The burden of cardiovascular diseases in Santa Catarina State, Brazil, in 2009

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Abstract

Objective: to estimate the burden of cardiovascular diseases in Santa Catarina State, Brazil. **Methods**: this is an ecological study with the nine health macroregions of the state as units of analysis; the number of years of life lost, the number of years lived with disability and the number disability-adjusted life years (DALYs) for 2009 were estimated. **Results**: a total of 358,777 DALYs were estimated, with a rate of 5,852 DALYs/100,000 inhabitants, 51.1% in males; age groups with the highest rates were 45-59, 60-69, and 70-79 years; diseases that most contributed to the DALYs were ischemic heart diseases and cerebrovascular diseases; health regions with the highest DALYs rates were Planalto Norte, Sul and Serra Catarinense. **Conclusion**: the high burden of cardiovascular diseases in Santa Catarina shows the need to intensify actions of health promotion and prevention in all regions of the state.

Keywords: Cardiovascular Diseases; Disability-Adjusted Life Years; Cost of Illness; Mortality; Ecological Studies.

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Introduction

Cardiovascular diseases represent a major issue, being the leading cause of death in Brazil and accounting for one third of the total of deaths in the country.[1] They contribute significantly for the global burden of diseases, with ascending behavior in developing countries and descending behavior in developed countries.[2] Countries such as Ukraine with 33.9% and Russia with 31.2% presented the highest percentages for this diseases, in 2013.[2] In Brazil, the percentage increased from 11.9% in 1990 to 14.5% in 2003.[2]

The mortality burden related to cardiovascular diseases increased around 41% in the period from 1990 to 2013, although it has decreased 39% in specific age groups.[3]

Among cardiovascular diseases, ischemic heart diseases and cerebrovascular diseases constitute the subgroups which contribute the most to the global burden of diseases.[2] In the 2008 Brazilian study on Global Burden of Diseases, cardiovascular diseases accounted for the first (7.2%) and fourth place (4.4%) among males, and second (6.4%) and fourth (4.8%) place among females.[4]

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The estimation of the burden of disease, composed by indicators of early mortality and morbidity, reveals priorities in health prevention and offers subsidies for the conception of public policies. The Disability-Adjusted Life Years (DALYs) indicator, which was idealized by Murray,[5] has been used worldwide in the studies on Global Burden of Disease in 1990,[2] 2010[6] and 2013.[7]

In Brazil, the global burden was estimated in 1998[8] and updated in 2008.[4] The state of Minas Gerais had its global burden estimated in 2011.[9] Studies for some disease groups were conducted in the state of Santa Catarina, at state[10-15] and municipal levels.[16-18] It is important to highlight the importance of monitoring burden indicators, not only to guide new actions but also to ratify the ones already under way. Up to the conclusion of this article, there was no knowledge of Brazilian studies that have assessed the burden of cardiovascular diseases at a local level. The objective of this study was to estimate the burden of cardiovascular diseases in Santa Catarina State, Brazil.

Methods

An ecological study was carried out based on the records of individuals resident in Santa Catarina that were hospitalized or received treatment in hospitals from the Brazilian National Health System (SUS) for cardiovascular diseases or who died for that same reason in 2009.

We used information on the resident population estimated for that year, by sex and age group, in the state as a whole and in its nine health macroregions: *Sul*, *Grande Florianópolis*, *Nordeste*, *Planalto Norte*, *Serra Catarinense*, *Foz do Rio Itajaí*, *Vale do Itajaí*, *Meio Oeste* and *Grande Oeste*. The variable "age" was divided into nine age groups, in years: under 1, 1-4, 5-14, 15-29, 30-44, 45-59, 6-69, 70-79 and 80 or over.

The data on mortality due to cardiovascular diseases were obtained from the Mortality Information System (SIM) database, available at the website of SUS IT Department (Datasus): www.datasus.gov.br (access on March 10th, 2011). The deaths with unknown age or sex were redistributed proportionally.

