Cardiovascular Mortality and its Relation to Socioeconomic Levels among Inhabitants of São José do Rio Preto, São Paulo State, Brazil

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Summary

Objective: To analyze cardiovascular mortality indicators in São José do Rio Preto – a city in the State of São Paulo, Brazil – and to evaluate the municipality's mortality rates by socioeconomic levels.

Methods: Data used came from the Mortality Information System and from the Information and Computing Department of the federal government's Unified Health System (SUS). Standardized mortality rates and proportional cardiovascular mortality rates were calculated. A thematic map of the demographic census sectors of the city's urban area – grouped according to socioeconomic levels – was drawn up and is presented with the respective rates.

Results: The municipal, state, and national mortality rates decreased in the course of the 1980-2002 period. The municipal mortality rate in 2003 stood at 195.9 deaths per 100,000 inhabitants, with proportional cardiovascular mortality at 31.3%. The three main causes of death were cerebrovascular disease, myocardial infarction, and hypertensive disease. The mortality rate for the population corresponding to the group featuring the lowest socioeconomic levels was 40% higher than that of the group comprising the highest socioeconomic levels.

Conclusão: The cardiovascular mortality rate decreased in the three geographical areas analyzed. This group of diseases was responsible for approximately one-third of all deaths in São José do Rio Preto in 2003. The area with the lowest socioeconomic level presented the highest mortality rate.

Palavras-chave: Cardiovascular diseases / mortality / economy / ethnology.

Introduction

Cardiovascular diseases are the top ranking cause of death in Brazil. They account for nearly one-third of all deaths and 65% of deaths in the 30-69 year age bracket, directly affecting the adult population in its fully productive phase[1-3]. Within the realm of the federal government's Unified Health System (SUS), in 2002 cardiovascular diseases were responsible for more than 1.2 million cases of hospitalization (10.3% of all admissions), and 17% of the system's financial outlays[4].

The assistential logic for promoting health and preventing disease is based on knowledge of which diseases require priority treatment for the health of a certain population occupying a specific geographic space[5]. It is therefore important to become acquainted with and analyze the epidemiologic reality of cardiovascular diseases in order to gauge the size of the problem and characterize it in terms of time, space, and attributes of the people.

Temporal analysis, study of the distribution of a certain disease over time which, when it involves long periods is known as a secular trend, is an important public health strategy that has made it possible to follow up on diseases over time and to create normative horizons, i.e., the establishment of desirable health situations[6]. Spatial analysis is an important tool in health management that makes it possible to establish relations between a specific illness and the environment, provides subsidies for the establishment of control measures, and makes it possible to plan interventions in areas and populations more exposed to risk[7,8]. Analysis related to the characteristics of the people allows, for example, to identify risk differences among age brackets and sexes

Thus, the objectives of this study targeting cardiovascular diseases are to analyze the historic series of its mortality coefficients in São José do Rio Preto from 1980 to 2002 and compare them to those of the State of São Paulo and of Brazil; to analyze its mortality indicators for the municipality for 2003, and to evaluate the geographic distribution of its mortality coefficients in areas with different socioeconomic levels within the municipality for 2002 and 2003.

Methods

The study was carried out for São José do Rio Preto, a city located in the Northeast region of the State of São Paulo.

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In 2005 the city's population totaled 406,827 inhabitants[1]. Data on deaths was obtained from the Mortality Information System (SIM) of the São José do Rio Preto Municipal Health and Hygiene Department and from the Health Ministry's Unified Health System (DATASUS) Information Technology and Data Department. DATASUS[1] also provided population data of the locations surveyed for the various years studied. Data related to the 432 census sectors of the urban area of São José do Rio Preto were provided by the Brazilian Institute of Geography and Statistics (IBGE)[9], which defines them as continuous and homogeneous areas comprising approximately 300 buildings each.

