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Premature mortality from chronic non-communicable diseases according to social vulnerability

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Abstract

Chronic non-communicable diseases constitute the highest burden of morbidity and mortality in the world and is responsible for 63% of deaths worldwide. In Brazil, they still represent the highest mortality in the country. Thus, the objective of the study was to identify areas of risk and protection for premature mortality from chronic non-communicable diseases according to social vulnerability in the city of Ribeirão Preto from 2010 to 2014. This was an ecological, quantitative study in which, through the method of spatial scanning, the relative risk and 95% confidence interval were calculated according to social vulnerability data. Five areas of statistical significance were identified, with two high-risk areas being predominantly of census sectors classified as low vulnerability, medium vulnerability, and high vulnerability in urban environments, and three protection areas with being predominantly of census sectors classified as extremely low vulnerability. It was possible to identify areas of risk or protection for premature mortality due to CNCDs, which can contribute to the development of effective innovative strategies to reduce the burden of these diseases for SUS.

Keywords: Chronic Disease. Mortality. Premature Mortality. Spatial Analysis.

INTRODUCTION

In 2019, premature mortality from chronic non-communicable diseases (CNCDs) were 43.48% of the total deaths worldwide due to CNCDs, showing the impact of this group of diseases in the age group between 30 and 69 years[1].

In Brazil, in 2016, 975,400 deaths were attributed to CNCDs, which is equivalent to 74% of deaths that occurred that year, with an emphasis on cardiovascular diseases and neoplasms[2].

Another national study showed that in 2013 there were a total of 829,616 premature deaths from CNCDs, comprising 68.6% of the total number of deaths also demonstrating an increase in the number of premature deaths from CNCDs. Among CNCDs, the percentage of deaths attributed to diseases

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of the cardiovascular system in this group stands out (28.1%), followed by neoplasms (16%), chronic respiratory disease (5.6%), and Diabetes Mellitus (DM) (4.8%)[3].

A study carried out in the interior of São Paulo in Ribeirão Preto showed an increase in the rates of premature mortality due to CNCDs, especially in neoplasms and diabetes mellitus[4].

To reduce the impact of CNCDs on premature mortality, it is necessary to advance access to healthcare and health promotion policies, prevention, and surveillance. Therefore, the design and implementation of controlling, surveillance, and monitoring policies focused on the prevention and care of this vulnerable group with CNCDs is imperative[5].

In this regard, the World Health Organization published the 2013-2020 Global Action Plan for the prevention and control of chronic non-communicable diseases and the National Ministry of Health prepared the 2011-2022 Plan for Coping with Chronic Non-Communicable Diseases which aims to reduce premature mortality due to CNCDs and the impact of social factors on health[6,7].

The social factors and determinants of health are related to social inequalities. These factors influence the healthcare disparity and are intertwined in social stratification, which effects the unequal distribution of power, prestige, and resources among people in society. To understand the processes of health inequalities, it is necessary to understand how power operates economic, social, and political relationships, and how geographic space influences the health-disease process[8].

Given the above, the present study aims to identify areas of risk and protection for premature mortality from chronic non-communicable diseases according to social vulnerability. It is hoped that the results of this study can provide subsidies for the development of effective innovative strategies to reduce the burden of premature mortality due to CNCDs in the municipality investigated.

METHODOLOGY

This was an ecological time series study[9] of premature mortality (30 to 69 years) due to CNCDs, carried out in Ribeirão Preto, in the interior of the state of São Paulo, carried out in 2017.

The city is located in the Northeast of the state of São Paulo, 313 km from the state capital. It has a total area of 650 km^2 and the population, in 2010, was 604,682 inhabitants. Between 2000 and 2010, the population of Ribeirão Preto, SP, grew at an average annual rate of 1.82%, while in Brazil it was 1.17%, in the same period[10]. During this decade, the city's urbanization rate went from 99.57% to 99.72%[11].

