Mortality due to Cardiovascular Diseases in Brazil and in the Metropolitan Region of São Paulo: A 2011 Update

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Abstract

Background: Cardiovascular diseases (CVD) are the leading causes of death in our population. There was a progressive decrease in mortality due to CVD up to 2005.

Objective: To update the trends in mortality from cardiovascular diseases in Brazil and in the metropolitan region of São Paulo (MRSP) from 1990 to 2009.

Methods: Mortality and population data were obtained from the Brazilian Institute of Geography and Statistics and the Ministry of Health. The risk of death was adjusted by the direct method, having as reference the world population in 2000.

Results: There was a progressive decrease in the risk of death from ischemic heart disease (IHD) and stroke in Brazil and in the MRSP. From 1990 to 2009, there was a decrease in mortality from IHD and stroke in men and women in Brazil and in the MRSP. There was a greater reduction in mortality from IHD in men in the MRSP than in Brazil (36.24% vs. 23.35%, p <0.001) and in women in the MRSP (44.55% vs. 29.5%; p <0.001). The highest reduction in stroke mortality was observed in men in the MRSP, when compared to Brazil (42.43% vs. 34.9%, p = 0.036) and an equal reduction in women in the MRSP and in Brazil (42.98% vs. 36.15%, p = 0.082). The decrease in mortality was significant for all age groups.

Conclusion: We observed a progressive decrease in mortality from CVD, IHD and stroke in Brazil and in the MRSP. In spite of this decrease, we still have high rates of mortality from these diseases. (Arq Bras Cardiol 2012;99(2):755-761)

Keywords: Cardiovascular disease; epidemiology; mortality; Brazil.

Introduction

Cardiovascular diseases (CVD) are the major cause of death in women and men in Brazil. They account for approximately 20% of all deaths in individuals older than 30 years. According to the Ministry of Health, 962,931 deaths occurred in individuals older than 30 years in 2009. Ischemic heart disease (IHD) was responsible for 95,449 deaths and stroke for 97,860 deaths. The cardiovascular causes that are attributable to atherosclerosis were responsible for 193,309 deaths, neoplasias for 166,036 deaths, respiratory diseases accounted for 106,927 deaths, external causes for 77,503, digestive system diseases for 53,754 deaths and genitourinary tract diseases for 21,527 deaths.

Despite being the leading cause of death in Brazil, CVD mortality has been decreasing in recent decades, and this decrease was higher in the South and Southeast regions and in the age group older than 60 years[1,2]. In Western Europe countries and the U.S., death from IHD is approximately three times more frequent than from stroke, which is not observed in the countries in Eastern Europe, Asia and Latin America[3-5]. In Brazil, the stroke predominate over IHD, but the trend of stroke decrease was greater than that observed for IHD[6].

This study aimed to update the data on mortality from IHD and stroke in Brazil and in the metropolitan region of São Paulo (MRSP)[7], and this region was chosen due to its higher degree of urbanization. The MRSP has approximately 20 million inhabitants, which are distributed in 39 municipalities with high human development index[8].

Methods

We analyzed mortality from IHD and stroke in Brazil and in São Paulo, from 1990 to 2009. The mortality data were obtained from the site www.datasus.gov.br of the Ministry of Health of Brazil. The population data, from the Brazilian Institute of Geography and Statistics (IBGE), were obtained from the same site. Deaths from 1990 to 1995 were classified

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according to ICD-9, 9th Review Conference of the International Classification of Diseases (ICD) of 1975, and adopted by the 20th World Health Assembly. Mortality data from the year 1996 were obtained through the 10th review of the International Classification of Diseases.

Diseases of the circulatory system (CD) were grouped in codes 390-459, IHD, from codes 410 to 414, and stroke, from codes 430-438, of the 9th Review of the ICD. The mortality from the year 1996 was classified according to the 10th review of the ICD. The CD are grouped in codes I00-I99, IHD, from codes I20-I25 and stroke from codes I60-I69. We analyzed the mortality from the age of 30 years, according to gender, per 100,000 at age ranges 30-39 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years, and ≥ 80 years. For comparison, mortality was adjusted by the direct method for age according to world standard population of 2000[8]. And for more recent international comparisons, we show the adjustment for the standard European population between 35 and 74 years, of the last three available years (2007-2009)[8].