Cardiovascular mortality coefficients (number of cardiovascular deaths per 100,000 inhabitants) between 1980 and 2002 were calculated for the municipality of São José do Rio Preto, the State of São Paulo, and for Brazil. These coefficients were standardized by the population of São José do Rio Preto reported in 2003. Total cardiovascular mortality coefficients for São José do Rio Preto in 2003 were calculated by sex, age bracket and specific cause of death, and proportional mortality.

Cardiovascular deaths in 2002 and 2003 in the urban area of the municipality were geoprocessed using tools of the MapInfo 7.0 program[10], and vector maps with street axes provided by the local government. Geoprocessing is a set of techniques used for collection, treatment, and exhibition of georeferenced data that makes it possible to identify variables that reveal which social, economic, and environmental structures may offer health risks[7,8].

The above-mentioned deaths were grouped according to the 432 census sectors, and the socioeconomic level of the sectors was based on income level and years of schooling of the woman responsible for the household, the proportion of illiterate persons and illiterate women, and the proportion of homes housing five or more dwellers. These variables were analyzed by the STATA[11] program using the principal component analysis statistical technique that produces factors unrelated to one another and that represent significant aspects characterized by correlations among the variables[12].

The factor chosen among the various obtained was that responsible for the greatest proportion of total variation, which was identified as the socioeconomic factor. This factor characterized the census sectors according to their socioeconomic level so that the higher the value, the better the socioeconomic level of the inhabitants of a certain census sector of the municipality. The 432 sectors were classified by the respective values of the socioeconomic factor and grouped into quartiles. The group of sectors corresponding to the first quartile was classified as socioeconomic level I (lowest), those of the second and third quartiles as socioeconomic levels II and III (average), and those of the fourth quartile as socioeconomic level IV (highest). The mortality coefficients were calculated for the two-year period (2002 and 2003), and according to the various areas analyzed and standardized for the total population of São José do Rio Preto in 2003.

Results

Figure 1 shows the historic series of cardiovascular mortality coefficients (CMC) for São José do Rio Preto, State of São Paulo, Brazil between 1980 and 2002, featuring a large decrease in its values. During this period, the CMC was down 39.1% for São José do Rio Preto, 45.3%f or the State of São Paulo, and 34.1% for Brazil as a whole. São José do Rio Preto consistently showed CMC levels lower than those registered for the State of São Paulo, but higher than those for Brazil as a whole in the initial years of the historic series. As of 1985, fluctuation of the levels for São José do Rio Preto began to accompany more closely the levels registered for Brazil as a whole.

In 2003, proportional cardiovascular mortality, taking into account only defined cases, amounted to 31.7%, and the cardiovascular mortality coefficient came to 195.9 deaths per 100,000 inhabitants. The mortality coefficients by sex were 225.4 deaths per 100,000 inhabitants for males, and 168.3 deaths per 100,000 inhabitants for females – a mortality coefficient 33.9% greater among male inhabitants. For 2003, the three main causes of death in this group were: a) cerebrovascular disease; b) acute myocardial infarction; and c) hypertensive disease. The first of these (cerebrovascular disease) registered an overall coefficient of 53.6 deaths per 100,000 inhabitants, while males registered 57.3 and females 50.2 deaths per 100,000 inhabitants. The overall coefficient for acute myocardial infarction was 48.4 deaths per 100,000 inhabitants – 59.5 among males and 38.1 among females. The overall coefficient for hypertensive disease was 11.8 per 100,000 inhabitants – 10.3 for males and 13.2 for females.

Figures 2, 3, and 4 show the mortality coefficients by age bracket and sex due to these three causes for the year of 2003. As far as age brackets are concerned, we see that the mortality coefficients for these three diseases increased greatly as of 50 years of age. For cerebrovascular disease and acute myocardial infarction, the coefficients were always greater among men, and in the case of hypertensive disease there was an inversion as of 70 years of age when the levels are higher among women.

