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DIABETES MELLITUS MORTALITY ON A HEALTH MACRO-REGION OF MINAS GERAIS

MORTALIDADE POR DIABETES MELLITUS EM UMA MACRORREGIÃO DE SAÚDE DE MINAS GERAIS

LA MORTALIDAD POR DIABETES MELLITUS EN UNA MACRO-REGIÓN DE SALUD DE MINAS GERAIS

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ABSTRACT

Objective: analyze the spatiotemporal pattern of mortality from diabetes mellitus and identify possible factors related in the municipalities of South Triangle Health Macro-Region, state of Minas Gerais, from 2008 to 2012. **Method**: ecological study of the mortality rates for diabetes mellitus. Moran index, annual historical series, the chi-square and Pearson's correlation was used. The results of the spatial distribution were presented in a representative map on the average mortality rates. **Results**: the study sample was composed of 694 cases of deaths due to diabetes mellitus, registered in the Mortality Information System. Mortality from diabetes mellitus shows increasing trend in the state of Minas Gerais and in South Triangle Health Macro-Region. The women had the highest rates. Association was found between mortality by sex in terms of age and education. **Conclusions**: it is important that health professionals are aware about the epidemiological scenario of mortality from diabetes mellitus in order to strengthen the coping the disease.

Keywords: Diabetes Mellitus; Spatial Analysis; Epidemiology; Public Health.

RESUMO

Objetivo: analisar o padrão espaço-temporal da mortalidade por Diabetes Mellitus e identificar possíveis fatores relacionados nos municípios da Macrorregião de Saúde Triângulo do Sul, do estado de Minas Gerais, no período de 2008 a 2012. **Métodos:** estudo ecológico sobre os coeficientes de mortalidade por Diabetes Mellitus. Foi utilizado o índice de Moran, a série histórica anual, o teste do Qui-Quadrado e a correlação de Pearson. Os resultados da distribuição espacial foram apresentados em um mapa representativo sobre os coeficientes médios de mortalidade. **Resultados:** a amostra do estudo foi composta pelos 694 casos de óbitos por Diabetes Mellitus, registrados no Sistema de Informação sobre Mortalidade. A mortalidade por Diabetes Mellitus apresentou tendência de aumento no estado de Minas Gerais e na Macrorregião de Triângulo do Sul. O sexo feminino apresentou as taxas mais levadas. Foi encontrada associação entre a mortalidade por sexo em relação à faixa etária e a escolaridade. **Conclusões:** é relevante que os profissionais da saúde estejam atentos acerca do cenário epidemiológico da mortalidade por Diabetes Mellitus, a fim de fortalecer o enfrentamento a doença.

Palavras-chave: Diabetes Mellitus; Análise Espacial; Epidemiologia; Saúde Coletiva.

RESUMEN

Objetivo: analizar el patrón espacio-temporal de la mortalidad por diabetes mellitus e identificar posibles factores relacionados, en los municípios de Macro-Salud Triángulo del Sur, en el estado de Minas Gerais, 2008-2012. **Método**: estudio ecológico de las tasas de mortalidad por diabetes mellitus. Se utilizó el índice de Moran, serie histórica anual, el chi-

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cuadrado y la correlación de Pearson. Los resultados de la distribución espacial fueron presentados en un mapa representativo de las tasas de mortalidad promedio. **Resultados**: la muestra del estudio estaba compuesta por 694 casos de muertes debidas a la diabetes mellitus, registrada en el Sistema de Información sobre Mortalidad. La mortalidad por diabetes mellitus muestra la tendencia creciente en el estado de Minas Gerais y en el Macro-Salud Triángulo del Sur. Las mujeres tenían las tasas más altas. Se encontró asociación entre la mortalidad por sexo en cuanto a la edad y la educación. **Conclusiones**: es importante que los profesionales de la salud son conscientes de la situación epidemiológica de la mortalidad por diabetes mellitus con el fin de fortalecer el afrontamiento de la enfermedad.
Descriptores: Diabetes Mellitus; Análisis Espacial; Epidemiologia; Salud Pública.

