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Variations and particularities in cardiovascular disease mortality in Brazil and Brazilian states in 1990 and 2015: estimates from the Global Burden of Disease

Variações e diferenciais da mortalidade por doença cardiovascular no Brasil e em seus estados, em 1990 e 2015: estimativas do Estudo Carga Global de Doença

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ABSTRACT: ***Objective:*** To analyze variations and particularities in mortality due to cardiovascular disease (CVD) in Brazil and in Brazilian states, in 1990 and 2015. ***Methods:*** We used data compiled from the Global Burden of Disease (GBD) 2015, obtained from the database of the Mortality Information System (SIM) of the Brazilian Ministry of Health. Correction of the sub-registry of deaths and reclassification of the garbage codes were performed using specific algorithms. The cardiovascular causes were subdivided into 10 specific causes. Age-standardized CVD mortality rates — in 1990 and 2015 — were analyzed according to sex and Brazilian state. ***Results:*** Age-standardized CVD mortality rate decreased from 429.5 (1990) to 256.0 (2015) per 100,000 inhabitants (40.4%). The proportional decrease was similar in both sexes, but death rates in males were substantially higher. The reduction of age-standardized mortality rate was more significant for rheumatic heart disease (44.5%), ischemic cardiopathy (43.9%), and cerebrovascular disease (46.0%). The decline in mortality was markedly different across states, being more pronounced in those of the southeastern and southern regions and the Federal District, and more modest in most states in the north and northeast regions. ***Conclusion:*** Age-standardized CVD mortality has declined in Brazil in recent decades, but in a heterogeneous way across states and for different specific causes. Considering the burden magnitude and the Brazilian population aging, policies to prevent and manage CVD should continue to be prioritized.

Keywords: Brazil. Cardiovascular diseases. Mortality. Health impact assessment. Trends.

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RESUMO: ***Objetivo:*** Analisar as variações e os diferenciais da mortalidade por doenças cardiovasculares (DCV) no Brasil e em seus estados, em 1990 e 2015. ***Métodos:*** Foram utilizados os dados de mortalidade compilados pelo *Global Burden of Disease* (GBD) 2015, obtidos da base de dados do Sistema de Informação sobre Mortalidade do Ministério da Saúde. Foram realizadas a correção do sub-registro de óbitos e a reclassificação dos códigos *garbage* por meio de algoritmos específicos. As causas cardiovasculares foram subdivididas em 10 causas específicas. As taxas de mortalidade — dos anos 1990 e 2015 — foram padronizadas pela idade, de acordo com o sexo e o estado brasileiro. ***Resultados:*** A taxa de mortalidade por DCV padronizada por idade caiu de 429,5 (1990) para 256,0 (2015) a cada 100 mil habitantes (40,4%). A redução proporcional foi semelhante em ambos os sexos, mas as taxas em homens são substancialmente mais altas do que nas mulheres. A redução da taxa padronizada por idade foi mais acentuada para a doença cardíaca reumática (44,5%), cardiopatia isquêmica (43,9%) e doença cerebrovascular (46,0%). A queda na mortalidade diferiu marcadamente entre os estados, sendo mais acentuada nos estados das regiões Sudeste e Sul do país e no Distrito Federal, e atenuada nos estados do Norte e Nordeste. ***Conclusão:*** A mortalidade por DCV padronizada por idade reduziu no Brasil nas últimas décadas, porém de forma heterogênea entre os estados e para diferentes causas específicas. Considerando a magnitude da carga de doença e o envelhecimento da população brasileira, as políticas de enfrentamento das DCV devem ser priorizadas.

Palavras-chave: Brasil. Doenças cardiovasculares. Mortalidade. Avaliação do impacto na saúde. Tendências.

INTRODUCTION

Brazilian health care system has been greatly impacted by non-communicable diseases (NCDs) since the 1960s, a decade marked by epidemiologic transition in Brazil when there was a shift of morbidity and mortality causes from a predominance of infectious diseases and those related to nutritional deficiencies to NCD[1]. Among NCD, cardiovascular diseases (CVDs) are the main cause of death – 31% of total deaths and 42% of deaths due to NCDs in 2011 – and hospitalization in Brazil, which leads to high costs in the inpatient component of the health care system[2,3].