The data used were from patients who received treatment or were hospitalized because of cardiovascular diseases and were obtained from the Hospital Admission Authorization (AIH-SUS) of SUS Hospital Information System (SIH/SUS), provided by Datasus. The records of hospitalizations and/or treatments of the same patient, in case there was more than one hospitalization, were excluded from the database, keeping only the first.

All the cases whose codes of the 10th Revision of the International Classification of Diseases and Related Health Problems (ICD-10) did not correspond to rheumatic heart diseases (I01-I09), ischemic heart diseases (I20-I25), cerebrovascular diseases (I60-I69), inflammatory heart diseases (I30-I33, I38, I40, I42), hypertensive heart diseases (I10-I13), pulmonary embolism (I26) and aortic aneurysm and dissection (I71) were included into a category named "residual". However, the codes relating to unspecified diseases/symptoms (I47-I51 and I70), named "garbage-codes", were redistributed proportionally among the other types of cardiovascular diseases, according to the correction proposal used in

the Study on Global Burden of Diseases in Brazil,[8] which, in turn, was based on the Study on Burden of Disease in Australia.[19] In short, the code I50 (heart failure) was redistributed in different proportions, according to age groups, among ischemic heart diseases, inflammatory heart diseases and hypertensive heart disease. The same was done with the other codes relating to unspecified diseases/symptoms, however, they were placed into the group of ischemic heart diseases and into the group of other heart diseases.

The number of Years of Life Lost (YLLs) due to premature death was estimated by subtracting the age at death from the standardized life expectancy. In this study, we used the same parameters for the studies on global burden of diseases[2] and the estimate of the burden of disease in Brasil[8] in its 2008 revision,[4] i.e., life expectancy at birth of 80 years for males and 82.5 years for females. These values are standardized to allow international comparability between the results of studies which used the same parameters (the study on global burden of diseases carried out in 2015 uses different parameters). To calculate the YLLs, the data from SIM was classified by type of cardiovascular disease according to ICD-10 (Table 1).

A discount rate of 3% was applied for each year of life lost in the future to calculate the YLLs.[4,8] Therefore, the future years suffer the effect of the discount rate, so that each year of healthy life lost was counted as 97% of the previous one and so on.

The number of Years Lived with Disability (YLDs) was estimated by multiplying the weight of the disease/sequelae by its length of time. For the cases of pulmonary embolism and diseases classified as of rheumatic, bacterial or viral acute behavior, the length of time considered was the hospitalization period. For the remaining cases, the length of time was considered permanent, calculated by subtracting the individual's age when hospitalized from the standardized life expectancy.[4,8]

The disability weights recommended by the World Health Organization (WHO)[20] for the several cardiovascular diseases were used (Table 1).

The Disability-Adjusted Life Years – DALYs – were calculated by adding the YLLs to the YLDs.

All the data were inserted in Excel worksheets and then were exported to the Statistical Package for the software Social Sciences (SPSS) version 18.0, through which it was analyzed. The YLLs, YLDs and DALYs rates were calculated per 100,000 inhabitants, taking into account the resident population of the state and its health macroregions in the year studied, and later standardized through the direct method, with the population of Santa Catarina State in 2010 as the standard population.

The study respected the guidelines established by the Resolution of the National Health Council (CNS) No. 466, dated December 12th 2012, and used data from official health information systems, of public domain, so the project was exempted from appreciation by an Ethics Research Committee.

Results

A total of 9,597 deaths (SIM) and 45,320 cases of hospitalization (SIH/SUS) due to cardiovascular diseases were registered in Santa Catarina, in 2009. Out of this total, 13,763 cases (30.3%) were redistributed for being cases with unspecified codes.

We estimated 358,777.5 DALYs, which generated a rate of 5,852.5 DALYs/100,000 inhabitants, among which 51.1% were males and 48.9% females (Table 2).