INTRODUCTION

Chronic Noncommunicable Diseases (NCDs) are identified as a relevant public health problem, due to their national burden and due to the damages caused, including those related to the subjects' quality of life and high expenses for the system of health. These diseases have as characteristics multiple risk factors and are related to physical and functional disabilities in the subjects affected. [1]

Among NCDs, Diabetes Mellitus (DM) has shown a tendency to increase in prevalence rates worldwide, bringing with it negative impacts on the quality of life of the population with the disease. This is because DM, in its initial phase, tends to be asymptomatic, potentializing the evolution of the disease without the perception of the subject. [2]

Data indicate that in the year 2013, the prevalence of DM was 8.3% worldwide, leading to the death of around 5.1 million subjects between the ages of 20 and 79 years, and 48% of these deaths occurred in people under 60 years of age, drawing attention to the negative potential on mortality of the population of working age.[3] In Brazil, the data indicate that in the year of 2013 the prevalence of the disease was 9.4%, with more than 100,000 cases of deaths due to the disease in subjects aged 20 to 79 years. [2]

Considering the above, it is considered relevant to understand the spatio-temporal pattern of DM mortality, in order to identify the areas where rates occur on a larger scale, to plan new actions and strategies, and to strengthen those that are in force . This study questions: how the spatio-temporal pattern of DM mortality is configured in the municipalities of the Triângulo do Sul Health Macro-region of the state of Minas Gerais, from 2008 to 2012?

In order to answer the research problem, the objective of this study was to analyze the spatio-temporal pattern of DM mortality and to identify possible related factors in the municipalities of the

Triângulo do Sul Health Macroregion, in the state of Minas Gerais, from 2008 to 2012.

METHOD

Ecological study on the spatiotemporal analysis of the DM-related deaths occurring in the municipalities of the Triângulo do Sul Health Macroregion in the state of Minas Gerais, from 2008 to 2012. The Triângulo do Sul Health Macro-region is one of the 13 Macroregions of Health of the state of Minas Gerais, located to the west of the state and to the south of the Triângulo Mineiro.[4] This macro-region consists of 27 municipalities, land area of 29,644 square kilometers, 697,812 inhabitants, population density of 23.11 inhabitants / km² and GDP 18,243,782.30. Among the municipalities, what stands out by the largest population is Uberaba, with 295,988 inhabitants.[5]

The study population was composed of DM deaths of subjects living in the 27 municipalities that make up the Triângulo do Sul / Minas Gerais Health Macroregion, comprising a sample of 694 deaths. To do so, the indicator selected for the analysis was the DM mortality coefficient, selected by categories of the International Classification of Diseases (ICD-10): E-10 (insulin-dependent diabetes mellitus), E-11 (noninsulin-dependent diabetes mellitus), E-12 (Diabetes mellitus related to malnutrition), E-13 (other specified types of diabetes mellitus) and E-14 (unspecified diabetes mellitus), for the period 2008 to 2012, obtained from the Mortality Information System of Informatics System in Health of the Unified Health System (DATASUS).[4] Data were collected using the following variables: year of death and place of residence.

The average mortality rate of each municipality was calculated using as the numerator the average deaths of by DM, of the period 2008 to 2012 and, as denominator, the population of each municipality in the year 2010 [5], This year was chosen because it is the middle year of the study period and considering demographic census data. The result was multiplied by 100,000 inhabitants and used for distribution, spatial analysis and statistical analysis.

In order to understand the temporal pattern of DM mortality in the state of Minas Gerais and in the Triângulo do Sul Macroregion, the annual historical series was analyzed using the annual mortality coefficient. The calculation was as numerator the absolute number of deaths by DM of each unit of analysis for each year and as the denominator the

population[5] each year, multiplied by 100,000.

For the spatial analysis was used the global Moran index (I), which allows the assessment of the existence of spatial correlation coefficients, about the average mortality for DM, between the municipalities of Macroregion South Triangle. This index ranges from -1 to 1 where results close to -1 indicate inverse correlation, results close to zero indicate randomness and values close to 1 indicate direct spatial correlation.[6]

Spatial statistics were calculated using the weightless method for the distance between neighbors and considering the contiguity strategy, which points out as neighbors the municipalities that divide the border.[6] The cartographic mesh used was collected in the DATASUS site.[4]

The dependent variable of the study was the DM mortality coefficient and the independent variables were the municipalities that are part of the Triângulo do Sul Macroregion and the demographic, socioeconomic and coverage variables of Primary Care. These variables are presented by sex, age, color / race, average household income per capita (in the 2010 year), the proportion of illiteracy in 2010 (the population of ≥ 15 years old) and average coverage ratio of primary care (in the period 2008 to 2012) of each municipality of the Macroregion Triângulo do Sul (basic care indicators). The variables of income per capita municipal house and proportion of illiteracy are from the IBGE[5], while the others were collected in the DATASUS site.[4]

The descriptive results of data on DM mortality in each category of age and color / race stratified by sex were presented in absolute numbers and in frequencies. The same data were submitted to Chi-square test, in order to evaluate the association between sex and age, color / race and schooling. Pearson's correlation was used to analyze the correlation between DM mortality in each municipality and the other independent variables. The significance of ≤ 0.05 was considered.