The population aging and the increase in the prevalence of cardiovascular risk factors, such as hypertension and diabetes, were responsible for the increasing impact of CVDs in recent decades in Brazil[1,2]. Importantly, the most prevalent CVDs, such as ischemic cardiopathy and cerebrovascular diseases, have common risk factors, which are potentially modifiable through healthy life habits[4].

Within this context, knowledge of trends of the main causes for CVDs in Brazil, including regional differences, is of utmost importance, as it will contribute to the construction and implementation of public health policies considering current and future challenges. The Global Burden of Disease (GBD) is an epidemiologic observational study of great relevance that examines trends for morbidity and mortality due to the main diseases, conditions, and risk factors at global, national, and regional level. The objective of the GBD 2015 is to understand, by assessing trends from 1990 to 2015, the changes

in the profile mortality causes, diseases, conditions, and risk factors that affect 21st-century populations[5].

The objective of this study was to analyze the mortality variations and particularities due to CVDs in Brazil and in Brazilian states, in 1990 and 2015, having the GBD 2015 study as its base for estimates.

METHODS

THE GBD STUDY AND THE SPECIFICITIES IN BRAZIL

The GBD 2015 utilized data available on causes of death in 195 countries. This information was collected from information systems regarding vital statistics, mortality surveillance systems, studies, hospital records, and police records[6]. In Brazil, the data were obtained mainly from the Mortality Information System (acronym in Portuguese – SIM), from the Ministry of Health – a system created by the Ministry of Health in 1975, based on the international form of the death certificate, implemented in 1976, substituting several models used at that time. Coding of death certificates in SIM is undertaken utilizing an automated coding system. All deaths require a declaration of cause (death certificate) issued by a physician. For deaths occurring outside health facilities, causes of death are certified, whenever possible, by the Death Verification Service (in Portuguese, *Serviço de Verificação de Óbitos* – SVO) – an official institution which performs autopsies in non-external deaths with unknown causes – or by another civil registrar, when there is no physician, in which cases the death certificate is not recorded[7].

In addition, techniques were utilized for the standardization of causes of death[8].

Corrections were made for the underreporting of deaths and for garbage codes – a term used to describe causes that cannot be considered as underlying causes of death or that are poorly specified. Redistribution algorithms of the garbage codes were developed in the GBD study to increase the validity of the estimates. For this redistribution into specific causes of death, evidence from various sources was considered, such as medical literature, specialist's opinions, and statistics[6,9].

After the data quality improvements, a variety of statistics models were applied in GBD study to determine the number of deaths per cause, especially using the CODEm algorithm (Cause of Death Ensemble Model). To guarantee that the number of deaths per cause did not exceed the total number of estimated deaths, a correction technique (CoCorrect) was utilized. This adjustment technique guarantees that the sum of the estimates of death per cause does not exceed 100% of the estimated deaths in a certain year[6].

To produce comparative estimates, this study was based on the data presented and the methods employed in the GBD 2015 study, which have been previously described[6], and in the aforementioned data collection and adjustment techniques for mortality.

The data were analyzed in 1990 and 2015; all of the analyses conducted were stratified by sex, presented in absolute estimates, and standardized by age and for the different states in the Brazilian territory.

CVD DEFINITIONS

The nine most common global causes of death due to CVD were considered as well as an additional category for other CVDs, in addition to the global mortality grouped by CVD. The underlying cause of death was defined as CVD through the ICD (International Classification of Diseases) coding, from the underlying cause of death informed on the death certificate, the basic document for information in Brazil. These causes were:

1. Rheumatic heart disease (codes I01-I01.9, I02.0, I05-I09.9);
2. Ischemic cardiopathy (codes CID 10 I20-I25.9);
3. Cerebrovascular disease (G45-G46.8, I60-I61.9, I62.0, I63-I63.9, I65-I66.9, I67.0-I67.3, I67.5-I67.6, I68.1-I68.2, I69.0-I69.3);
4. Hypertensive heart disease (I11);
5. Cardiomyopathy and myocarditis (A39.52, B33.2-B33.24, D86.85, I40-I43.9, I51.4-I51.5);
6. Atrial fibrillation and flutter (I48);
7. Aortic aneurysm (I71);
8. Peripheral artery disease (I70.2-I70.7, I73-I73.9)
9. Endocarditis (A39.51, I33-I33.9, I38-I39.9).

The grouping of these causes was performed according to specific consequences of the disease (for example, ischemic cardiopathy due to acute coronary syndrome, chronic stable angina, chronic ischemic cardiopathy, and ischemic cardiomyopathy). Adjustments were made to the data that did not follow the definition of a specific cause – which occurred with the electronic confirmations for the clinical diagnosis[6,8,10].

