillance System (*VIVA*). The data provided by this system complements information obtained from the systems that record deaths (*SIM*) and hospitalizations (*SIH/SUS*) as well as increasing knowledge about the epidemiology of external causes.

The *VIVA* system is comprised of two components: *VIVA Contínuo* and *VIVA Inquérito*,[5,6,7] and it was implanted in 2006 by the Ministry of Health, by means of Ordinance MS/GM No. 1356.[8] The Continuous component of the *VIVA* system is responsible for the continuous surveillance of violence via cases reported on the *SINAN* system[3], whilst the Survey component performs sentinel surveillance by collecting data on accidents and violence, from both urgent and emergency care, by means of specific and periodical surveys.[5,6,7]

Specifically in relation to reported cases of violence, understanding the type of violence reported is the starting point for the qualification of this information. For the purposes of reporting, violence is divided into: domestic violence; sexual violence; human trafficking; torture; legal intervention, self-inflicted violence and other forms of interpersonal and urban violence. The first six types of violence are reported when they occur at any age in the life of females and males, whereas other forms of interpersonal and urban violence are only reported for children, adolescents, the elderly and women. Extrafamily violence (criminality/delinquency) the victims of which are adult men aged 20-59 are not reported and are monitored through other information systems, reporting sources and specific surveys.[9]

It is also important to highlight that violence has been included on the list of compulsory notifiable conditions, by means of Ordinance No. 1271, dated June 6th 2014.[10] This means that reporting violence has become universal in all health services, thus increasing reporting and ensuring its sustainability.

Given their wide-scale national coverage, these systems have become the country's most relevant sources of health information, especially regarding cases of violence and accidents. Even so, consideration must be given to the quality of the data they provide, since the better the quality, the more the data can be used in the creation of health policies and actions.[11]

Data quality evaluation can be performed based on its various dimensions. As such, reliability, validity, coverage and completeness are used in 90% of studies in the area of health.[1] Double counting and consistency are also extremely important dimensions, but are not usually evaluated.[12]

Quality-related problems can occur at any stage, right from data collection through to data consolidation. In order to improve the quality of information, an evaluation therefore needs to be made of these problems and also of the data production process.[1,13] It is also extremely important to create measurements capable of quantifying quality and to establish controls so that identified problems do not happen again.[14,15] Some activities that can be done to enhance the quality of health data include decentralizing validation

[3] Data on violence reported on the SINAN system can be accessed at:
<http://dtr2004.saude.gov.br/sinanweb/tabnet/dh?sinannet/violencia/bases/violebrnet.def>

and analysis of information by collection site, creating unified record forms and tables to be used by different systems, creating groups responsible for enhancing data quality in specific subareas, and so forth. Several of these actions are already undertaken by health service management at the three levels of government.[13,16]

Therefore, the definition of a national method for the management of health data quality by standardizing concepts and dimensions to be used will bring a variety of benefits, such as evaluation homogenization, increased scope of the regions and systems analyzed, identification and prevention of data problems, and so on.[16]

In view of this, it is known that in order to achieve good diagnosis of the health situation, including external causes, in addition to having a reliable information system, a correct understanding of the variables is also needed, i.e., knowing what they mean, what they show us and the quality of their data.[17]

Accurate and complete recording of specific causes is fundamental for assertive public policy planning and actions. As such, monitoring the proportion of undetermined or ill-defined causes in a dataset guides health service management as an indicator for the evaluation of the quality of the information to be used in health prevention and promotion actions.[18,19,20]

Specifically in relation to external causes, the importance of the quality of information regarding the circumstances of accidents and violence for the adequate planning of preventive actions has been highlighted for several years, both in Brazil and in other countries.[21,22]

The objective of this chapter is therefore to describe and analyze the quality of external cause reporting on the *SIM*, *SIH*/*SUS* and *VIVA*/SINAN national information systems, identifying the proportion of hospitalizations and deaths having undetermined information regarding external causes, the percentage change in ill-defined causes in the general information group and the quality of the data on violence reported on the *SINAN* system.

Methods

This is a descriptive study of external causes recorded on national health sector systems, evaluating both cases of external causes that were either unspecified or of undetermined intent .

Data was obtained from information held on the *SIM* and *SIH*/*SUS* systems for the period 2009-2013. The *SIM* system uses Statements of Death as its source of information.[23] When the event is related to external causes, a record of this is made along with the underlying cause of the circumstances or violence that produced the fatal injury. The *SIH*/*SUS* system in turn uses Hospital Admission Authorizations as its source of information and contains the record of the secondary diagnosis of the circumstances of the accident or violence that produced the injury, whilst the primary diagnosis describes the nature of the injury.

With regard to reported cases of violence, we used information on the year 2013 taken from the *VIVA*/*SINAN* system containing case information input by municipal services and validated by the Ministry of Health based on a set of validation criteria. Cases are reported using a specific *SINAN* system form for any suspected or confirmed case of interpersonal and self-inflicted violence. The following is a condensed set of the main steps involving standardized criteria used by the Ministry of Health technical area when auditing the quality of reported cases of violence:

- Understand and identify the type of violence reported;
- Identify reporting period to be validated;
- Identify true duplicated "pairs", either by using *SINAN*'s own tool or by means of probabilistic linkage;
- Apply criteria for identifying inconsistencies to be excluded;
- Exclude selected cases of double counting or inconsistency;
- Apply correction criteria, cross-checking variables or selecting inconsistencies.