The socioeconomic factor, identified in analysis of the principle components, was responsible for 87% of the total variation and corresponds to a score that was calculated for each of the census sectors using the following formula: 0.97 x (average years of schooling of the heads of households) + 0.94 x (average number of years of schooling of female heads of households) + 0.85 x (average income of heads of households) + 0.85 x (average income of female heads of households) + (-)0,56 x (proportion of illiterate persons) + (-)0.89 x (proportion of illiterate women) + (-)0.56 x (proportion of households with five or more dwellers). Table 1 shows the characterization of each of the four groupings of census sectors obtained based on the socioeconomic factor.

The CMC levels obtained according to socioeconomic levels for 2002 and 2003 are shown in Figure 5. We found a 40% greater cardiovascular mortality coefficient in the area corresponding to sectors with the lowest socioeconomic levels (I) as compared to the highest levels (IV). Mortality rates were similar to one another in the groupings corresponding to levels II, III, and IV.

Table 2 draws CMC comparisons by age brackets and

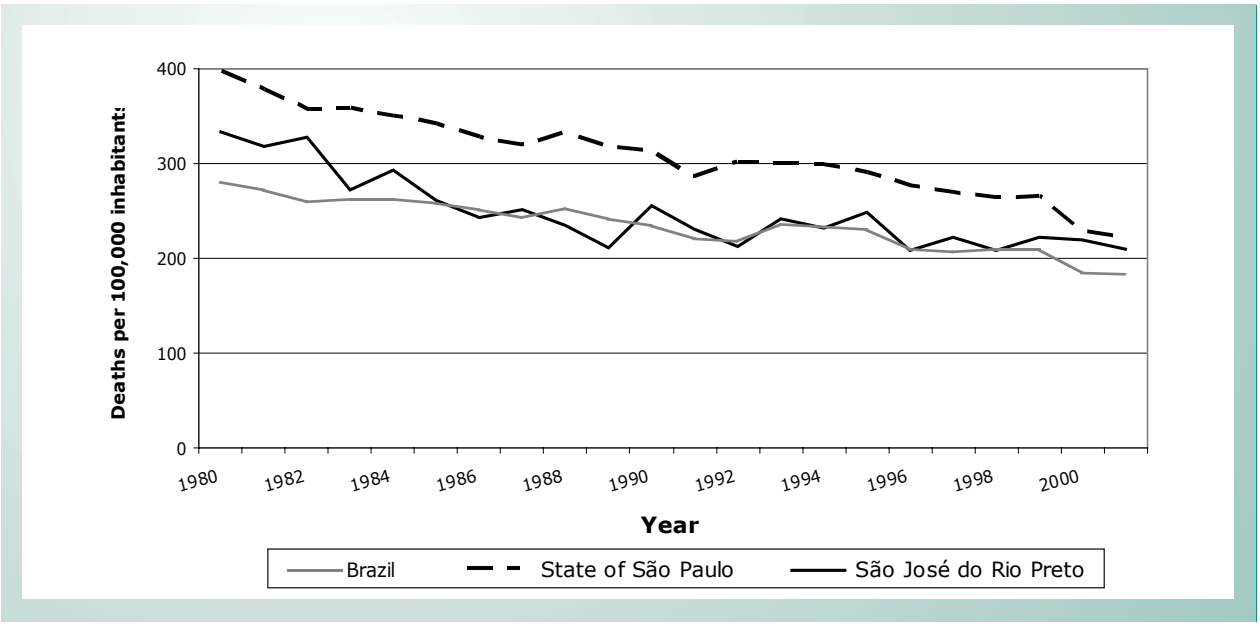

Fig. 1 - *Historic series of standardized cardiovascular mortality, São José do Rio Preto, State of São Paulo, and Brazil, 1980 - 2002.*

socioeconomic levels. The greater coefficient for level I is explained by the greater coefficients presented according to the various age brackets in this class, especially as of 40 years of age. It is important to note that the non-standardized values were found to be inverse to the standardized values – a reflection of the age structures of the populations of each of the groupings analyzed. While in the 2002-2003 period only 14% of the people in the level I grouping were 50 or older, in the level IV grouping, 25% were in this age bracket.