ETHICAL CONSIDERATIONS

The project was approved by the Research Ethics Committee from the *Universidade Federal de Minas Gerais* (CAAE nº. 62803316.7.0000.5149).

RESULTS

CVDs were responsible for 267,635 deaths in 1990 (29.3% of total deaths) and 424,058 in 2015 (31.2%). During this same period, the mortality rate due to CVDs standardized

by age reduced from 429.5 to 256.0 per 100,000 inhabitants, a 40.4% decrease (Table 1). Among men, between 1990 and 2015, the reduction was from 524.8 to 315.8 per 100,000 inhabitants (39.8%), whereas for women, from 358.3 to 210.7, per 100,000 inhabitants (41.2%). Considering the specific causes, the reduction of the standardized rate by age was more significant for rheumatic heart disease, ischemic cardiopathy, and cerebrovascular disease, with a decrease also occurring in hypertensive heart disease, cardiomyopathy and myocarditis, and other cardiovascular and circulatory diseases. Mortality due to atrial fibrillation and atrial flutter remained stable, while there was an increase in mortality standardized by age for aortic aneurysms – particularly among women – peripheral artery disease and endocarditis (Table 1).

Table 2 shows the cardiovascular mortality rate standardized by age for the Brazilian states, stratified by sex, in 1990 and 2015, whereas Figure 1 presents the trend of this rate at 5 year intervals starting at 1990. The reduction in mortality was different

Table 1. Total cardiovascular mortality and by cause, standardized by age and stratified by sex, in Brazil, in 1990 and 2015.

Cause of Death	Total			Men			Women		
	1990	2015	% of change	1990	2015	% of change	1990	2015	% of change
Rheumatic heart disease	2.6	1.5	-44.5	2.9	1.4	-50.2	2.5	1.5	-40.3
Ischemic cardiopathy	209.4	117.6	-43.9	260.6	148.9	-42.9	169.9	93.2	-45.1
Cerebrovascular disease	162.9	88.0	-46.0	195.2	106.9	-45.2	139.7	74.3	-46.8
Hypertensive heart disease	18.2	14.9	-18.2	19.3	16.0	-17.0	17.3	14.0	-19.2
Cardiomyopathy and myocarditis	14.0	11.3	-19.4	17.3	14.8	-14.4	11.4	8.5	-25.8
Atrial fibrillation and atrial flutter	2.7	2.8	2.7	3.6	3.6	0.0	2.2	2.3	4.3
Aortic aneurysm	5.0	5.8	16.8	8.7	8.5	-2.4	2.4	3.9	64.6
Peripheral artery disease	0.9	1.6	82.1	1.2	2.0	70.9	0.7	1.4	94.8
Endocarditis	1.2	1.4	17.9	1.4	1.7	20.0	1.0	1.2	15.7
Other cardiovascular and circulatory diseases	12.7	11.1	-12.1	14.7	12.0	-18.7	11.1	10.4	-6.4
Cardiovascular diseases – total	429.5	256.0	-40.4	524.8	315.8	-39.8	358.3	210.7	-41.2

Table 2. Total cardiovascular mortality, standardized by age and stratified by state and sex, in Brazil, in 1990 and 2015.