External causes that were either unspecified or of undetermined intent were used to check for information quality problems present in the health information systems since they do not enable the type of event to be specified. The International Classification of Diseases – 10th Revision (ICD-10) codes selected for checking for this in this study were:

- Chapter XVIII – Symptoms, signs and abnormal clinical and laboratory findings (ill-defined causes);
- X58 – Accidental exposure to other specified factors;
- X59 – Accidental exposure to unspecified factors;
- Y33 – Other specified events, undetermined intent
- Y34 – Unspecified event, undetermined intent

Data was processed for each Federative Unit and Region using frequencies and relative frequencies. Data was assessed using proportions and percentage change.

All data analyzed can be accessed by the public via the *DATASUS* website, whereby patients' identification is omitted, in accordance with the ethical principles of research involving human beings, in compliance with National Health Council Resolution 466, dated December 12, 2012.

Results

The results shown below elucidate the quality of data on hospital mortality and morbidity due to external causes and cases of violence recorded on Brazil's national information systems.

Mortality Information System (*SIM*)

731,491 deaths due to external causes were recorded between 2009 and 2013 in Brazil. There was an increase of 9.4% over this period. Table 1 shows the distribution of total deaths by Region and Federative Unit of residence. The proportional distribution of deaths due to external causes in Brazil's five regions is 41.4% in the Southeast; 23.1% in the Northeast; 17.2% in the South, 9.4% in the Midwest and 8.9% in the North. Reduction in the percentage change of deaths due to external causes in the period was only found in the states of: Pernambuco (-8.5%), Rio de Janeiro (-4.6%), Paraná (-3.8%), Rondônia (-2.1%), Federal District (-1.6%) and Espírito Santo (-0,9%).

Table 1 – Distribution of deaths due to external causes and percentage change (%) in the period, by Region and Federative Unit (*UF*) of residence – Brazil, 2009-2013

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northern Region	10,837	12,415	12,205	13,163	13,324	22.9
Acre	387	439	488	531	522	34.9
Amapá	421	503	488	536	545	29.5
Amazonas	1,991	2,263	2,527	2,678	2,596	30.4
Pará	5,200	6,125	5,744	6,197	6,487	24.8
Rondônia	1,436	1,528	1,397	1,566	1,406	-2.1
Roraima	351	372	350	419	506	44.2
Tocantins	1,051	1,185	1,211	1,236	1,262	20.1
Northeast Region	40,473	42,976	44,220	47,183	48,020	18.6
Alagoas	3,060	3,403	3,572	3,367	3,514	14.8
Bahia	11,493	12,168	11,968	13,233	12,545	9.2
Ceará	5,849	7,047	7,420	8,433	9,081	55.3
Maranhão	3,585	3,887	4,135	4,663	5,026	40.2
Paraíba	2,731	2,907	3,093	3,191	3,269	19.7
Pernambuco	7,968	7,646	7,771	7,483	7,291	-8.5
Piauí	1,860	1,975	2,083	2,314	2,366	27.2
Rio Grande do Norte	2,286	2,162	2,414	2,544	2,763	20.9
Sergipe	1,641	1,781	1,764	1,955	2,165	31.9
Southeast Region	54,843	54,820	56,108	56,339	55,745	1.6
Espírito Santo	3,930	3,944	3,804	3,995	3,894	-0.9
Minas Gerais	12,681	12,931	14,263	14,237	14,170	11.7
Rio de Janeiro	14,184	13,794	13,765	13,066	13,525	-4.6
São Paulo	24,048	24,151	24,276	25,041	24,156	0.4
Southern Region	20,683	20,907	20,788	21,692	20,763	0.4
Paraná	9,286	9,535	9,376	9,832	8,935	-3.8
Rio Grande do Sul	7,358	7,257	7,167	7,575	7,766	5.5
Santa Catarina	4,039	4,115	4,245	4,285	4,062	0.6

continues

conclusion

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Midwest Region	11,861	12,138	12,521	13,636	13,831	16.6
Federal District	1,918	1,878	1,940	2,051	1,888	-1.6
Goiás	4,921	5,279	5,542	6,371	6,575	33.6
Mato Grosso	2,912	2,861	2,815	3,027	3,177	9.1
Mato Grosso do Sul	2,110	2,120	2,224	2,187	2,191	3.8
Total	138,697	143,256	145,842	152,013	151,683	9.4

Source: Ministry of Health, Health Surveillance Secretariat, Mortality Information System (*SIM*).

On the other hand, the proportion of deaths registered with ill-defined information is improving every year in Brazil as a whole. In 2013 these causes accounted for 5.9% of total deaths, with a reduction of 17.2% over the period 2009-2013. In terms of the country's regions, the Midwest had the largest reduction in the period (32.3%). In 2013 only the states of Acre, Amapá, Amazonas, Bahia, Minas Gerais and Pará had proportions greater than or equal to 8%. The proportion of deaths due to ill-defined causes and their percentage changes can be seen in Table 2.

Table 2 – Proportion (%) of deaths due to ill-defined causes (Chapter XVIII) and percentage change (%) in the period, by Region and Federative Unit (UF) of residence – Brazil, 2009-2013