The age groups that presented the highest rates were 60-69 (22,083.5 DALYs/100,000 inhabitants), 70-79 (19,861.2 DALYs/100,000 inhabitants) and 45-59 years (13,391.8 DALYs/100,000 inhabitants) (Figure 1). The diseases that contributed the most to DALYs were ischemic heart diseases (36.5%), cerebrovascular diseases (32.7%) and hypertensive heart disease (7.8%) (Figure 2).

Santa Catarina health macroregions with the highest global rates of DALYs were *Planalto Norte* (9,238.8 DALYs/100,000 inhabitants), *Sul* (7,563.7 DALYs/100,000 inhabitants) and *Serra Catarinense* (6,437.7 DALYs/100,000 inhabitants). It should be highlighted that *Planalto Norte* presented the highest rates in six out of the seven diseases studied; the exception was the hypertensive heart disease, for which the highest rate was observed in the health macroregion *Sul* (Figure 3).

Discussion

This study showed high burden of cardiovascular diseases in the entire state of Santa Catarina, in 2009. This corroborates to the behavior of these diseases, identified at national and global levels, as demonstrated in the studies on Global Burden of Disease in 1990, 2010, 2013,[2] in which ischemic heart diseases and

Table 1 – Distribution of cases of death and hospitalization for group of cardiovascular diseases and disability weights in Santa Catarina state, 2009

Cardiovascular diseases (ICD-10) [a]	Deaths	Hospitalizations	Disability weights [b]
Rheumatic heart diseases (I01-I09)	143	788	0.25
Ischemic heart diseases (I20-I25)	3,970	17,741	0.44
Cerebrovascular diseases (I60-I69)	2,776	5,859	0.92
Inflammatory heart diseases (I30-I33, I38, I40, I42)	545	1,277	0.25
Hypertensive heart disease (I10-I13)	1349	5,087	0.25
Pulmonary embolism (I26)	197	242	0.12
Aneurysm and aortic dissection (I71)	7,205	351	0.44
Other codes	412	13,975	0.12
Total	**9,597**	**45,320**	**–**

a) Codes of the International Statistical Classification of Diseases and Related Health - 10th Revision (ICD-10)
b) Source: World Health Organization, Global Burden of Disease 2004 update: disability weights for diseases and conditions. WHO: Geneva, 2004.[20]

Table 2 – Disability-Adjusted Life Years, rates (per 100,000 inhabitants) and percentage (%) of burden of desease, according to sex and group of cardiovascular diseases, in Santa Catarina state, 2009

Female				Male			
Cardiovascular diseases	DALYs [a]	Rate/100,000 inhabitants	% of burden	Cardiovascular diseases	DALYs [a]	Rate/100,000 inhabitants	% of burden
Cerebrovascular diseases	57,062.8	1,874.2	32.5	Coronary artery diseases	75,459.3	2,508.6	41.1
Coronary artery diseases	55,539.2	1,824.2	31.7	Cerebrovascular diseases	59,403.4	1,974.9	32.4
Hypertensive heart disease	15,980.5	524.9	9.1	Hypertensive heart disease	11,886.6	395.2	6.5
Inflammatory heart diseases	7,298.0	239.7	4.2	Inflammatory heart diseases	6,969.2	231.7	3.8
Rheumatic heart diseases	5,047.2	165.8	2.9	Rheumatic heart diseases	5,144.7	171.0	2.8
Aneurysm and aortic dissection	1,358.6	44.6	0.8	Aneurysm and aortic dissection	3,105.8	103.3	1.7
Pulmonary embolism	1,050.5	34.5	0.6	Pulmonary embolism	1,008.8	33.5	0.5
Subtotal	**143,336.8**	**4,707.9**	**100.0**	**Subtotal**	**162,977.8**	**5,418.2**	**100.0**
Residual (other codes)	32,019.1	679.7	–	**Residual (other codes)**	20,443.7	1,051.7	–
Total	175,355.9	5,759.6	–	**Total**	183,421.6	6,097.8	–

a) DALYs: Disability-Adjusted Life Years

cerebrovascular diseases corresponded to the fourth and sixth global causes for DALYs in Brazil, representing 5.7% and 4.1% of the total of DALYs, respectively, in 1990. In 2010, these diseases had already risen up the ranking to the first and fourth positions, with 6.5% and 4.7% of the total of DALYs, respectively.[21] Data from 2013 confirmed the position of both diseases in the ranking, whilst the contribution of ischemic heart diseases rose to 6.8%.[22] The reduction of 14% in ischemic heart diseases and 8% in cerebrovascular accidents, from 1990 to 2013, is noteworthy.[22]