Simple linear regression was used to analyze the temporal evolution of the mortality rate associated with IHD and stroke, and then we performed the comparison of slopes of regression lines. The statistical software used was Primer of Biostatistics, release 4.02.9.

Results

Mortality rates due to CVD, IHD and stroke in Brazil and the MRSP are shown in Table 1.

We observed a progressive and similar decrease in mortality from IHD and stroke in Brazil and in the MRSP. From 1990 to 2009, there was a decrease in mortality from IHD in women and men in Brazil (23.35% *vs*. 29.5%; p = 0.675) and in the MRSP (36.24% *vs*. 44.55%; p = 0.366), and from stroke in Brazil (34.9% *vs*. 36.15%; p = 0.972) and in the MRSP (42.43% *vs*. 42.98%; p = 0.990). We also observed a higher decrease in mortality from IHD in men in the MRSP than in Brazil (36.24% *vs*. 23.35%; p < 0.001) and in women in the MRSP (44.55% *vs*. 29.5%; p < 0.001). We observed a higher decrease in mortality from stroke in men in the MRSP than in Brazil (42.43% *vs*. 34.9%; p = 0.036) and an equal decrease in women in the MRSP and in Brazil (42.98% *vs*. 36.15%; p = 0.082) (Figure 1).

The decrease in mortality was significant in all age groups. It was observed that mortality rates from IHD in the MRSP are higher than those in Brazil, while there are similarities between the mortality from stroke (Table 2). In Brazil, it was observed that women had higher mortality from stroke than from IHD, whereas men had similar mortality rates among the elderly. The association between IHD and stroke in the MRSP was lower than the unit in almost all age groups, except in women younger than 50 in the years 2004 and 2009 (Table 3). Table 4 shows the mortality from circulatory diseases standardized for the standard European population, between 35 and 74 years old, from 2006 to 2009. During this period, the decrease in mortality ranged from 11.76% to 18.91%.

Discussion

This study updated data on mortality from CVD in Brazil and in the MRSP. The MRSP had a higher mortality rate from IHD than in Brazil during this period, but the mortality rate from stroke was lower than that of Brazil. In the MRSP, the higher mortality from IHD in relation to stroke is similar to that found in Western Europe and the USA. A progressive decrease, already known since the 80s in the last century, remained steady and was more pronounced in the MRSP than in Brazil[1,2,4,5,7,10].

The decrease in mortality occurred in all age groups and was more pronounced for stroke[11]. When compared with the countries participating in the MONICA study by the WHO, the mortality from IHD and stroke in the MRSP and Brazil are among the highest in the world[3]. The mortality rates are similar to those seen in Eastern European countries and China and higher than those found in most Latin American countries[4,5,12]. For these same rates, the United States have mortality rates of 153.3 deaths per 100,000 inhabitants for IHD and 31.6 deaths for stroke in men and in women, of 60.4 deaths for IHD and 24.3 deaths for stroke, thus lower than the rates observed in Brazil and in the city of São Paulo[3]. Death rates in the U.S. population are significantly lower than those observed in Brazil, when standardized for the European population[3].

Despite the progressive decrease in CVD mortality in Brazil and the MRSP, mortality rates remain high and could be due to the high prevalence and at the same time, to the yet poor control of risk factors for CVD in our population. For instance, hypertension is the most prevalent risk factor in our population, as well as rates of blood pressure control are low in hypertensive individuals[13].

The prevalence of hypertension in Brazil, in a literature review by Pontes Neto et al[14] and Passos et al[15] varied between 20% and 44% and only 30% of hypertensive patients show blood pressure control[16]. Risk factors such as smoking, diabetes and dyslipidemia are the other major risk factors for CVD that are very prevalent in our population. With the exception of smoking, which is a behavioral risk factor, diabetes and dyslipidemia need constant control and has a high cost for the population[17]. It is known that the control of risk factors is responsible for at least 50% decrease in mortality from CVD[18]. The reduction of social inequalities, which includes education, may also substantially increase the trend of decrease in mortality from CVD.