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northern Region	12.6	11.8	11.0	10.7	8.9	-29.1
Acre	10.9	13.6	9.1	9.9	8.0	-27.2
Amapá	15.9	13.6	9.6	10.8	9.3	-41.8
Amazonas	16.3	15.3	13.8	14.2	13.4	-18.1
Pará	13.8	12.9	12.7	11.7	8.8	-36.6
Rondônia	8.5	9.2	8.2	7.6	7.0	-17.5
Roraima	5.1	4.6	3.4	6.7	5.4	6.2
Tocantins	4.4	2.7	3.1	3.1	3.3	-24.3
Northeast Region	7.7	7.8	7.7	7.4	7.3	-5.4
Alagoas	7.7	8.6	7.6	6.9	6.0	-22.2
Bahia	13.6	13.3	13.5	12.9	12.7	-6.7
Ceará	5.2	5.1	4.8	5.2	6.2	17.9
Maranhão	6.5	6.7	6.4	6.7	6.4	-0.9
Paraíba	7.8	7.9	7.7	6.4	6.2	-19.9
Pernambuco	5.2	5.4	5.2	4.9	4.6	-11.4
Piauí	3.3	4.3	5.2	4.8	4.6	38.5

continues

conclusion

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Rio Grande do Norte	3.7	3.0	3.6	3.2	3.5	-6.1
Sergipe	6.5	5.4	6.5	7.0	6.0	-7.0
Southeast Region	7.3	7.1	6.6	6.2	5.8	-20.0
Espírito Santo	1.6	1.4	1.3	1.1	1.0	-40.8
Minas Gerais	11.0	9.9	9.0	8.5	8.3	-24.2
Rio de Janeiro	7.0	7.4	6.8	6.1	5.5	-22.7
São Paulo	6.3	6.2	6.0	5.6	5.3	-15.4
Southern Region	5.2	4.9	4.5	4.6	4.1	-20.3
Paraná	5.3	5.1	4.8	4.7	3.7	-29.9
Rio Grande do Sul	4.6	4.5	4.6	4.8	4.7	1.1
Santa Catarina	6.1	5.3	4.0	4.0	3.6	-41.2
Midwest Region	3.8	4.0	4.4	3.1	2.6	-32.3
Federal District	1.6	1.0	1.1	0.8	0.7	-60.0
Goiás	5.8	6.1	5.6	2.8	2.4	-59.4
Mato Grosso	3.7	4.1	6.6	6.9	5.4	49.2
Mato Grosso do Sul	1.3	1.4	1.7	1.7	1.6	23.2
Total	7.2	7.0	6.7	6.3	5.9	-17.2

Source: Ministry of Health, Health Surveillance Secretariat, Mortality Information System (SIM).

Table 3 shows the proportion of deaths classified as being due to external causes that were either unspecified or of undetermined intent, as well as the percentage change in the period. Taking Brazil as a whole, a decrease can be seen in all Regions as well as a significant reduction of 24.3% in total cases. However, when analyzing some states, the opposite trend (increased cases) can be seen over the period, especially in Amapá (2,603.7%), the Federal District (228.2%) and Pernambuco (72.6%).

Table 3 – Proportion (%) of deaths classified as being due to external causes either unspecified or of undetermined intent (ICD-10 codes X58,X59,Y33,Y34) and percentage change (%) over the period, by Region and Federative Unit (*UF*) of residence – Brazil, 2009-2013

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northern Region	1.5	1.3	1.1	1.3	1.1	-29.7
Acre	0.8	0.7	0.4	0.2	0.2	-75.3
Amapá	0.2	0.0	1.2	0.9	6.4	2,603.7
Amazonas	1.3	1.2	1.1	1.1	0.2	-82.3
Pará	1.1	0.9	0.7	0.9	0.6	-42.9
Rondônia	1.9	2.0	1.7	2.0	1.1	-45.3
Roraima	6.0	5.4	4.3	6.4	4.9	-17.4
Tocantins	2.3	2.1	1.7	1.4	1.3	-44.5

continues

conclusion

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northeast Region	6.4	5.0	5.1	5.2	5.4	-15.8
Alagoas	0.2	0.3	0.2	0.2	0.3	36.8
Bahia	11.5	6.1	6.7	6.6	6.8	-40.8
Ceará	5.2	6.7	6.3	6.3	5.1	-1.9
Maranhão	2.0	1.7	1.6	2.2	2.3	18.5
Paraíba	1.1	1.6	0.7	0.3	0.6	-43.4
Pernambuco	6.5	7.7	8.2	7.9	11.3	72.6
Piauí	3.0	1.4	1.9	3.0	3.4	13.7
Rio Grande do Norte	10.5	7.4	7.9	9.5	6.3	-39.4
Sergipe	2.4	2.5	1.8	1.8	1.9	-20.3
Southeast Region	11.0	7.8	8.6	7.2	8.3	-24.7
Espírito Santo	3.5	2.9	2.8	3.7	4.3	25.4
Minas Gerais	9.5	8.0	9.4	6.8	8.2	-14.1
Rio de Janeiro	21.6	11.1	14.5	13.5	15.2	-29.4
São Paulo	6.9	6.7	5.7	4.8	5.2	-25.0
Southern Region	2.6	2.2	2.0	1.8	1.5	-40.9
Paraná	0.8	1.0	0.7	0.8	0.9	6.7
Rio Grande do Sul	5.0	4.1	4.3	3.7	2.7	-47.0
Santa Catarina	2.1	1.9	0.9	0.8	0.7	-64.9
Midwest Region	1.8	1.9	1.8	1.7	1.6	-7.3
Federal District	0.7	0.8	0.5	1.2	2.2	228.2
Goiás	2.4	2.4	1.6	1.6	0.9	-60.6
Mato Grosso	1.6	1.5	2.7	2.1	2.1	33.5
Mato Grosso do Sul	1.6	2.1	2.3	1.7	2.6	58.6
Total	6.9	5.1	5.4	4.8	5.2	-24.3

Source: Ministry of Health, Health Surveillance Secretariat, Mortality Information System (*SIM*).