The estimation of the burden of cardiovascular diseases at a local level is not common in Brazil. Thus, their behavior is unknown, both among the 27 federative units and within each one of them. Thus, the calculation of DALYs in Santa Catarina's health macroregions provides to health services, managers and technicians, a set of information on early deaths and disabilities caused by cardiovascular diseases. The present study demonstrates regional differences in the behavior of the indicator, showing that although the burden is high in the state as a whole, there are
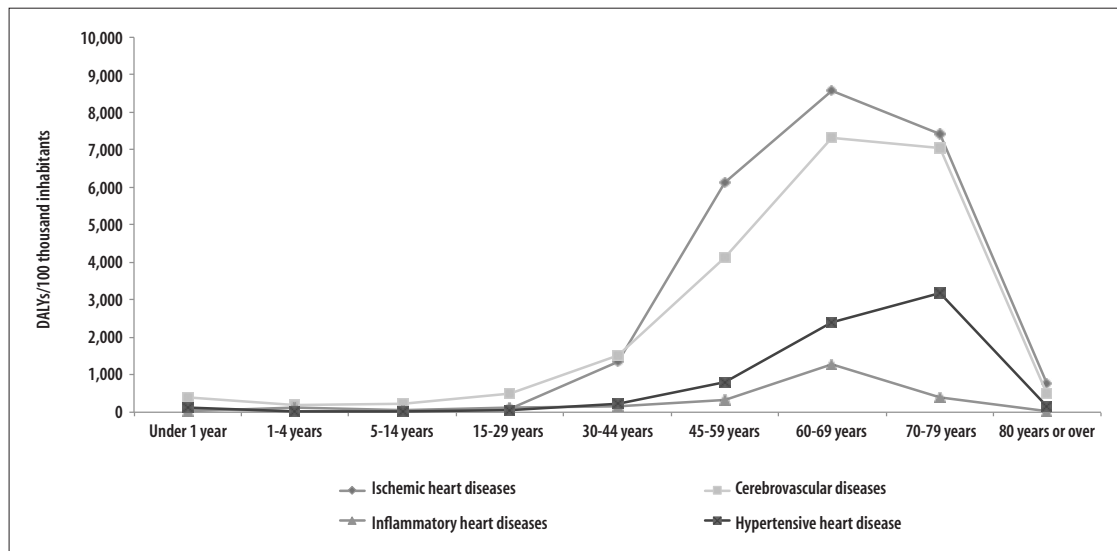
Figure 1 – Rates (per 100,000 inhabitants) of disability-adjusted life years, according to group of cardiovascular diseases with highest burdens and age groups, in Santa Catarina state, 2009
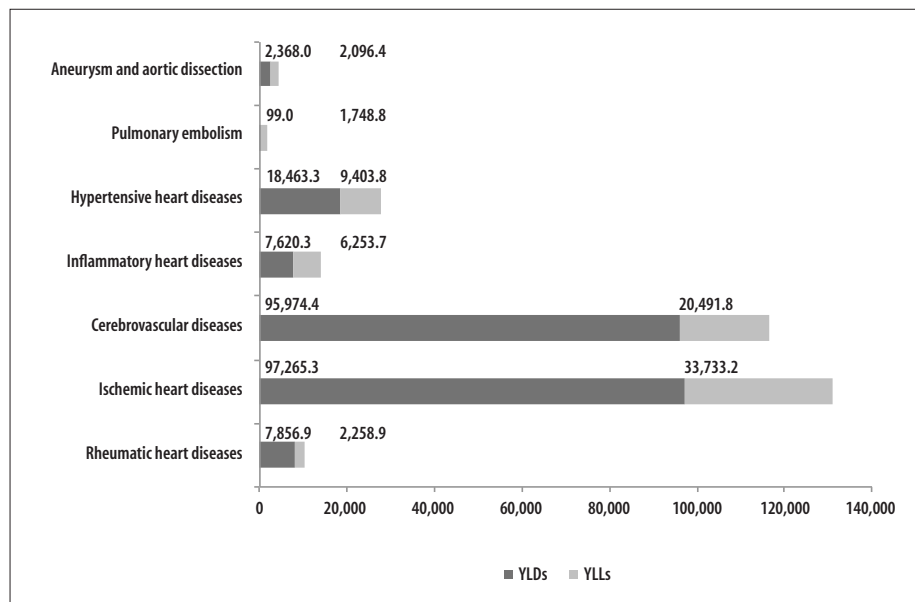