Bassanesi et al[19] observed that almost half the mortality from CVD before 65 years can be attributed to poverty. Ishitani et al[20] emphasized the importance of education in the inverse relationship between CVD mortality and socioeconomic factors.

Similarly, the urbanization process observed in Brazil probably had an important impact on the incidence of cardiovascular diseases. It is known that urbanization is associated with an inadequate profile of risk factors for cardiovascular diseases[21]. The population's increased access to primary care and treatment of CVD should be a priority for the government, as CVD are the leading causes of death in individuals older than 60 years, especially among the less favored socioeconomic classes[22]. Access to immunization in this age group for the influenza virus reduced the total

Table 1 – Risk of death*, per 100,000 inhabitants, due to ischemic heart disease (IHD) and stroke and the total variation in the observation period (1990-2009), in males (M) and females (F), in Brazil and in São Paulo

Year	São Paulo				Brazil			
	IHD M	IHD F	Stroke M	Stroke F	IHD M	IHD F	Stroke M	Stroke F
1990	348,33	198,89	223,82	159,80	194,87	120,28	206,09	160,17
1991	327,21	186,81	200,73	147,31	184,80	114,86	193,48	148,59
1992	332,75	179,67	202,99	145,16	178,55	109,50	192,96	148,21
1993	341,71	191,50	204,09	152,44	188,62	116,04	207,45	160,73
1994	334,18	190,26	202,06	152,93	186,74	116,07	202,70	158,71
1995	335,22	188,66	205,18	149,57	183,86	119,13	196,27	155,17
1996	351,27	189,83	211,89	145,83	175,95	110,06	173,60	137,07
1997	339,10	188,83	208,91	148,22	173,04	109,31	175,23	137,04
1998	333,43	183,61	200,62	145,75	176,97	110,42	177,90	136,85
1999	348,11	185,43	211,03	149,11	177,63	111,00	175,18	136,83
2000	302,49	162,13	169,97	121,24	162,12	96,99	156,68	119,82
2001	286,89	159,26	164,59	116,40	162,15	97,16	159,11	120,30
2002	289,73	157,40	163,31	119,71	164,00	99,47	158,35	121,38
2003	293,81	153,01	156,09	114,21	167,12	99,55	160,96	121,62
2004	291,79	153,43	162,93	118,46	171,92	103,35	162,08	124,13
2005	257,99	138,60	151,29	108,34	164,95	98,49	155,09	121,35
2006	269,92	141,88	156,95	110,32	174,48	103,40	165,42	128,58
2007	228,28	122,35	130,87	90,32	151,49	87,77	139,64	106,51
2008	232,94	117,52	130,60	93,86	152,67	87,83	138,70	105,40
2009	222,10	110,28	128,85	91,12	149,36	84,82	134,09	102,27
var(%)	-36,24	-44,55	-42,43	-42,98	-23,35	-29,5	-34,9	-36,15

** adjusted by the direct method for the world standard population of 2000; var (%) = percentage variation (2009/1990).*

load of respiratory infections and mortality from CVD. The vaccination campaign in this age group in Brazil has been significantly associated with reduced mortality from CVD[23]. Therefore, although further studies are needed to evaluate the effectiveness of this intervention on CVD mortality, the flu vaccine should be encouraged, especially in older individuals.

The limitations of this study are related to the Brazilian mortality statistics, such as errors related to the diagnosis, accuracy of death certificates, deaths associated with unknown causes and data entry errors. Validation studies for mortality data are not available in most states or cities in Brazil. An indirect indicator of the standard quality of data is the number of death certificates that contain a diagnosis for the cause of death, such as symptoms, signs and ill-defined health conditions.

Such certificates are significant in the Northeast, North, and Midwest regions, but are not significant in the South and Southeast regions of Brazil or in the MRSP. The standardization of data for the world and European populations can lead to differences in values obtained for mortality rates, but were used to facilitate comparison of our data with those published in literature.