CNCD mortality data totaling 11,843 deaths from 2010 to 2014, in the city of Ribeirão Preto, SP, were made available by the Epidemiological Surveillance Division of the City Secretary of Health regarding the deaths of people residing in the urban area of the city, regardless of the place of death and age, with data coming from the death certificate. The data were accessed in the Tabwin Program of the City Secretary of Health and the selected variables were the year of death, sex, age, home address, and basic cause of death: cardiovascular diseases (I00-I99), neoplasms (C00-C97), chronic respiratory diseases (J30-J97), and diabetes mellitus (E10-E14), according to the International Statistical Classification of Diseases and Health-Related Problems Tenth Revision ICD-10.

Starting from this first collection, deaths of

city residents aged between 30 and 69 years old were included, totaling 4762 deaths. The data of the present study are from a five-year period (from 2010 to 2014), which were the first five years that the city of Ribeirão Preto implemented a specific health information system for CNCDs. The data for the second five-year period (from 2015 to 2019) were not processed by the city, which makes the performance and comparison with the first period unfeasible.

The data analysis started with the geocoding of premature deaths by CNCDs, using the Google Earth tool and, through the participants' home addresses, their geographic coordinates (Latitude/Longitude) were made available along with the cartographic base of the city of Ribeirão Preto, SP, which has 1004 census sectors, of which 988 are considered urban and 16 are rural10. This step was performed using the QGIS Desktop software version 2.18.

After geocoding, the CNCD mortality rate by census sector was calculated using the geocoded cases and the population data of each census sector that was taken from the last IBGE census conducted in 2010.

Next, the identification of areas with spatial risk for the occurrence of deaths due to CNCDs was carried out by means of the spatial scanning method developed by Kulldorff and Nagarwalla[12] in order to detect clusters in space. In this step, the SaTScan software version 9.6 was used with the discrete Poisson model and only the urban census sectors were used because they presented all cases of premature mortality due to CNCDs studied in the period from 2010 to 2014. The following conditions were adopted: non-overlapping geographical area of the clusters, the maximum size of the cluster equal to 50% of the exposed population, the cluster with a circular shape and 999 repetitions.

Scanning analyses were carried out for the occurrence of high and low risk clusters using the relative risk (RR), which makes it possible to compare areas, as these are standardized in such a way that the effects of different populations are removed[12]. A type I error was fixed at 5% ($p < 0.05$) as statistically significant clusters and then the 95% confidence intervals were calculated. Next, five areas with statistical significance were identified. Areas protected from CNCD mortality (protection areas) were considered when the RR values were less than 1 and the areas at risk for CNCD mortality (risk areas) were defined as those with values greater than 1. After this stage, thematic maps were constructed with their respective risks using QGIS Desktop software version 2.18.

The latest data from the State System of Data Analysis Foundation (SEADE) for the São Paulo Social Vulnerability Index (SSVI) from the year 2010 were used to describe the social vulnerability of the clusters for the year 2010.

The SSVI is an indicator developed by the SEADE Foundation, which allows a detailed view of the living conditions in the municipalities of the state, identifying and spatial location of the census sectors according to the vulnerability of their populations to poverty[13].

The SSVI is subdivided into the socioeconomic and demographic dimensions and classified into seven groups: Group 1 - extremely low vulnerability; Group 2 - very low vulnerability; Group 3 - low vulnerability; Group 4 - medium vulnerability; Group 5 - high vulnerability in urban environments; Group 6 - very high vulnerability; and Group 7 - high vulnerability in rural environments[13].

The SSVI uses as a basis for its classification the social vulnerability index data from the last national IBGE Census conducted in 2010.

The study was approved by the Ethics Committee, under opinion number 1580375/2016 and was approved by the City Secretary of Health of Ribeirão Preto, SP.

RESULTS

In the period from 2010 to 2014, 4762 premature deaths due to CNCD were identified. The majority of premature mortalities occurred in males 2805 (58.9%). For spatial analysis, 4667 (98.0%) of premature deaths were geocoded, since 2% were excluded due to lack of a complete address recorded.

Figure 1 shows the rates of premature mortality due to CNCDs for each census sector in the municipality, which ranged from 0 to 4,709.76 premature deaths per 100 thousand inhabitants, an average of 326.82 premature deaths per 100 thousand inhabitants with a standard deviation of 338.10, according to areas in a darker gray shading.

Figure 2 shows that in the spatial scan, five statistically significant areas were identified, the first three being protection areas (clusters 1, 2, and 3) and two risk areas (clusters 4 and 5).