Discussion

The objectives of this research project were achieved by the use of three basic forms of descriptive epidemiological analysis, i.e., time, space, and people, each with specific characteristics and findings. One point to be highlighted is that this study was produced based only on data made available by SIM, DATASUS[1], and IBGE[9], which, according to Lotufo[13], are sufficient to carry out wide-ranging epidemiological and health planning studies.

The decrease in cardiovascular mortality coefficients identified in this study for the 1980 to 2002 period coincides with the findings obtained by Lotufo and Lolio[14] for the State of São Paulo, which analyzed the secular trend of CMCs from 1970 to 1992, and identified decreases in the mortality rates amounting to 33.6% among men, and 40.0% among women and raised – as an explanatory hypothesis – the increased consumption of polyunsaturated fats, decreased consumption of cholesterol, and decreased prevalence of the smoking habit. A study carried out by the Health Ministry[3] evaluating the tendency of cardiovascular mortality coefficients from 1980 to 2001 identified a decrease in most regions for both sexes and age brackets.

When analyzing the health and mortality profiles in Brazil, Simões[15] found that the number of years of lost life associated to cardiovascular disease has diminished and that this fact has reflected on an increase in life expectancy for Brazilians even though the greater part of that increase is due to the drop in infant mortality. The author points out that although cardiovascular diseases rank first among causes of death in the 60 or older age bracket, they are declining due to the relative improvement in socioeconomic conditions and the advance of new medical technology procedures, especially in the more highly developed areas of the country.

The proportional cardiovascular mortality in São José do Rio Preto was quite close to the values obtained in 2002 for Brazil (31.5%), for the southeast region (32.4%), and for the State of São Paulo (31.9%), taking into account only the defined causes[2]. The higher levels of the mortality coefficient for men as compared to women, and its increase as of 50 years of age for both sexes for this group of diseases in the municipality coincide with the behavior of these indicators for the country as a whole[3]. Finding cerebrovascular disease and acute myocardial infarction among the main causes of death in the group of cardiovascular diseases in the municipality coincides with results for the country and for the southeast region[1].

The finding of a higher cardiovascular mortality coefficient in the area with the lowest socioeconomic levels can be assessed from two different angles: that of individual risk and that of environmental risk. The fact that these socioeconomic levels were established based mainly on income and schooling seems to indicate that they are individual cardiovascular mortality risk factors. On the other hand, the environmental risk factor of living in an area that features less health and education infrastructure must also be taken into consideration.

An Indian study detected a similar association: cardiovascular diseases were found to be associated with social conditions and their prevalence seemed to be strongly related to the society's social and cultural conditions[16]. A study carried out in Botucatu in the State of São Paulo concluded that socioeconomic