Regions / States	Total			Men			Women		
	1990	2015	% of change	1990	2015	% of change	1990	2015	% of change
North									
Acre	363.0	252.2	-30.5	427.6	297.9	-30.3	299.8	211.2	-29.5
Amapá	313.0	256.3	-18.1	367.2	310.1	-15.6	268.5	208.7	-22.3
Amazonas	363.4	236.9	-34.8	414.6	285.5	-31.1	319.5	195.2	-38.9
Pará	388.8	275.4	-29.2	453.1	335.6	-25.9	336.9	223.0	-33.8
Rondônia	463.5	269.6	-41.8	540.6	320.5	-40.7	378.4	218.0	-42.4
Roraima	373.1	234.9	-37.0	435.3	281.3	-35.4	307.2	189.4	-38.3
Tocantins	389.6	325.8	-16.4	446.5	388.0	-13.1	334.9	264.7	-21.0
Northeast									
Alagoas	459.1	312.4	-32.0	524.2	386.2	-26.3	408.2	259.6	-36.4
Bahia	394.0	280.9	-28.7	446.2	336.5	-24.6	353.8	239.1	-32.4
Ceará	355.4	286.4	-19.4	417.7	370.5	-11.3	307.3	225.1	-26.8
Maranhão	497.0	353.2	-28.9	683.5	433.7	-36.5	340.4	290.4	-14.7
Paraíba	386.0	318.0	-17.6	440.1	410.3	-6.8	344.4	251.4	-27.0
Pernambuco	426.1	291.4	-31.6	500.4	366.1	-26.8	372.4	240.1	-35.5
Piauí	391.0	320.0	-18.2	470.0	405.6	-13.7	327.8	258.1	-21.3
Rio Grande do Norte	319.4	245.5	-23.1	382.5	320.1	-16.3	269.3	192.0	-28.7
Sergipe	368.2	267.5	-27.4	438.8	330.9	-24.6	315.9	223.6	-29.2
Central West									
Distrito Federal	350.0	187.0	-46.6	426.5	241.8	-43.3	298.4	153.0	-48.7
Goiás	412.6	259.8	-37.0	473.3	308.8	-34.8	358.4	216.9	-39.5
Mato Grosso	427.1	274.3	-35.8	496.8	330.4	-33.5	354.7	218.8	-38.3
Mato Grosso do Sul	431.2	278.3	-35.5	501.7	348.3	-30.6	365.6	218.5	-40.2
Southeast									
Espírito Santo	443.3	254.9	-42.5	552.0	318.6	-42.3	359.9	205.1	-43.0
Minas Gerais	436.8	240.9	-44.8	535.5	291.6	-45.5	363.3	199.7	-45.0
Rio de Janeiro	491.0	255.9	-47.9	634.6	325.7	-48.7	397.5	208.3	-47.6
São Paulo	427.5	229.9	-46.2	535.5	281.7	-47.4	349.8	191.1	-45.4
South									
Paraná	486.3	261.8	-46.2	584.7	320.5	-45.2	406.9	214.3	-47.3
Rio Grande do Sul	435.7	238.9	-45.2	551.4	290.7	-47.3	358.6	200.6	-44.0
Santa Catarina	445.1	234.3	-47.4	536.1	283.6	-47.1	376.9	195.9	-48.0
Brazil	429.5	256.0	-40.4	524.8	315.8	-39.8	358.3	210.7	-41.2

across states, being higher (above 40%) in the southeastern and southern regions of the country and in the Federal District. In contrast, the lowest reductions occurred in the northern and northeastern regions, which presented the highest rates in 2015 (Table 2 and Figure 1).

Figure 2 shows the ranking of the specific causes of cardiovascular mortality in 1990 (upper panel) and in 2015 (lower panel). In 1990, cerebrovascular disease was the main cause of cardiovascular death in five Brazilian states – Alagoas, Espírito Santo, Maranhão, Piauí, and Sergipe – exceeding ischemic cardiopathy in these locations. However, in 2015, a predominance of cerebrovascular diseases was only observed in the state of Amapá. It was also observed that, in 2015, hypertensive heart disease was the third cause of cardiovascular death in the majority of states, a position that was alternately held between other cardiovascular diseases and cardiomyopathy in 1990. Finally, in 2015, aortic aneurysms occupied the sixth position among the causes of death, and mortality due to rheumatic heart disease was less common.

DISCUSSION

On the basis of estimates from the GBD 2015, regarding the variation of mortality due to CVD in Brazil and in Brazilian states, a consistent reduction of mortality rates standardized by age can be observed, especially due to the reduction in the mortality