Unified Health System's Hospital Information System (*SIH/SUS*)

4,867,912 Unified Health System (SUS) hospitalizations due to external causes were registered during the period. There was a 33.8% increase over the period. Proportional distribution of hospitalizations between Brazil's five regions was 41.3% in the Southeast, 23.2% in the Northeast, 17.2% in the South, 9.4% in the Midwest and 8.9% in the North. The highest percentage change in the Federative Units occurred in Paraíba (744.2%) and Mato Grosso (79.5%), whilst the lowest percentage change was found in Amapá (3.9%). Hospitalization distribution and percentage change over the period can be seen in Table 4

Table 4 – Distribution of hospitalizations due to external causes and percentage change (%) over the period, by Region and Federative Unit (*UF*) of residence – Brazil, 2009-2013

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northern Region	74,896	83,527	85,702	90,542	98,289	31.2
Acre	4,038	4,724	5,059	5,305	5,880	45.6
Amapá	2,419	2,435	2,285	2,571	2,325	3.9
Amazonas	6,862	8,019	10,363	11,520	11,284	64.4
Pará	41,256	44,700	44,132	44,882	50,373	22.1
Rondônia	7,227	9,360	8,732	10,351	12,056	66.8
Roraima	2,142	2,604	2,563	2,649	2,713	26.7
Tocantins	10,952	11,685	12,568	13,264	13,658	24.7
Northeast Region	173,084	214,982	230,578	248,963	260,436	50.5
Alagoas	9,375	10,003	10,991	11,041	12,617	34.6
Bahia	48,110	60,007	67,210	70,667	65,212	35.5
Ceará	37,715	43,066	44,044	43,360	46,233	22.6
Maranhão	19,196	21,114	23,818	28,399	33,949	76.9
Paraíba	1,772	10,682	7,192	15,210	14,960	744.2
Pernambuco	28,386	35,997	39,773	42,732	45,515	60.3
Piauí	12,636	14,283	16,835	17,978	20,526	62.4
Rio Grande do Norte	9,707	12,048	12,987	13,062	13,901	43.2
Sergipe	6,187	7,782	7,728	6,514	7,523	21.6
Southeast Region	351,943	393,335	409,959	420,992	432,988	23.0
Espírito Santo	12,840	15,409	18,799	18,361	21,888	70.5
Minas Gerais	92,898	106,906	111,204	117,740	121,939	31.3
Rio de Janeiro	37,574	45,020	46,941	51,884	57,952	54.2
São Paulo	208,631	226,000	233,015	233,007	231,209	10.8
Southern Region	135,144	162,553	170,332	182,611	188,195	39.3
Paraná	61,779	74,537	78,909	84,082	84,873	37.4
Rio Grande do Sul	40,568	50,774	51,842	56,561	59,945	47.8
Santa Catarina	32,797	37,242	39,581	41,968	43,377	32.3
Midwest Region	75,490	86,471	93,307	98,571	105,022	39.1
Federal District	11,034	13,221	14,628	13,541	12,516	13.4
Goiás	35,002	39,017	41,578	44,461	48,522	38.6
Mato Grosso	13,909	17,010	18,628	21,894	24,969	79.5
Mato Grosso do Sul	15,545	17,223	18,473	18,675	19,015	22.3
Total	810,557	940,868	989,878	1,041,679	1,084,930	33.8

Source: Ministry of Health, Health Care Secretariat, Unified Health System's Hospital Information System (*SIH/SUS*).

Table 5 shows the proportion of hospitalizations with ill-defined underlying causes in relation to total hospitalizations and percentage change over the period. Ill-defined

causes in Brazil as a whole were less than 1.5% over the period. The Federative Units with the highest proportions of ill-defined hospitalizations in 2013 were Pernambuco (2.2%), Amapá (1.8%), the Federal District (1.7%) and São Paulo (1.7%), whilst those with the lowest proportions were Alagoas (0.6%), Amazonas (0.8%), Pará (0.8%) and Roraima (0.8%). There was an increase of 13.2% in the percentage change of ill-defined diagnoses during the period in Brazil was a whole, whilst the Northeast and Northern Regions stood out with percentage changes of 29.3% and 24.6%, respectively.

Table 5 – Proportion (%) of hospitalizations due to ill-defined causes (Chapter XVIII) and percentage change (%) over the period, by Region and Federative Unit (*UF*) of residence, Brazil, 2009-2013

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northern Region	0.7	0.8	0.8	0.8	0.9	24.6
Acre	1.2	1.2	1.4	1.1	0.9	-22.8
Amapá	2.7	2.6	2.1	2.0	1.8	-32.6
Amazonas	0.7	0.7	0.7	0.7	0.8	23.2
Pará	0.5	0.5	0.6	0.7	0.8	62.1
Rondônia	0.5	0.7	0.6	0.8	0.9	100.0
Roraima	0.4	0.9	0.6	0.8	0.8	92.1
Tocantins	1.2	1.3	1.3	1.1	0.9	-27.5
Northeast Region	1.0	1.2	1.3	1.4	1.3	29.3
Alagoas	0.5	0.5	0.4	0.5	0.6	26.6
Bahia	0.7	0.8	1.0	1.1	1.2	81.4
Ceará	1.1	1.4	1.2	1.4	1.3	22.8
Maranhão	0.9	0.9	0.9	1.1	1.0	3.3
Paraíba	2.2	2.0	1.4	1.4	1.6	-26.0
Pernambuco	2.3	2.9	2.6	2.7	2.2	-5.0
Piauí	0.5	0.6	0.7	0.9	1.0	119.7
Rio Grande do Norte	0.6	0.6	1.2	1.3	1.3	137.3
Sergipe	1.1	0.8	0.7	0.8	1.2	12.4
Southeast Region	1.5	1.6	1.5	1.5	1.5	2.2
Espírito Santo	0.8	1.1	1.5	1.2	1.3	65.0
Minas Gerais	1.4	1.3	1.2	1.2	1.2	-9.1
Rio de Janeiro	1.1	1.2	1.2	1.4	1.3	18.3
São Paulo	1.7	1.8	1.8	1.8	1.7	1.3
Southern Region	1.1	1.3	1.4	1.4	1.3	15.9
Paraná	1.6	1.7	1.9	1.8	1.6	2.3
Rio Grande do Sul	0.8	0.9	0.9	1.1	1.0	26.9
Santa Catarina	0.9	1.0	1.2	1.2	1.3	47.8