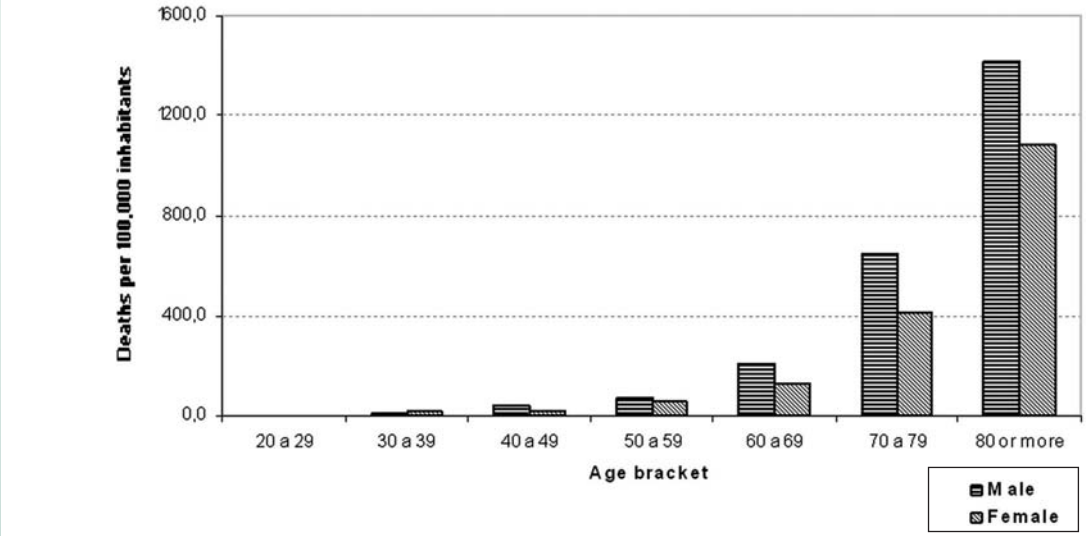

Fig. 2 - *Coeficientes de mortalidade por doença cerebrovascular segundo faixa etária e sexo, São José do Rio Preto, 2003.*

Variables	Census-Sector Groupings			
	I	II	III	IV
Average years of schooling of heads of households	5.3	6.5	7.9	10.8
Average years of schooling of female heads of households	4.6	5.8	7.2	10.0
Average income (in Reais*) of heads of households	465.20	690.03	1046.99	2401.42
Average income (in Reais*) of female heads of households	298.50	453.60	687.20	1510.40
Proportion of illiterate individuals over 5 years of age (%)	11.3	8.1	5.8	3.2
Proportion of illiterate females over 5 years of age (%)	12.4	9.2	6.6	3.6
Proportion of households with 5 or more dwellers (%)	23.5	17.2	15.5	13.7

** Values for September 2000.*

Table 1 - Socioeconomic characteristics of the four census sector groupings, São José do Rio Preto, 2000

indicators should be considered in the selection of risk groups for participation in prevention programs aimed to reduce mortality due to cardiovascular diseases[17].

Silva[18] points to the tendency toward higher rates of illness and mortality from potentially preventable diseases in the population characterized by low income and scant schooling – therefore with less access to the benefits of prevention and treatment. This tendency is confirmed by studies carried out by the World Health Organization that have shown that developing countries – places featuring the worst socioeconomic levels – concentrate a large portion of the burden of cardiovascular diseases[19].

Some studies carried out in Brazil have investigated this issue and seemed to confirm the above-mentioned hypothesis. A survey carried out in Salvador (State of Bahia) showed a large proportion of multiple cardiovascular risk factors and that these factors occur more frequently among those with scant schooling, and among the African-Brazilian population[20]. A survey carried out in Bambuí (State of Minas Gerais) found association between less than four years of schooling and a worse cardiovascular risk profile in adults[21]. Molina et al[22] showed, in Vitória (State of Espirito Santo), that the consumption of salt was greater among individuals of lower socioeconomic levels and that this fact may explain, at least in part, the greater prevalence of arterial hypertension in these populations.

Based on the results of this study and of the others mentioned above, it is reasonable to declare that the less privileged population must also present a greater prevalence of risk factors already established and considered changeable (dyslipidemia, arterial hypertension, diabetes mellitus, smoking, obesity, sedentariness, and stress), since the unchangeable factors have shown no correlation with individuals' social or economic situation.

Age (years)	Socioeconomic level							
	I		II		III		IV	
	% of inhab.	CI	% of inhab	CI	% of inhab.	CI	% of inhab	CI
0 – 9	18.3	0	14.3	0	12.5	0	10.7	13
10 – 19	19.2	5	17.6	6	16.9	7	16.7	16
20 – 29	18.7	0	18.0	12	17.3	0	16.8	24
30 – 39	17.4	68	16.5	13	16.4	58	16.0	51
40 – 49	12.1	245	14.0	240	14.3	158	15.2	106
50 – 59	7.2	634	9.2	569	10.0	332	10.6	470
60 – 69	4.3	1857	6.0	1321	7.0	1329	7.6	1369
70 – 79	2.0	5548	3.2	2842	4.0	3407	4.6	3327
80 or +	0.7	11188	1.2	10114	1.5	10026	1.9	9483
CI non-standardized		355		382		450		517
Total standardized*		541		392		383		387