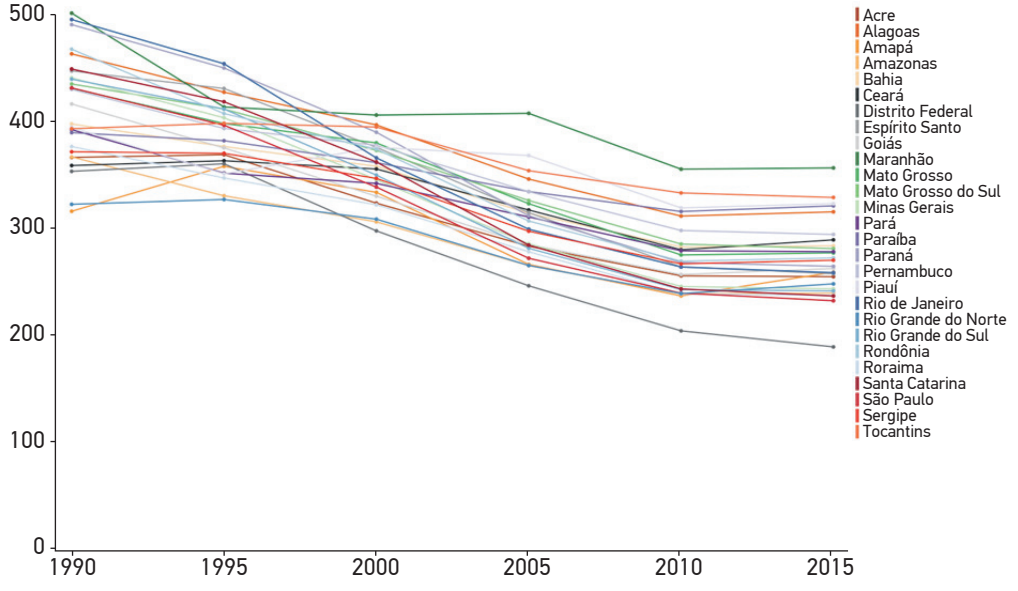

Figure 1. Variation of total cardiovascular mortality, standardized by age, in Brazilian states, between 1990 and 2015.

Both sexes, All ages, 1990, Deaths per 100,000.

	Acre	Alagoas	Amapá	Amazonas	Bahia	Ceará	Distrito Federal	Espírito Santo	Goiás	Maranhão	Mato Grosso	Mato Grosso do Sul	Minas Gerais	Pará	Paraíba	Paraná	Pernambuco	Piauí	Rio de Janeiro	Rio Grande do Norte	Rio Grande do Sul	Rondônia	Roraima	Santa Catarina	São Paulo	Sergipe	Tocantins
Ischemic heart disease	1	2	1	1	1	1	1	2	1	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1
Cerebrovascular disease	2	1	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	1	2
Hypertensive heart disease	3	3	4	5	3	5	4	3	4	3	5	4	3	3	5	3	3	3	3	3	4	3	3	5	4	5	3
Other cardiovascular	4	5	3	4	5	3	6	5	5	5	4	5	5	4	4	5	4	5	4	4	3	5	5	3	5	4	5
Cardiomyopathy	5	4	5	3	4	4	3	4	3	4	3	3	4	5	3	4	5	4	5	5	5	4	4	4	3	3	4
Rheumatic heart disease	6	6	6	7	6	7	7	7	6	7	7	7	7	6	7	7	7	7	7	7	7	6	7	7	7	6	7
Aortic aneurysm	7	7	7	6	7	6	5	6	7	6	6	6	6	7	6	6	6	6	6	6	6	7	6	6	6	7	6
Endocarditis	8	8	9	8	9	9	8	8	8	8	8	8	8	8	9	8	9	9	8	9	9	8	9	8	8	9	8
Atrial fibrillation	9	9	8	9	8	8	9	9	9	9	9	9	9	9	8	9	8	8	9	8	8	9	8	9	9	8	9
Peripheral artery	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Both sexes, All ages, 2015, Deaths per 100,000.

	Acre	Alagoas	Amapá	Amazonas	Bahia	Ceará	Distrito Federal	Espírito Santo	Goiás	Maranhão	Mato Grosso	Mato Grosso do Sul	Minas Gerais	Pará	Paraíba	Paraná	Pernambuco	Piauí	Rio de Janeiro	Rio Grande do Norte	Rio Grande do Sul	Rondônia	Roraima	Santa Catarina	São Paulo	Sergipe	Tocantins
Ischemic heart disease	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cerebrovascular disease	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hypertensive heart disease	3	3	4	3	3	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	4	5	3	3
Other cardiovascular	4	5	3	5	4	5	6	5	5	4	5	5	5	4	5	4	5	5	5	4	3	5	5	3	4	5	5
Cardiomyopathy	5	4	5	4	5	3	3	4	3	5	4	4	4	5	4	5	4	4	4	5	5	4	4	5	3	4	4
Aortic aneurysm	6	6	6	6	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Rheumatic heart disease	7	9	7	9	8	9	8	9	7	8	9	9	9	9	8	8	8	9	10	8	10	8	8	8	8	8	8
Atrial fibrillation	8	7	9	7	7	7	7	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Endocarditis	9	8	8	8	9	8	10	10	9	9	8	8	10	8	9	10	10	8	9	9	8	9	9	9	10	9	9
Peripheral artery	10	10	10	10	10	10	9	7	10	10	10	10	8	10	10	9	9	10	8	10	9	10	10	10	9	10	10