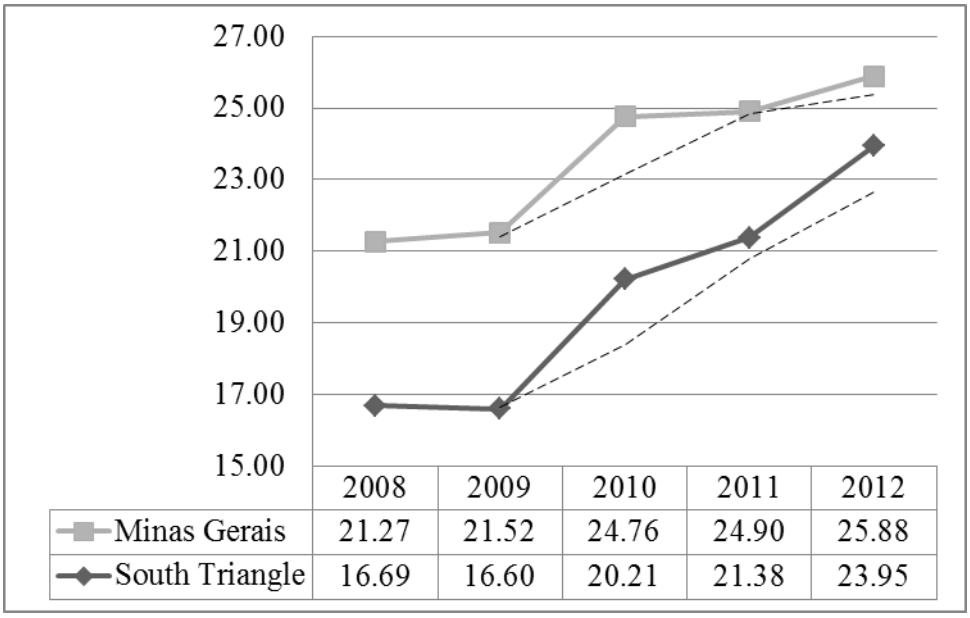
Tabulation of data and processing of coefficients was developed in TabWin 32 *software*, distribution and spatial analysis were developed in terraView 4.2.2 *software* and statistical analysis was performed using SPSS 20 *software*. This research has no ethical implications because Used public domain data. Therefore, it was not necessary to submit to the Research Ethics Committee.

RESULTS

The descriptive results indicate 694 DM deaths occurring in the municipalities that are part of the Triângulo do Sul Macro-Region of Health in the period studied. Of these, 54% are female, 26% consider the age group from 70 to 79, being this the age group with the highest number of deaths, and 84% consider ICD-10 E14.