** Standardized for the total population of São José do Rio Preto in 2003.*

Table 2 - Cardiovascular mortality coefficients for 2002 and 2003 (CI), and age-bracket distribution of the population by socioeconomic levels in the urban area of São José do Rio Preto

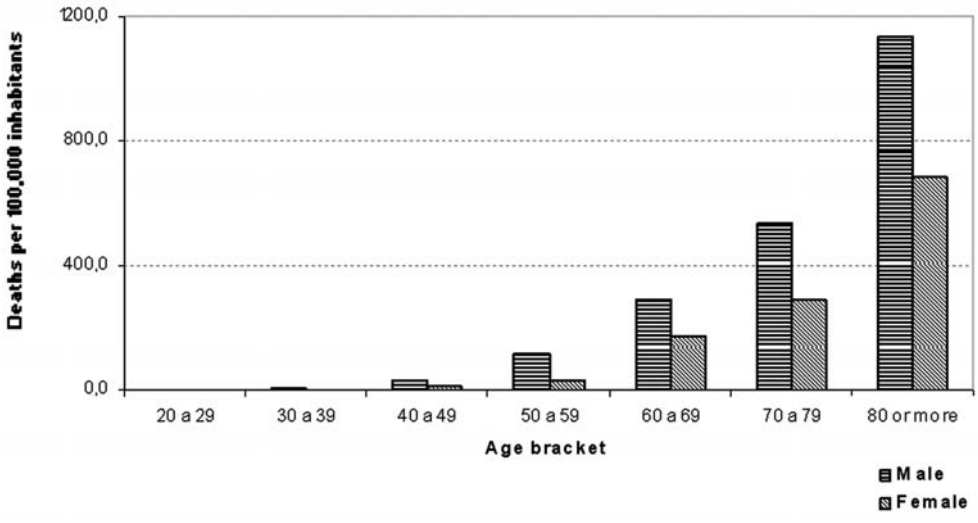

Fig. 3 - *Myocardial infarction mortality coefficients by age bracket and sex, São José do Rio Preto, 2003.*

This study is based on secondary data and therefore has limitations stemming from problems related to the filling out of death certificates. The main problems relate to the basic cause of death: poorly defined causes or incorrect reporting. Examples of this include the need to calculate proportional mortalities taking into account only the cause defined and the fact that DATASUS lists hypertensive disease among the cardiovascular diseases, but hypertensive disease includes essential arterial hypertension, hypertensive heart disease, hypertensive renal disease, and secondary hypertension[1].

It is important to note the fact that arterial hypertension appears in DATASUS as a cause of cardiovascular death, contrary to what is seen in medical literature where it is described as a cardiovascular risk factor, be it in the form of ischemic disease, heart failure, or cerebrovascular disease[23,24]. The manner in which death certificates have been filled out or how the causes of death have been grouped in DATASUS may be inappropriate, a fact that may lead to prejudice of the statistical analysis of cardiovascular deaths.

To finalize, this study for the municipality of São José do Rio Preto showed that the cardiovascular mortality coefficient has decreased over time, presents high levels in the over-50