Figure 2. Most common causes of cardiovascular death, considering the mortality adjusted by age, in Brazilian states, in 1990 and 2015.

of the most prevalent CVDs – cerebrovascular disease and ischemic cardiopathy, which was the main cause of deaths in Brazil in 2015[2,3]. However, it is important to emphasize that the reduction in mortality occurred heterogeneously: in addition to being lower in the states with a worse socioeconomic condition, it reached a plateau in most states in the last five years. These two findings, along with the aging of the Brazilian population[1,2], which will lead to an increase of the absolute number of deaths due to CVDs in the next few decades, regardless of the reduction in the rates of mortality standardized by age, make CVDs a topic to deserve greater attention in Brazil's health policy agenda.

The reduction in mortality due to CVD in Brazil may be due to an improvement in the socioeconomic situation of a large portion of the population and also due to public policies that were implemented in recent decades[11-13]. Objectively, we can cite the higher control of atherosclerotic risk factors, such as hypertension and tobacco use[3,14], and better conditions to treat acute events, such as acute myocardial infarction and stroke[15,16]. Some factors have contributed to the previously cited improvements, such as the expansion of the Primary Health Care Network through the access to diagnoses and treatment[17,18]; the implementation of populational public policies to control CVD risk factors such as policies aiming at tobacco use control– which was reduced by 50% from 1990 to 2010[14] – and the creation, in 2013, of the urgent and emergency care system, which currently covers two thirds of the Brazilian population, facilitating access to early hospital care[19].

Despite the fact that reduction in mortality due to CVDs reflects the improvement in the condition of life for the Brazilian population in recent decades, the analysis by state shows an important regional variation, with less developed states presenting less reduction in mortality. Previous analyses conducted in Brazil show that individuals of black race and with lower socioeconomic conditions present a higher rate of mortality due to CVDs[3], and make up the group with the highest number of occurrences of premature deaths due to CVDs[20]. This type of death, in individuals aged from 30 to 69 years, impacts significantly the life of individuals affected and generates higher cost for the health system[2].

When analyzing specific cardiovascular causes, results reveal that, among CVDs, ischemic cardiopathy is the main cause of cardiovascular death in all of the national territory – except for Amapá – followed by cerebrovascular diseases. These data are in consonance with the already concluded epidemiologic transitions in Brazil, with the communicable CVDs, such as Chagas disease, and rheumatic diseases, being of relatively low prevalence since 1990[1]. In addition, the predominance of ischemic cardiopathy as the cause of death can reflect a better control of arterial hypertension, strongly associated with cerebrovascular disease, when compared with other risk factors that are more associated with ischemic cardiopathy, such as dyslipidemia and diabetes[3]. Indeed, the increase in the prevalence of diabetes in Brazil, along with the obesity epidemics,

is a challenge that should be addressed in order to maintain the reduction in mortality due to CVDs in coming years.

While mortality due to the more prevalent CVDs presented a reduction between 1990 and 2015, data from this study show that there was an increase in mortality due to aortic aneurysms, peripheral artery disease, and endocarditis, in addition to the stability in mortality due to atrial fibrillation. Despite the relevant variation in the mortality rates due to aortic aneurysms, peripheral artery disease, and endocarditis, they still have a low impact in mortality due to cardiovascular causes in 2015. Regarding peripheral vascular diseases, our data are compatible with the growing prevalence of this disease worldwide, especially among women[21], and can reflect the growing impact of the increasing prevalence of diabetes in Brazil[3]. However, the fact that there was a significant reduction in tobacco use in Brazil in recent years – one of the main risk factors for aortic aneurysms and peripheral artery disease[22] – makes us question if these trends are real or if they occurred due to other factors, such as higher recognition and diagnosis of these causes of death in recent years or potential changes in coding. In the case of aortic aneurysms – a disease with a long period of exposure – the effects of a recent reduction in prevalence of tobacco use might not have been observed yet.