Table 1 shows the characteristics of spatial clusters.

Table 2 shows that in Clusters 2 and 3, that is, protection areas, there was a predominance of census sectors classified as extremely low vulnerability (SSVI 1). On the other hand, high-risk areas in Cluster 4, had higher percentages of sectors classified as low vulnerability (SSVI 3), medium vulnerability (SSVI 4), and high vulnerability in urban environments (SSVI 5).

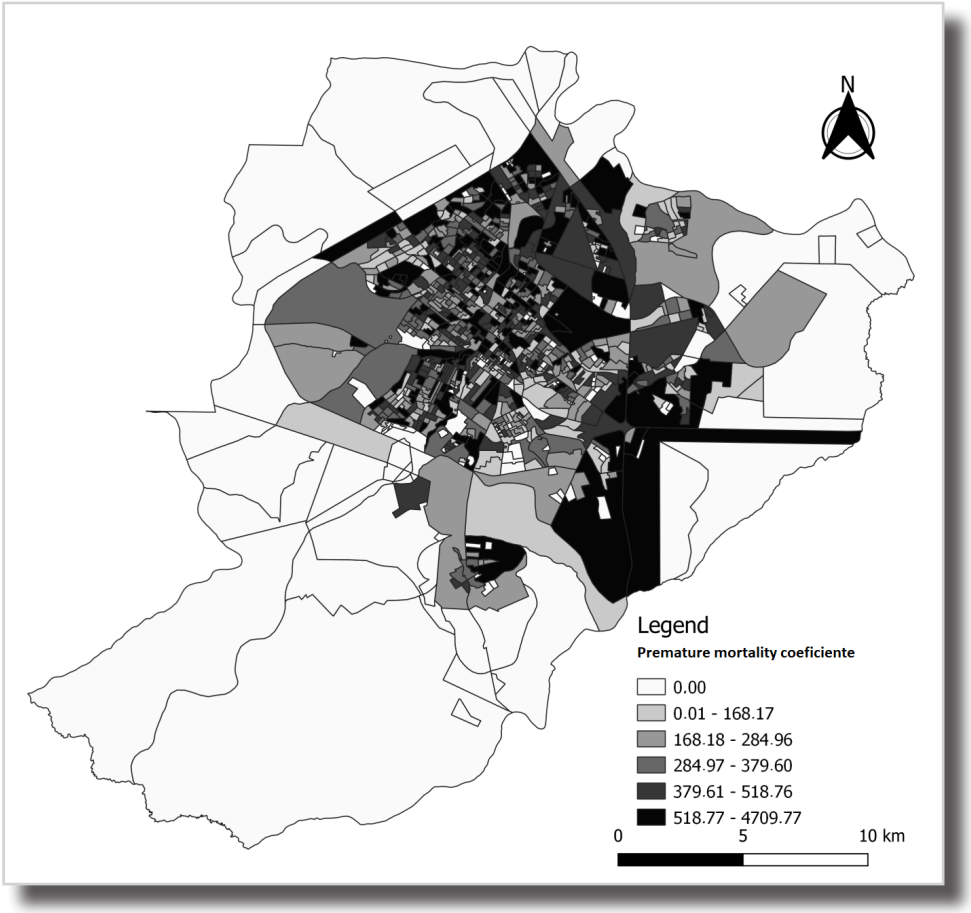

Figure 1 – Rates of premature mortality for chronic noncommunicable diseases per 100 thousand inhabitants and census sector in the period from 2010 to 2014. Ribeirão Preto, SP, 2021.