continues

conclusion

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Midwest Region	1.2	1.2	1.3	1.3	1.4	17.5
Federal District	1.6	1.6	1.7	1.6	1.7	9.1
Goiás	1.2	1.3	1.5	1.5	1.6	40.5
Mato Grosso	0.7	0.8	0.8	0.9	1.0	41.8
Mato Grosso do Sul	1.6	1.0	1.1	1.1	1.2	-25.1
Total	1.2	1.3	1.4	1.4	1.4	13.2

Source: Ministry of Health, Health Care Secretariat, Unified Health System's Hospital Information System (*SIH/SUS*).

Hospitalizations due to external causes having ICD-10 unspecified or undetermined intent codes recorded on the secondary diagnosis of the Hospital Admission Authorization were analyzed and the proportion of these hospitalizations over the period studied and their percentage change are shown in Table 6. Taking Brazil as a whole the proportion of cases recorded using these codes is growing annually and the increase between 2009 and 2013 was 14.3%. In terms of the country's Regions, during the period there was an increase in the South (80.6%), North (49.4%), Midwest (18.1%) and Southeast (9.5%), whilst there was a reduction in the Northeast (-11.6%). With regard to the country's Federative Units, the highest percentage changes in hospitalizations with undetermined external causes occurred in Espírito Santo (2,839.0%), Maranhão (369.4%), Rondônia (268.1%), Goiás (176.0%) and Acre (158.8%), whereas Piauí (-70.2%), Amapá (-49.1%) and Paraíba (-41.8%) had significant reductions.

Table 6 – Proportion (%) of hospitalizations classified as being due to external causes either unspecified or of undetermined intent (ICD-10 codes X58, X59, Y33, Y34) and percentage change (%) in the period, by Region and Federative Unit (*UF*) of residence, Brazil, 2009-2013

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Northern Region	13.8	15.5	17.4	19.9	20.6	49.4
Acre	14.8	19.3	24.1	28.3	38.2	158.8
Amapá	6.0	7.8	4.5	5.3	3.1	-49.1
Amazonas	44.7	41.4	43.2	51.3	52.1	16.6
Pará	8.3	9.7	9.1	9.6	7.0	-15.9
Rondônia	9.6	8.1	15.0	18.4	35.2	268.1
Roraima	0.0	0.0	0.3	0.3	0.3	0.0
Tocantins	22.1	29.5	30.3	31.6	31.7	43.2
Northeast Region	20.4	18.8	17.5	17.3	18.0	-11.6
Alagoas	10.8	10.9	9.7	8.4	8.4	-22.5
Bahia	5.8	7.2	6.4	6.1	10.7	86.6

continues

conclusion

Region and UF of residence	2009	2010	2011	2012	2013	Percentage Change (%) (2013-2009)
Ceará	20.1	16.9	15.8	18.4	17.5	-12.8
Maranhão	1.6	2.1	3.7	6.8	7.3	369.4
Paraíba	23.8	16.8	11.5	10.0	13.8	-41.8
Pernambuco	72.3	61.1	58.2	55.5	51.6	-28.6
Piauí	7.1	8.6	7.9	4.0	2.1	-70.2
Rio Grande do Norte	0.7	0.5	1.0	0.8	0.9	31.6
Sergipe	28.0	28.7	23.8	27.0	29.5	5.1
Southeast Region	9.0	9.5	9.6	9.5	9.9	9.5
Espírito Santo	0.4	4.1	11.6	9.7	11.4	2,839.0
Minas Gerais	12.4	12.2	10.2	8.7	8.5	-31.2
Rio de Janeiro	10.8	13.1	15.4	18.3	19.6	82.4
São Paulo	7.7	7.8	7.9	7.9	8.0	3.4
Southern Region	5.4	5.4	5.7	7.1	9.7	80.6
Paraná	3.2	3.7	4.2	5.2	5.8	79.4
Rio Grande do Sul	10.9	9.7	10.2	13.7	19.9	82.9
Santa Catarina	2.7	2.8	3.0	2.1	3.4	27.8
Midwest Region	13.5	12.4	13.1	15.6	15.9	18.1
Federal District	6.5	4.4	7.7	10.6	10.1	55.9
Goiás	4.4	5.9	7.8	10.9	12.0	176.0
Mato Grosso	5.7	5.2	4.8	9.1	7.9	37.8
Mato Grosso do Sul	45.9	40.5	37.4	38.3	40.2	-12.5
Total	11.7	11.7	11.8	12.4	13.4	14.3