While analyzing differences between sexes, data from this study suggest that the changes in Brazil present the same pattern observed in the rest of the world: as the development level increases, mortality due to CVDs tends to reduce first among women. Therefore, a more expressive reduction in mortality among women, standardized by age, in the northern and northeastern regions, in contrast with the similar reduction among the sexes in the southeast and in the south regions, could suggest that in the north and in the northeast of Brazil there is still a delay in the reduction of mortality rates among men due to reduced development and, consequently, poorer access to health services.

Reduction in mortality due to CVDs has reached a plateau in the last five years suggesting that there is a need to renew the strategies to tackle these diseases. Efforts to establish public health policies have been held worldwide to stimulate the control of risk factors and healthy behaviors, aiming at a reduction of the global burden of NCDs – with emphasis on CVDs – in the upcoming decades. International recommendations have been published, with methodologies and schedules that differ slightly, but have similar final objectives. Since the World Health Assembly in May, 2012, governments of 194 countries agreed on the first global objective regarding NCDs – including the CVDs – and made the commitment of reducing the premature mortality rate (among those aged from 30 to 70 years) by 25%, by 2025[23]. To accomplish this, a global monitoring framework agreed upon 25 indicators combined into three blocks – mortality and morbidity, risk factors, and national systems response – and nine global voluntary targets for the prevention and control of NCDs. As a member of this assembly, the Brazilian government launched the Strategic Action Plan to Tackle NCDs in Brazil, with metrics and challenges in accordance with the plan elaborated by the World Health Organization (WHO)[2,24,25].

In this context, the following strategies implemented by the Ministry of Health in Brazil to tackle the CVDs should be highlighted: the creation of the NCD Surveillance Organization – which aims at learning about the epidemiology of chronic diseases and conditions, in addition to supporting health promoting policies – and the development of the National Policy of Health Promotion – which has prioritized actions in the field of nutritional education, physical activity, and the prevention of tobacco use and alcohol consumption. In addition, the expansion of Primary Health Care in recent years – which serves approximately 60% of the Brazilian population – occurred along with the increased availability of drugs for CVDs, such as antihypertensive and hypoglycemic agents[2,24].

The short time elapsed since the Action Plan introduction in Brazil does not yet allow for assessment of its results. However, even with political and economic difficulties in the recent decades, it can be assumed that CVD mortality data, according to the GBD model, indicate Brazil's progress toward the goals established by the global actions for the reduction of premature mortality due to NCDs.

The limitations of the GBD study models have been previously discussed[10]. Despite the improvement in the completeness of data collection for mortality in Brazil from 1990 to 2015 demonstrated by some studies[26,27], estimates from the GBD 2015 study indicate that the integrity of death counts in Brazil remained around 90%, in the 1990s and 2000s, with a slow improvement in data quality and in the evolution of mortality rates[10]. For some groups of diseases, the models are inadequate to the Brazilian scenario, such as the low mortality for rheumatic heart disease – with decreasing rates, according to the data presented in this study – which differs from current prevalence data in the country[28,29]. There is a proposal to adopt different models for children and schoolchildren in developing countries, where the incidence of rheumatic heart disease among children and teenagers is still high, considering the inadequacy of its notification as an underlying cause of other adverse outcomes – such as valve replacement surgeries[29].

GBD is a robust and broad initiative, from an epidemiologic point of view, for estimating the mortality due to CVDs in the entire Brazilian territory, especially in regions where primary data is scarce. The lack of precision in the model for Brazil does not affect the main results and the large contribution of the GBD approach in tracking mortality risks. The main strength of this study is to demonstrate the consistent reduction in mortality due to CVDs in the country, adjusted by age, despite the observed increase in the absolute mortality rates, possibly related to the changes in the age distribution of the population.

This study is relevant for assessing the results of health promotion actions, in addition to evidencing the challenges involving the elaboration, planning, and adequacy of current public health policies. Regional trends on premature mortality due to some groups of diseases should be carefully analyzed, aiming at the customization of strategies for the realities of the various Brazilian states.

CONCLUSION

GBD 2015 data show a reduction in global mortality due to CVD, standardized by age, in Brazil between 1990 and 2015. This reduction was more pronounced in the states in the southern and southeastern regions, and less significant in the northern and northeastern regions, possibly being influenced by the economic development rates. Despite the reduction in the global mortality rate due to CVD, an increase was observed for age adjusted mortality for some conditions, such as aortic aneurysms, peripheral artery disease, and endocarditis.

Population aging is responsible for the increase in absolute mortality due to CVDs, showing that the country should maintain, or even increase, investments for the prevention, control, and treatment of CVDs.

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