Future studies using the Brazilian population as the standard will be required to obtain values with less chance of distortion.

Conclusion

We observed a progressive decrease in mortality from CVD, IHD and stroke in Brazil and in the MRSP. However, in spite of this decrease, we still have high mortality rates due to these diseases. Therefore, intensifying the control of risk factors and increase the population access to health services are crucial.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

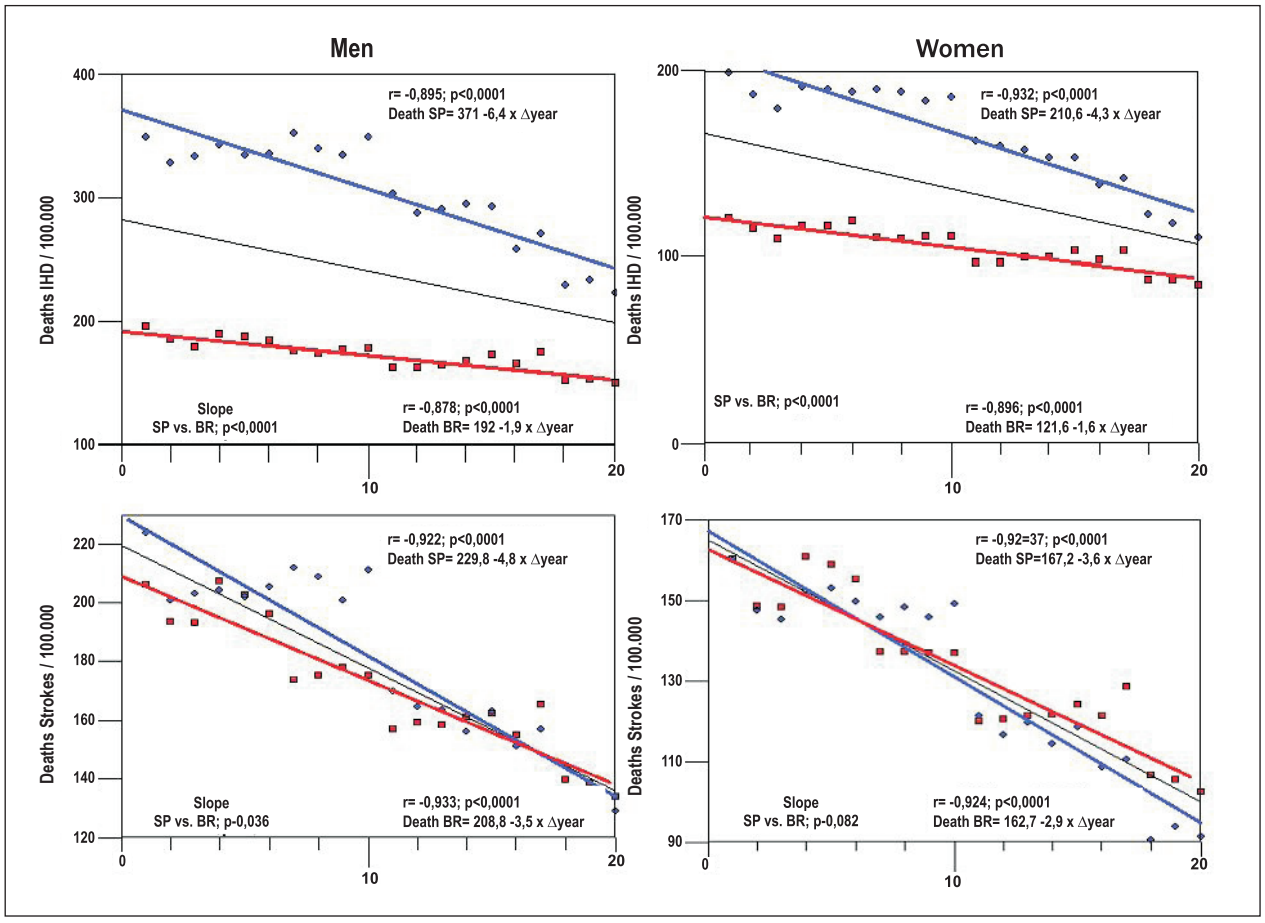

Figure 1 - *Linear regression of death from IHD and Stroke adjusted for age 30 years or older, in Brazil and in Sao Paulo, in men and women.*