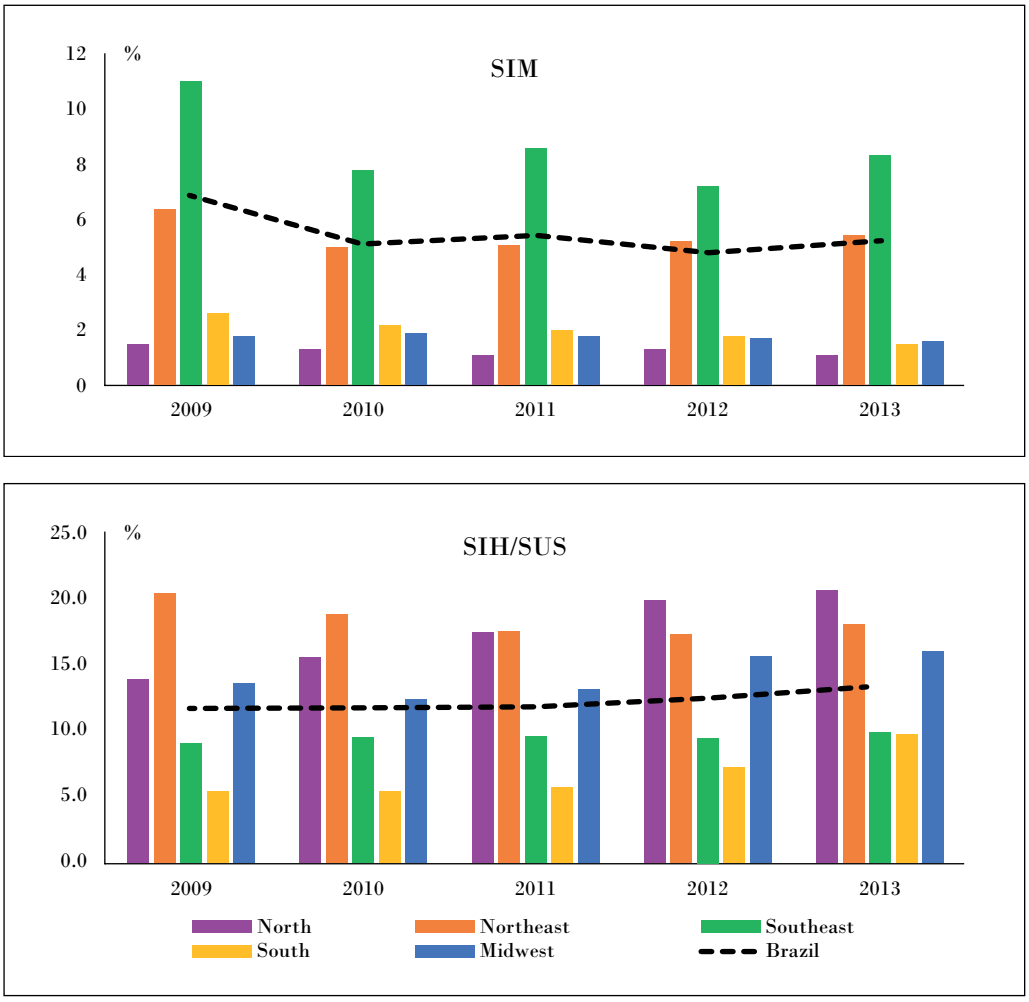
Source: Ministry of Health, Health Care Secretariat, Unified Health System's Hospital Information System (*SIH/SUS*).

Undetermined external causes on the *SIM* and *SIH/SUS* systems

The proportions of deaths and hospitalizations classified as being due to external causes that were either unspecified or of undetermined intent (ICD-10 codes X58, X59, Y33 and Y34) on the *SIM* and *SIH/SUS* systems shown in Tables 3 and 4 can be compared in Graph 2, both with regard to Brazil as a whole and the country's Regions.

The proportions registered on the *SIM* system between 2009 and 2013 are lower than those registered on the *SIH/SUS* system for each region and for the country as a whole. Hospitalizations coded as unspecified / of undetermined intent accounted for a high proportion of total hospitalizations, whereas there was a decrease in the proportion of deaths coded as undetermined. The Southeast Region stands out because of the decreased tendency on the *SIM* system and its percentage change lower than that for Brazil as a whole, despite this percentage being higher than that of the other Regions.

Graph 2 – Proportion (%) of deaths and hospitalizations classified as being due to external causes either unspecified or of undetermined intent (ICD-10 codes X58, X59, Y33, Y34), by region of residence – Brazil, 2009-2013