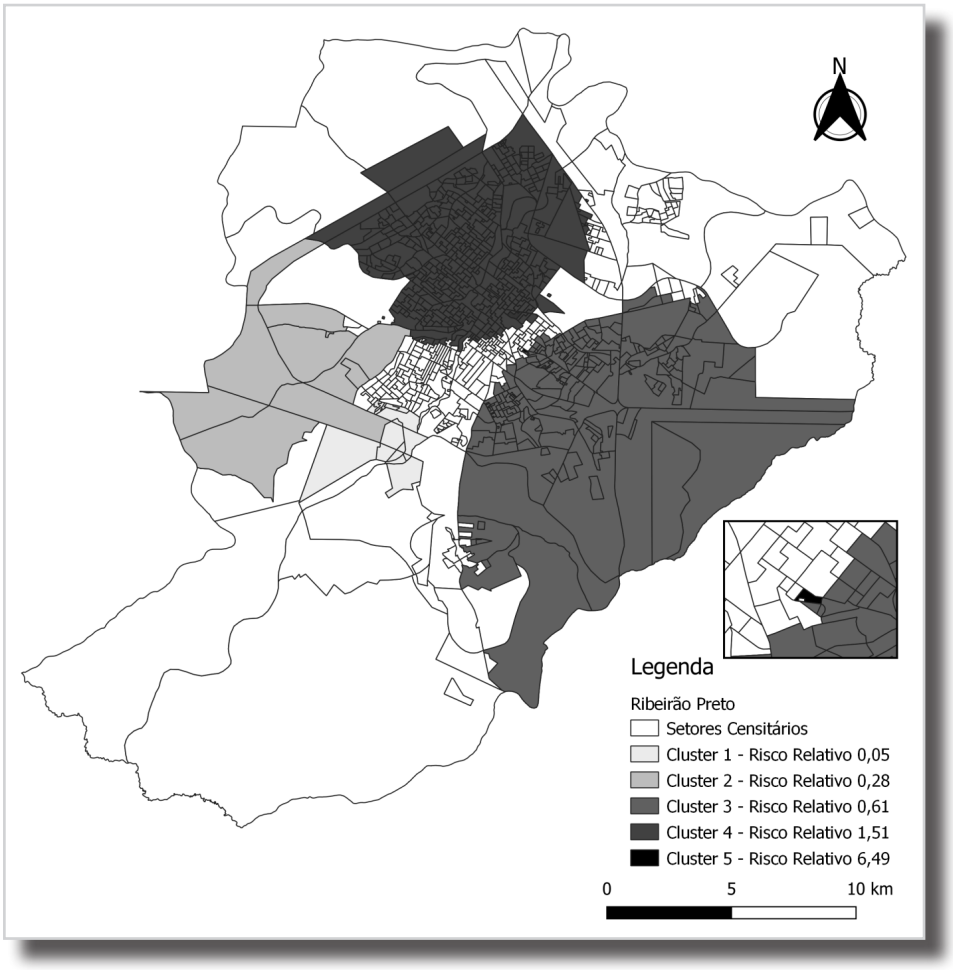

Figure 2 – Areas of risk and protection from premature mortality due to chronic non-communicable diseases in the period from 2010 to 2014. Ribeirão Preto, SP, 2021.

Table 1 – Characteristics of the census sectors according to the risk and protection areas for premature mortality from chronic non-communicable diseases in the period from 2010 to 2014. Ribeirão Preto, SP, 2021.

Characteristics	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Number of census sectors	18	9	215	460	1
Population	3.352	1.948	65.949	141.520	248
Number of cases	3	9	704	2.711	25
Average rate (per 100 thousand inhabitants)	17.6	92.0	213.2	383.9	2.043,1
Relative Risk	0.05*	0.28*	0.61*	1.51α	6.49α
Confidence interval	0.01-0.17	0.15-0.55	0.57-0.66	1.42-1.59	4.41-9.30
P value Ω	0.001	0.001	0.001	0.001	0.001

* protection areas; α risk area; Ω reference p value <0.05.

Table 2 – Description of Groups from the São Paulo Social Vulnerability Index (SSVI) of spatial clusters according to census sectors. Ribeirão Preto, SP, 2021.

Description	Census sectors (n)	SSVI 1[a] n (%)	SSVI 2[b] n (%)	SSVI 3[c] n (%)	SSVI 4[d] n (%)	SSVI 5[e] n (%)	SSVI 6[f] n (%)	SSVI 7[g] n (%)	No value
Cluster 1	18	0	0	1(5.6)	0	6(33.3)	0	0	11(61.1)
Cluster 2	9	2(22.2)	1(11.1)	0	0	0	1(11.1)	0	5(55.6)
Cluster 3	215	85(39.5)	74(34.3)	40(18.6)	4(1.9)	0	3(1.4)	0	9(4.2)
Cluster 4	460	21(4.6)	265(57.6)	78(17.0)	41(8.9)	17(3.7)	20(4.3)	0	18(3.9)
Cluster 5	1	0	1(100.0)	0	0	0	0	0	0
Município	1004	177(17.6)	431(42.9)	193(19.2)	55(5.5)	36(3.6)	33(3.3)	1(0.1)	78(7.8)

[a] Extremely low vulnerability;
[b] Very low vulnerability;
[c] Low vulnerability;
[d] Medium vulnerability;
[e] High vulnerability in urban environments;
[f] Very high vulnerability;
[g] High vulnerability in rural environments.