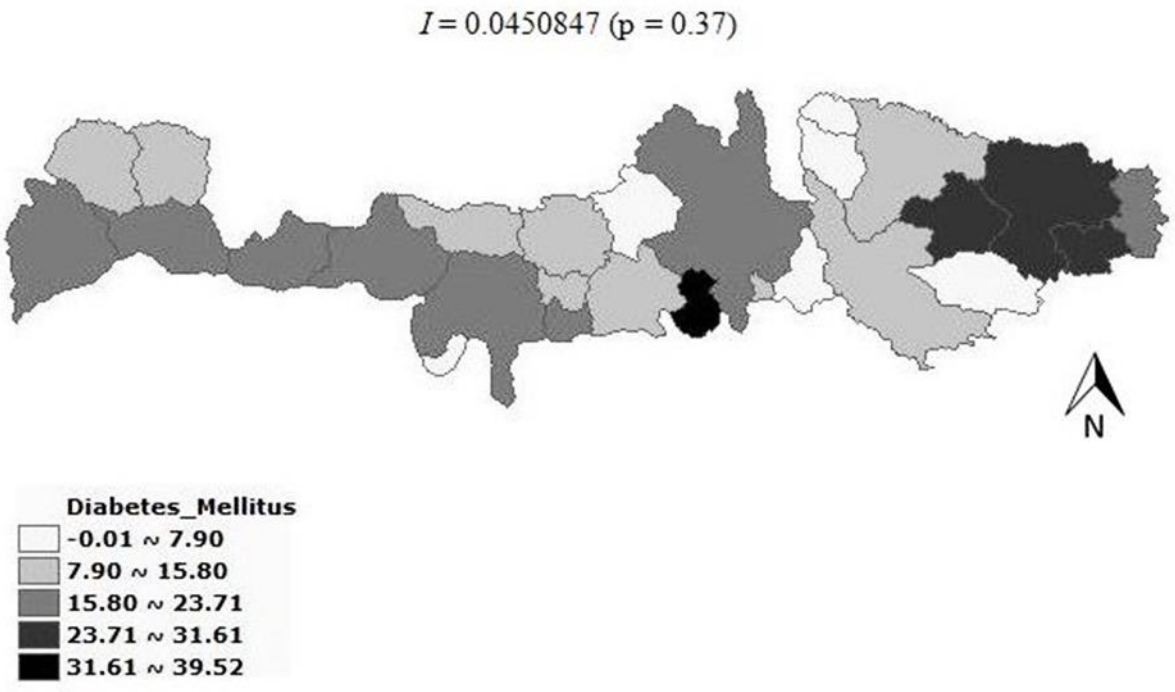
The result of the annual historical series points to a trend of increased DM mortality for the state of Minas Gerais and for the South Triangle Macroregion in the period analyzed (Graph 1).For the state of Minas Gerais, the increase represented 22% and in on Macroregion of Triângulo do Sul the increase was 43%.

Graph 1 - Mortality rate for Diabetes Mellitus in Macroregion Health South Triangle / Minas Gerais, from 2008 to 2012.



The result of the spatial distribution allows a general visualization of the spatial pattern of DM mortality in the Triângulo do Sul Macroregion. It can be seen that the municipality of Água Comprida, followed by the municipalities of Araxá, Ibiá and Pratinha, is the one with the highest coefficient. The Moran Global Index presented values close to zero and not significant (Figure 1).

Figure 1 - Spatial distribution of the mean rate of mortality from diabetes mellitus in Macroregion Health South Triangle / Minas Gerais, from 2008 to 2012.



The mean mortality rate for the South Triangle Macroregion in the study period was 19.76%. In this perspective, the municipalities that presented the most critical values, being above the average of the Macroregion, were Água Comprida (39.51), Araxá (31.17), Ibiá (31.01), Pratinha (24.50), Iturama (22.64), Planura (21.19), and Uberaba (19.80).

The results show an association between gender and age and schooling variables. There is a tendency between the male with the age group of 40 to 59 years, and the female with the age group of 60 to 80 years. In relation to schooling, the data indicate a higher tendency between female and low schooling (0 to 3 years of schooling) and the male with schooling between 4 and 12 years (table 1).

Table 1 - Deaths from Diabetes Mellitus by sex, age and race / color in Macroregion South Triangle Health / Minas Gerais, from 2008 to 2012.

	Male	**Female**	**p***
	N (%)	**N (%)**	
Age Group			<0.0001
40 to 49 years	31 (72%)	12 (28%)	
50 to 59 years	60 (55%)	49 (45%)	
60 to 69 years	79 (49%)	82 (51%)	
70 to 79 years	77 (43%)	104 (57%)	
≥ 80 years	58 (34%)	115 (66%)	

Schooling			0.0001
None	21 (27%)	57 (73%)	
1 to 3 years	85 (46%)	99 (54%)	
4 to 7 years	54 (61%)	35 (39%)	
8 to 11 years	24 (53%)	21 (47%)	
≥12 years	15 (65%)	8 (35%)	
Color / Race			0.09
White	197 (45%)	243 (55%)	
Black	41 (47%)	46 (53%)	
Brown	49 (58%)	36 (42%)	

* Chi-square test (excluding ignored information).

No association was found between sex and color / race, but the descriptive results show a predominance of females among the white / black race population, affected by DM, and males with color brown population (Table 1). The results of Pearson correlation analysis show that there is no significance between mortality from diabetes and the illiteracy rate, the per capita household income and the proportion of coverage of primary care.

DISCUSSION

The results indicate that DM mortality was present at a higher frequency among the female population. This data has also been shown in other studies[7-9], and shows that this pattern follows a trend also displayed in surveys conducted in other countries.