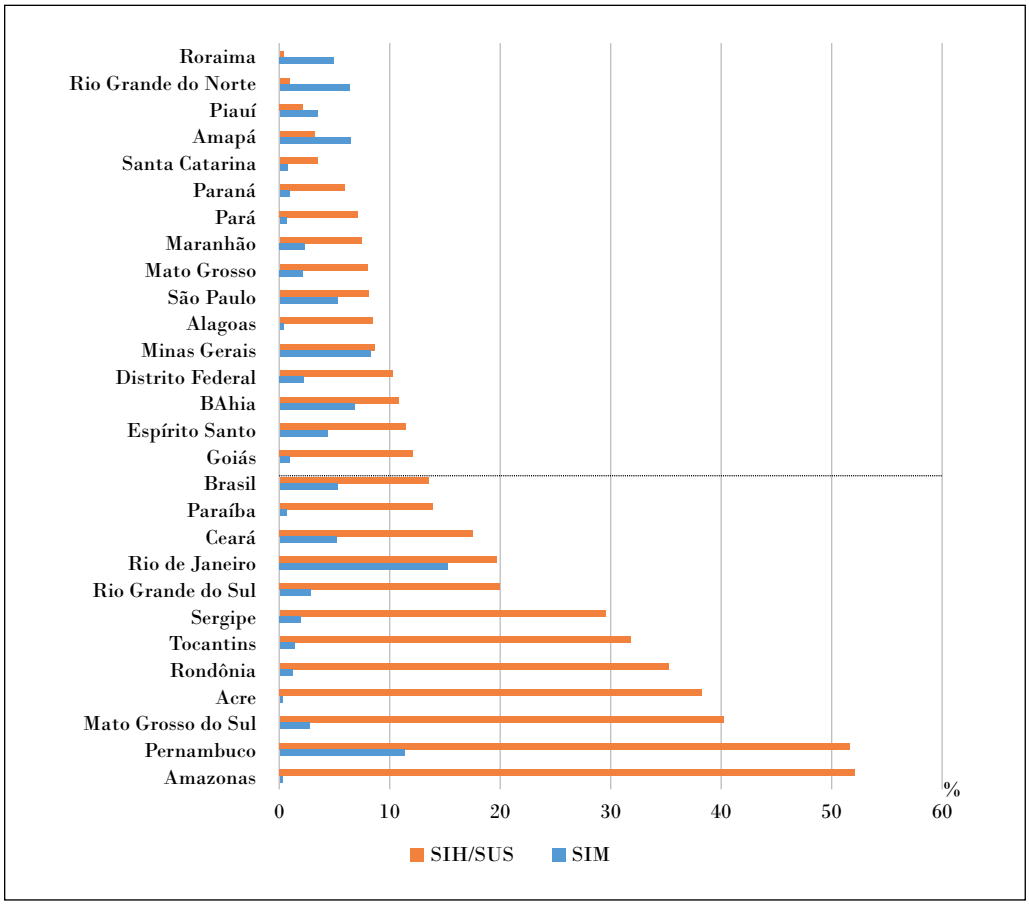


Source: Ministry of Health. Health Surveillance Secretariat, Mortality Information System (*SIM*) and Health Care Secretariat, Unified Health System's Hospital Information System (*SIH/SUS*).

Graph 3 shows the proportions of total deaths and hospitalizations per Federative Unit in 2013 classified as being due to exernal causes that were either unspecified or of undetermined intent. The proportions of these codes used to classify deaths were only greater than those used to classify hospitalizations in the states of Roraima, Rio Grande do Norte, Piauí and Amapá. More than 50% of hospitalizations in the states of Amazonas and Pernambuco were classified using these codes. The high proportion of these codes

in some Federative Units is prejudicial to the quality of data on external causes recorded on Hospital Admission Authorization forms.

Graph 3 – Proportion (%) of deaths and hospitalizations classified as being due to external causes either unspecified or of undetermined intent (ICD 10 codes X58, X59, Y33, Y34), by Federative Unit (*UF*) – Brazil, 2013



Source: Ministry of Health. Health Surveillance Secretariat, Mortality Information System (*SIM*) e Health Care Secretariat, Unified Health System's Hospital Information System (*SIH/SUS*).

Violence reported on the National Notifiable Diseases Information System (*SINAN*)

In 2013, once the process used by the Ministry of Health to apply standardization criteria had been concluded, 188,728 reported cases were validated nationwide. Cases were reported by 10,364 health centres in 3,423 municipalities, representing an average of 3 notifying health centers per notifying municipality. On average 8.9% of cases were excluded from the national data. Regionally, the highest percentage of excluded cases occurred in the Northeast Region (9.7%) and the lowest in the Northern Region (5.7%). The states with the highest percentage of excluded cases were Mato Grosso (23.5%), Paraíba (21.6%) and Santa Catarina (17.1%). 41% of total recorded cases did not inform the time of day of occurrence. Table 7 provides information on notifying municipalities and health centres and total excluded cases for each Brazilian Region and Federative Unit.

One specific case of excluded cases identified relates to reported cases of violence outside the family among men aged 20-59 in which the specific type of violence was not recorded. 31.5% of adult male cases had to be excluded for this reason in 2013, notably in the states of Paraíba (73.9%), Mato Grosso (56.3%) and Santa Catarina (55.8%).

Table 7 – Result of the Validation of Cases of Violence Reported on the National Notifiable Disease Information System (*SINAN*), by Region and Federative Unit (*UF*) – Brazil, 2013

Notifying UF	Total initial reported cases on SINAN	Number of notifying municipalities	Number of notifying Health Centres	True duplications excluded	Records excluded due to inconsis-tencies	Percentage (%) excluded records	Final total of reported cases
Northern Region	13,056	240	670	51	689	5.7	12,316
Acre	1,096	15	53	0	60	5.5	1,036
Amapá	500	10	20	1	30	6.2	469
Amazonas	4,544	49	196	37	315	7.8	4,192
Para	3,746	57	194	10	120	3.5	3,616
Rondônia	349	25	52	0	16	4.6	333
Roraima	788	15	38	1	17	2.3	770
Tocantins	2,033	69	117	2	131	6.5	1,900
Northeast Region	39,541	794	2,051	76	3,773	9.7	35,692
Alagoas	3,482	66	136	1	529	15.2	2,952
Bahia	8,249	218	560	10	709	8.7	7,530
Ceara	1,787	108	334	4	234	13.3	1,549
Maranhão	2,666	83	198	4	338	12.8	2,324
Paraíba	5,299	41	90	2	1,143	21.6	4,154
Pernambuco	10,427	92	266	24	324	3.3	10,079
Piauí	4,420	89	230	23	223	5.6	4,174
Rio Grande do Norte	1,983	75	172	5	221	11.4	1,757
Sergipe	1,228	22	65	3	52	4.5	1,173

continues

conclusion

Notifying UF	Total initial reported cases on SINAN	Number of notifying municipalities	Number of notifying Health Centres	True duplications excluded	Records excluded due to inconsis-tencies	Percentage (%) excluded records	Final total of reported cases
Southeast Region	94,394	1,332	4,396	237	7,838	8.6	86,319
Espirito Santo	2,804	56	193	3	227	8.2	2,574
Minas Gerais	32,809	800	2,223	92	2,314	7.4	30,403
Rio de Janeiro	18,224	75	527	74	2,536	14.4	15,614
São Paulo	40,557	401	1,453	68	2,761	7.0	37,728
Southern Region	41,757	795	2,381	119	3,185	7.9	38,453
Paraná	16,395	272	898	28	657	4.2	15,710
Rio Grande do Sul	15,567	356	918	69	876	6.1	14,622
Santa Catarina	9,795	167	565	22	1,652	17.1	8,121
Midwest Region	17,489	262	866	88	1,453	8.8	15,948
Federal District	2,772	1	84	4	119	4.4	2,649
Goiás	5,509	134	360	25	468	9.0	5,016
Mato Grosso	2,214	70	180	5	515	23.5	1,694
Mato Grosso do Sul	6,994	57	242	54	351	5.8	6,589
Total	206,237	3,423	10,364	571	16,938	8.9	188,728