Figure 2 – Distribution of disability-adjusted life years and its components: years of life lost (YLLs) and years lived with disability (YLDs), according to cardiovascular diseases, in Santa Catarina state, 2009

regions that show higher burden, such as *Planalto Norte*, where six of the seven diseases studied had the highest rates in the state. In turn, the *Sul* region of Santa Catarina showed the highest burden attributed to hypertensive heart disease, revealing differences in health conditions among the state's macroregions; possibly, such differences are not sufficiently sensitive to being detected by other indicators used in epidemiological

studies on cardiovascular diseases. The results presented here reflect the need to develop researches with adequate research designs to point out the reasons for higher burden of cardiovascular diseases in certain regions of Santa Catarina state.

Non-communicable chronic diseases, especially cardiovascular diseases, are the highest priority in Brazil's Public Health system. The prevalence of diabetes
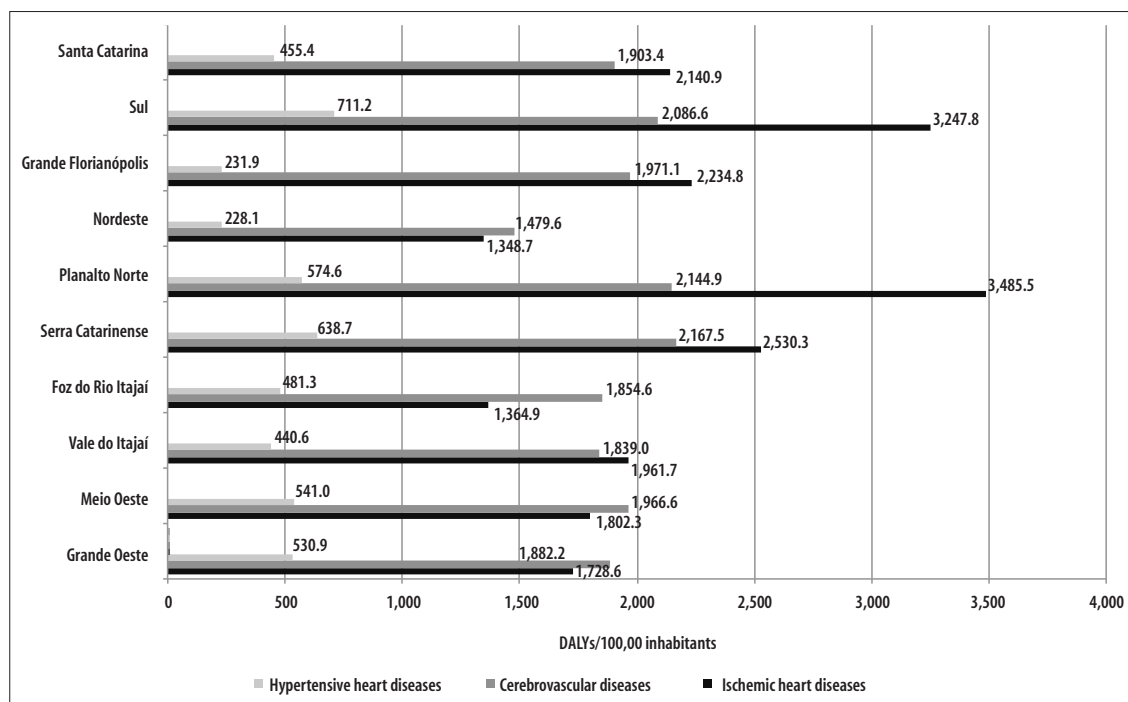
Figure 3 – Distribution of disability-adjusted life years rates (DALYs/100), according to cardiovascular diseases and health macroregions, in Santa Catarina state, 2009