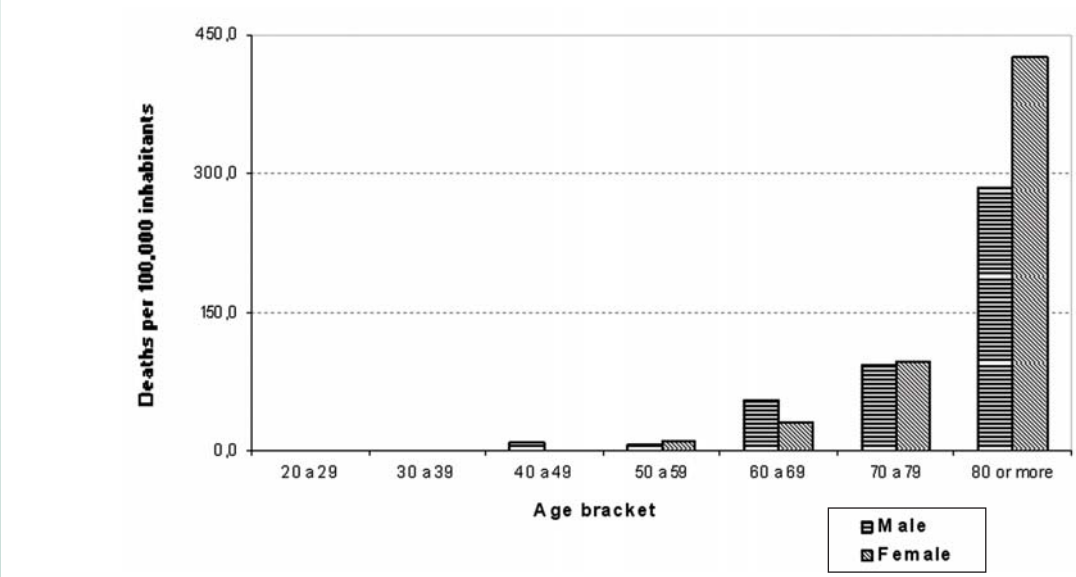

Fig. 4 - *Hypertensive disease mortality coefficients by age bracket and sex, São José do Rio Preto, 2003.*

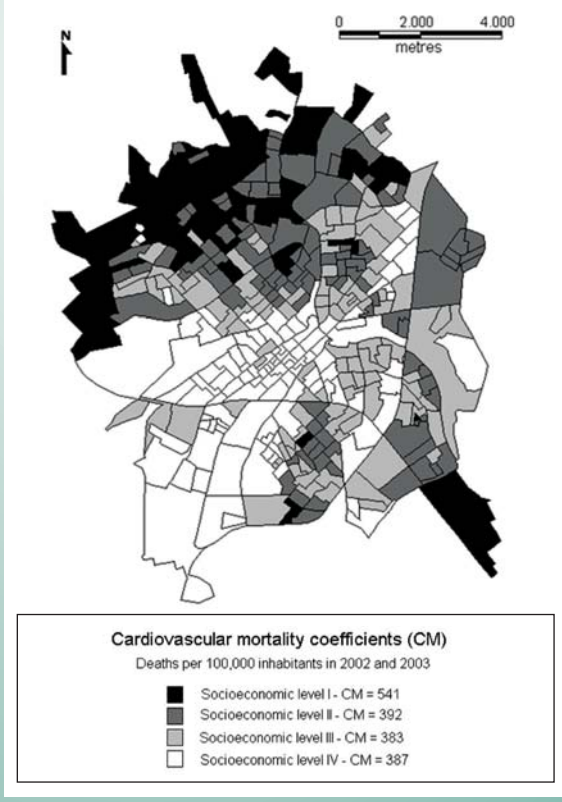

Fig. 5 - *Standardized cardiovascular mortality coefficients by socioeconomic levels, São José do Rio Preto, 2002 and 2003.*

age bracket, and is greater for those living in areas featuring the worst socioeconomic levels. Although the first conclusion can be considered good news, the second implies that health policies aimed specifically at these diseases should be implemented in this age group as a means of continuously increasing their life expectancy and improving their quality of life[15]. The last conclusion shows the potential of geoprocessing as an important tool for epidemiological analysis. Thus, the planning of specific actions for the control of cardiovascular diseases cannot be idealized for the whole of the municipality seen as an indivisible unit. On the contrary, the areas of highest risk – coincidentally those featuring the worst socioeconomic levels – must be prioritized.

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Potential Conflict of Interest

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

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