Source: Ministry of Health. Health Surveillance Secretariat, Violence and Accidence Surveillance/Notifiable Disease Information System (*VIVA/SINAN*).

Discussion

The results presented in this chapter enable knowledge and quantification of some of the aspects of the quality of external cause data held on the *SIM*, *SIH/SUS* and *SINAN/VIVA* systems which help to provide an estimate of the dimension of the occurrence of external causes in Brazil. The recording and distribution of this specific type of cause was also shown, whereby there was an increase in recorded cases of deaths and hospitalizations over the period, although there were fewer on the *SIM* system than on the *SIH* system.

Efforts made to improve information and expand coverage of recorded cases can increase the visibility of certain cases and decrease underestimation[24]. *SIM* system coverage is satisfactory for exploring the pattern of mortality in Brazil. With regard to hospitalizations, however, *SIH/SUS* system coverage does not extend to the entire country because care provided by hospitals outside the Unified Health System (*SUS*) is not recorded on the system.[3] Coverage of cases of violence reported on the *SINAN/VIVA* system is increasing as a result of the increase in the number of notifying health centres and this in turn enables increased knowledge of the scenario of these cases each year.[25]

The quality of the information stored can be seen when examining case coding, either by using codes for ill-defined causes or for undetermined causes.

Evaluating ill-defined causes is justified by the importance of knowing the real causes determined for the events or facts surrounding external causes, in order to be able to distinguish between accidents, self-inflicted injury or assault. During the period studied

there was a significant decrease in ill-defined causes reported on the *SIM* system, whereas they increased on the *SIH/SUS* system.

The codes selected in this study to represent unspecified external causes or external causes of undetermined intent (ICD-10 codes X58, X59, Y33, Y34), usually characterized as "*rubbish codes*", are responsible for the omission of the type of external cause recorded on the *SIM* and *SIH/SUS* systems. Proportional redistribution of unspecified cause codes among those available in ICD-10 Chapter XX can bring rates closer to the real panorama of external causes, quantifying their variability. However the opposite can also occur, causing overestimation of already existing errors.[26,27] Specifically in the period studied, the use of "*rubbish codes*" codes to classify deaths reduced by around 25%, whereas it increased in relation to hospitalizations. This reflects significant improvement in the coding or recording of data on the *SIM* system, whilst this did not happen on the *SIH* system.

The improvement in the quality of information about the underlying cause of death is a result of investments in the qualification of the recording of deaths by building the capacity of professionals who work with the *SIM* system, efforts by Health Departments to actively trace data, as well as the use of manuals produced to improve the recording of deaths with ill-defined causes, this being reflected in death data qualification.[25,28]

With regard to hospitalizations, the South and Southeast Regions have the best indicators of hospital data quality. Notwithstanding, more progress still needs to be made with qualifying the technical staff responsible for hospital sector information, especially in relation to external causes, because even when complying with Ministry of Health Ordinance 142/97[29] which provides for the filling in of secondary diagnosis on Hospital Admission Authorization forms, failure to audit data relating to the circumstances in which the injury occurred contributes to information inconsistency.

It is important to note that hospital information is at a turning point in Brazil owing to the implantation of e-SUS, which is a Ministry of Health strategy for developing, restructuring and integrating information systems with the aim of facilitating and contributing to the organization of health professionals' work in order to enhance the care provided to the population. Specifically, Hospital e-SUS represents a new phase in hospital information management, indicating a promising future for the quality of hospital records as well as facilitating monitoring based on hospital morbidity and mortality.[30]

Another way the health sector has found to expand the scenario and understanding of accidents and violence has been by registering them through the *VIVA* surveillance programme and reporting cases of violence on the *SINAN* system. Beyond this, however, in order to ensure better quality information, strategies had to be implanted to standardize criteria for cleaning reported violence data and guidance as to types of violence reported.[31]

For this specific study, incomplete and inconsistent information recorded on the national systems were not considered as indicators of quality. The codes assessed here therefore only indicate part of the quality of the data.

Monitoring the quality of information included in health information systems is important for providing service managers with valuable information for local actions to

improve data quality and keep health surveillance services aware of the standard of quality of the information that is gathered and disseminated.

The large volume of information and easy access to it make a variety of epidemiological studies and the production of health sector indicators possible.[3] The Interagency Health Information Network (*RIPSA*) standardizes some indicators of mortality due to external causes, but there are few studies regarding the qualification of data related to these causes.[3,32] Greater effort is therefore needed to quantify the quality of information about external causes recorded on national information systems and, specifically, to ensure continuous reduction in the proportion of ill-defined and unspecified causes and causes of undetermined intent.

The overriding challenge is therefore to ensure that health professionals understand how important the correct filling in of external causes on data collection instruments is for building actions to prevent and reduce accident and violence morbidity and mortality.

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TECHNICAL TEAM

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