Table 2 - Death per 100,000 inhabitants in males (M) and females (F), by age range, in five-year intervals in Brazil and the metropolitan region of São Paulo

	Brazil – Ischemic Heart Disease						São Paulo – Ischemic Heart Disease					
	1990	1994	1999	2004	2009	var(%)	1990	1994	1999	2004	2009	var(%)
30 - 39h	14,8	13,7	12,1	10,1	9,7	-34,7	21,3	22,5	17,5	13,7	11,1	-48,2
30 - 39F	5,4	5,5	4,4	3,7	3,7	-31,3	7,3	5,5	5,8	4,2	4,2	-42,5
40 - 49h	58,3	57,1	54,2	47,6	40,6	-30,4	101,1	89,4	92,5	61,1	54,2	-46,5
40 - 49F	22,1	23,1	21,6	20,9	17,7	-20,2	28,2	32,3	27,2	24,0	18,5	-34,2
50 - 59h	171,4	157,1	155,7	148,5	125,9	-26,6	276,2	254,0	269,9	234,0	176,2	-36,2
50 - 59F	67,9	66,0	65,2	63,5	51,0	-24,8	90,8	89,1	89,8	87,4	58,5	-35,6
60 - 69h	356,3	346,9	326,3	318,2	280,5	-21,3	597,9	583,9	591,1	501,6	378,9	-36,6
60 - 69F	179,2	179,7	174,6	160,3	136,1	-24,1	269,8	274,4	260,2	210,0	146,8	-45,6
70 - 79h	668,4	652,6	640,4	628,9	549,1	-17,9	1239,7	1160,8	1280,1	1064,7	832,7	-32,8
70 - 79F	460,6	439,7	439,3	407,3	323,0	-29,9	713,5	701,8	729,4	578,7	427,7	-40,1
80 + h	1308,4	1240,0	1121,2	1111,7	958,7	-26,7	2619,6	2653,4	2708,5	2336,2	1708,5	-34,8
80 + F	1273,4	1190,5	1080,7	993,0	820,1	-35,6	2550,9	2276,8	2140,0	1764,3	1283,6	-49,7
	Brazil – Stroke						São Paulo - Stroke					
	1990	1994	1999	2004	2009	var(%)	1990	1994	1999	2004	2009	var(%)
30 - 39h	16,3	14,9	10,7	8,1	5,9	-63,8	21,6	17,9	12,8	8,1	5,1	-76,3
30 - 39F	14,4	14,1	10,6	7,9	6,2	-56,9	16,4	15,6	13,8	8,7	5,8	-64,5
40 - 49h	54,3	54,0	40,7	34,2	24,7	-54,5	62,6	63,7	50,2	39,0	24,0	-61,6
40 - 49F	42,1	44,3	36,2	31,6	22,9	-45,6	46,2	52,0	43,9	32,0	23,7	-48,8
50 - 59h	149,2	137,2	116,7	101,3	76,9	-48,5	149,1	144,8	141,7	97,6	81,4	-45,4
50 - 59F	98,6	95,0	82,0	74,4	53,0	-46,3	92,9	84,7	83,8	68,9	48,4	-47,9
60 - 69h	330,3	327,5	281,2	251,2	198,9	-39,8	331,3	308,8	308,0	268,8	194,3	-41,3
60 - 69F	215,7	213,0	180,3	157,3	128,6	-40,4	199,7	179,1	170,4	153,2	115,1	-42,4
70 - 79h	797,6	783,2	704,9	643,6	536,9	-32,7	875,2	738,4	810,0	583,9	527,1	-39,8
70 - 79F	607,8	575,8	504,9	456,2	375,3	-38,3	583,0	500,5	529,5	365,9	300,8	-48,4
≥ 80h	1627,7	1658,6	1454,2	1484,1	1199,4	-26,3	1847,7	1641,7	1934,6	1553,2	1199,9	-35,1
≥ 80F	1583,7	1631,9	1432,2	1352,1	1204,6	-23,9	1676,4	1757,0	1690,5	1430,0	1125,0	-32,9