and systemic arterial hypertension arise alongside overweight, and are associated with sedentary lifestyle. Data on the global burden of disease in 2013 pointed that the biggest risk factors for the increase of DALYs were dietary aspects, systemic arterial hypertension and high body mass index (BMI).[21-22] Adequate treatment for systemic arterial hypertension is well established as a factor for the reduction of cardiovascular diseases.[23]

Despite the efforts in the implementation of public health policies for the prevention and treatment of non-communicable chronic diseases, the reduction of mortality attributed to them has only varied from 1 to 8% a year.[24]

To reduce the burden of non-communicable chronic diseases in Brazil, an intervention with six high priority points was settled: (i) systemic arterial hypertension control, (ii) screening of patients for systemic arterial hypertension, (iii) tackling sedentary lifestyles, (iv) controlling hypercholesterolemia, (v) cessation of smoking and (vi) alcoholism. Tackling obesity and overweight was also pointed out as an intermediate priority.[25]

A very common disease, for which an approach in primary health care is equally necessary, is the systemic arterial hypertension,[23] which can be early detected

and treated adequately to avoid the development of acute myocardial infarction, cerebrovascular accident, heart failure, renal insufficiency and death.[23] The guideline adopted by the United States of America in the treatment of systemic arterial hypertension presents the following recommendations for its management in adults: for the low-risk population under 60 years old, keeping arterial pressure below 150/90mmHg; and for the high-risk population, keeping arterial pressure below 140/90mmHg. The authors reinforce the need to correlate the guideline with cardiovascular risk recommendations, for the achievement of a general and uniform prevention strategy.[23]

The European Society of Hypertension, in its guideline updated in 2013, presents more simplified recommendations, according to which every individual should keep their arterial pressure below 140/90mmHg; however, it presents specific objectives and targets for lifestyle changes, such as limiting salt intake from 5 to 6 g a day and keeping BMI below 25kg/m^2.[26]

Physiopathology's knowledge on cardiovascular disease makes it clear that the benefits of cardiovascular prevention are accessible in a long-term; as for the obstacles to lifestyle changes, those are current challenges

to be overcome. Education and information in health are a priority, since patients with knowledge on their disease and precise information on its management tend to have better adherence to treatment.[27]

Although the present study has detected high burden of cardiovascular diseases in Santa Catarina, it is important to point out that it used relatively old (2009) secondary data, which are susceptible to problems such as the possible under-registration of cases. That is a restriction of unknown effects, so the interpretation of the results presented in this study should be done with caution. Other limitations of this study that may interfere in the results and conclusions of the research should be considered as well. For instance, the non-inclusion of data from hospitals not funded by SUS may have underestimated the burden of disability found. In turn, the incapacity to distinguish individuals who left the hospital without sequelae may have overestimated the burden. Finally, the different proportions of the population that uses SUS, reported by the several health macroregions, may – eventually – change its position in the ranking of the state's burden of disease.

Although the recommended methodological procedure for studies on burden of disease was used, the significant

percentage of cases with unspecified codes and with unknown age and sex is worrisome. This finding calls for a reflection on the need for more attention when filling out documents and monitoring records, so that more accurate and reliable information sources may be found. The percentage of cases with unspecified codes also implies caution when reading the results by disease.

We can conclude that the burden of cardiovascular diseases in Santa Catarina is high, and health managers should intensify actions of health promotion and prevention for these diseases in all regions of the state.

Authors' contributions

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