DISCUSSION

When analyzing the variation of the premature mortality coefficient and the average number of deaths, it was found that the average of the city by census sector is much lower when compared to the national study on the premature mortality coefficient in Brazil and in the southeast region[3].

It is recognized that CNCDs are considered to be the main causes of death; however. there was a reduction observed in mortality rates due to CNCDs in relation to cardiovascular diseases and respiratory diseases. Economic and social advances and the strengthening of the Unified Health System (SUS) may be contributing to the changes observed and, specifically, alleviating the existing inequalities[14].

On the other hand, an increase in mortality rates due to DM was observed. This may be related to disorganized urban growth, which together with the adoption of harmful lifestyle habits by the majority of the population can increase the probability of the development of this CNCD[14].

In relation to the five spatial clusters, three of which are protective and two at risk for premature mortality from chronic non-communicable diseases, it was found that the protection clusters were located in the eastern and southern regions, which have a greater number white color or race residents living there[10]. These areas have less social vulnerability on the SSVI, varying between group 1 (extremely low vulnerability) and group 3 (low vulnerability); that is, they have better socioeconomic conditions and healthy lifestyle habits[13]. Indeed, protective factors, such as the consumption of fruits and vegetables and physical activity during leisure time, a reduction of smoking and consumption of soft drinks, and an increase in mammography coverage, are positive indicators that corroborate the decrease in mortality due to CNCDs[15]. Therefore, we can infer that the population of spatial protection clusters is the one with the highest purchasing power and the largest coverage of the Healthcare System.

The high-risk clusters located in the central, northern, and western regions of the city

have a high number of black residents10 and demonstrated areas of greater SSVI social vulnerability (group 4 - medium vulnerability and group 5 - high vulnerability)[13]. In Brazil, the black race has worse working conditions, lower wages, greater likelihood of poverty, and more restrictions on access to healthcare services[16].

The increase in the burden of CNCDs affects the poorest people most and reflects the negative effects of globalization, the inequalities in access to health services, rapid urbanization, sedentary lifestyle and high-calorie diets, and marketing strategies that stimulate tobacco and alcohol use[5]. A study carried out in 2017 identified the main risk factors related to premature mortality due to CNCDs among women which were high body mass index (BMI), dietary risks, high systolic blood pressure and, among men, they were dietary risks, high systolic blood pressure, tobacco use, and high BMI[17].

This study has limitations, as it was an ecological study that analyzed a group and not individuals, and the use of secondary data that can generate bias due to the impossibility of generalization and the underreporting or incorrect registration in the death certificate. Another limitation of the study was the analyzed time span, five years (2010 to 2014), and not having the second five-year period from 2015 to 2019 processed for comparisons.

The identification of risk clusters was associated with sectors possessing greater social vulnerabilities and with less protection for premature mortality from CNCDs in Ribeirão Preto, SP. These findings provide direction for the development of effective innovative strategies to reduce the burden of these diseases on SUS. It is worth mentioning that, in this city, several strategies are already used; however, based on the results of this study, which investigated the first five-year series of data from the Epidemiological Surveillance, future studies on premature mortalities due to CNCDs are necessary in order to produce an evaluation of existing health programs.

CONCLUSION

Five statistically significant clusters were identified within the city, of which three were protection areas from premature mortality from chronic non-communicable diseases where the census sectors were mostly classified as extremely low social vulnerability. Moreover, there were two high-risk areas where there was a predominance of census sectors classified as low, medium, and high social vulnerability. The identification of areas of risk or protection for premature mortality due to CNCDs can contribute to the development of effective innovative strategies to reduce the burden of these diseases on SUS.

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