Table 3 - Association between death due to stroke and ischemic heart disease by age range and gender (M=males; F=females)

	São Paulo					Brail				
	1990	1994	1999	2004	2009	1990	1994	1999	2004	2009
30 - 34 M	1,0	0,9	0,6	0,8	0,3	1,1	1,2	0,9	0,8	0,7
30 - 34 F	2,6	3,7	2,5	1,7	0,9	2,7	2,7	2,7	2,3	1,6
35 - 39 M	1,0	0,7	0,8	0,5	0,5	1,1	1,0	0,9	0,8	0,7
35 - 39 F	2,1	2,4	2,3	2,5	1,8	2,7	2,5	2,3	2,1	1,7
40 - 44 M	0,6	0,8	0,7	0,8	0,5	1,0	1,0	0,8	0,7	0,7
40 - 44 F	2,0	1,9	2,1	1,8	1,5	2,2	2,0	1,9	1,7	1,4
45 - 49 M	0,6	0,7	0,5	0,6	0,4	0,9	0,9	0,7	0,7	0,6
45 - 49 F	1,4	1,5	1,3	1,1	1,2	1,7	1,8	1,5	1,4	1,2
50 - 54 M	0,5	0,6	0,6	0,4	0,5	0,9	0,9	0,7	0,7	0,6
50 - 54 F	1,2	1,1	1,0	0,9	0,9	1,6	1,6	1,4	1,3	1,1
55 - 59 M	0,5	0,6	0,5	0,4	0,4	0,9	0,9	0,8	0,7	0,6
55 - 59 F	0,9	0,9	0,9	0,7	0,7	1,4	1,3	1,2	1,1	1,0
60 - 64 M	0,6	0,5	0,5	0,5	0,5	0,9	0,9	0,8	0,7	0,7
60 - 64 F	0,7	0,7	0,7	0,7	0,8	1,2	1,2	1,0	1,0	0,9
65 - 69 M	0,5	0,5	0,5	0,5	0,5	0,9	1,0	0,9	0,8	0,8
65 - 69 F	0,7	0,6	0,6	0,7	0,7	1,2	1,2	1,0	1,0	1,0
70 - 74 M	0,7	0,6	0,6	0,5	0,6	1,2	1,1	1,1	1,0	0,9
70 - 74 F	0,8	0,7	0,8	0,7	0,6	1,3	1,2	1,1	1,1	1,1
75 - 79 M	0,7	0,7	0,7	0,6	0,7	1,2	1,3	1,2	1,1	1,1
75 - 79 F	0,8	0,7	0,7	0,6	0,8	1,4	1,4	1,2	1,2	1,2
≥ 80 M	0,7	0,6	0,7	0,7	0,7	1,2	1,3	1,3	1,3	1,3
≥ 80 F	0,7	0,8	0,8	0,8	0,9	1,2	1,4	1,3	1,4	1,5

Tabela 4 - Death adjusted for age, European Standard Population, 35 to 74 years

	Death due to circulatory diseases, 35 to 74 years – Brazil				
	2006	2007	2008	2009	Var (%)
IHD Men	183,02	171,29	171,48	158,74	-13,27
IHD Women	63,33	62,71	60,44	54,17	-14,46
Stroke Men	91,54	79,94	83,86	77	-15,88
Stroke Women	54,48	48,88	51,37	47,19	-13,38
	Death due to circulatory diseases, 35 to 74 years – São Paulo				
IHD Men	155,59	139,74	141,1	137,29	-11,76
IHD Women	76,38	67,22	67,99	64,9	-15,03
Stroke Men	119,84	104,35	104,2	100,38	-16,24
Stroke Women	82,94	71,56	70,84	67,26	-18,91

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