Mortality due to DM was more prevalent among the population aged 70 to 79 years. A study carried out with elderly people assisted by the Family Health Strategy (ESF), in a municipality of Minas Gerais, pointed out that in the elderly population the most affected by DM was the age group between 70 and 79 years. In this perspective, the same study addresses the importance of health professionals being prepared to subsidize health promotion actions for the population of this age group.[10]

Among the categories of ICD-10, analyzed in this study, the one with the highest mortality rate was category E-14, which included unspecified DM. This may bring a bias for the analysis of mortality in relation to the type of DM. In any case, this data are not irrelevant since they make it possible to understand the mortality pattern by the disease. Furthermore, the American Diabetes Association[11] esteem that about 90% of diabetics have the DM noninsulin-dependent (categorized by ICD-10 E11).

The temporal trend pointed to increased DM mortality in both the Triângulo do Sul Macroregion and the state of Minas Gerais, from 2008 to 2012. The increase in DM mortality is also described in other studies.[8,9,12]

The Strategic Action Plan for Coping with Chronic Noncommunicable Diseases in Brazil 2011-2022 established the goal of reducing premature mortality by chronic noncommunicable diseases at 2% per year.[13] However, a study pointed out that the state of Minas Gerais has unfavorable scenario for the fulfillment of premature mortality reduction target in DM context.[14]

In this perspective, we see the importance of strengthening coping strategies to DM existing, including the System of Registration and Monitoring of Hypertensive Diabetics (SisHiperdia / Brazil)[15,] which has the potential to support health promotion actions in the context of DM, through the identification of problem and the follow-up of diabetics.

The present study did not indicate a significant spatial correlation for the DM mortality rate among the municipalities of the health region of Triângulo do Sul. However, a study that analyzed the spatial correlation of the prevalence of DM among the municipalities of the state of Minas Gerais, pointed to positive and significant Moran indices, pointing to a cluster located in the south of the state, which had high rates to the DM and hypertension.[16]

The spatial distribution made it possible to point out the municipalities of the Triângulo do Sul Macroregion which presented the most critical mortality rates due to DM. This result is important so that health actions and intervention strategies are re-thought in the most vulnerable places and that require greater interventions. Studies discuss the importance of the spatial approach to the analysis of the epidemiology of mortality by DM.[7,9,12]

The data indicate that there is a worrying tendency, the frequency in DM mortality in men aged 40 to 59 years, in relation to the female sex. According to the National Policy for Integral Attention to Human Health, men are less likely to seek health services in relation to women, resulting in higher mortality in productive age and in avoidable causes.[17]

In this study, there was no significant correlation between mortality by DM and the variables illiteracy rate, per capita household income and the proportion of primary care coverage. A study, which also used these three variables to analyze the correlation between them with the mortality from cardiovascular disease, showed an inverse correlation to the variable *per capita* income, in municipalities in the south of the country, with more than 15,000 residents.[18]

The absolute numbers indicate that schooling between 1 and 3 years of schooling is the one that covers the largest

number of deaths due to DM, with a higher frequency among women. In this perspective, the literature presents a study on health literacy in relation to Type 2 Diabetes Mellitus (DM2 or non-insulin-dependent diabetes mellitus), where the majority of subjects (65.9%) had literacy In inadequate health.[19]

Literacy has been described previously as an important factor in coping with DM.[20] Functional illiteracy in health is a major challenge for health professionals, especially nurses, who need to find strategies that make it possible to clarify, to the users of the health services, the necessary care in relation to DM in order to control the disease and prevent complications Originating.[19]

CONCLUSIONS

It is relevant to consider some limitations of this study. First, the data comes from a secondary database, which may have problems of underreporting. In addition, the data are aggregated, causing the difficulty of controlling the confounding factors. In addition, deaths due to DM can have their cause identified as being due to other diseases, such as kidney diseases, hypertension and other cardiovascular diseases. However, it is pertinent to consider the importance of the DATASUS Mortality Information System as a facilitating tool for the development of health indicators.

Mortality due to DM has increased during the period of 2008 to 2012 in the state of Minas Gerais and in the Macroregion Health South Triangle. The spatial distribution made it possible to point out the municipalities where rates are higher.

The results indicate an association between sex and age and schooling in the context of DM mortality. Pointing in particular to the trend of early mortality for the male population. One hypothesis for this problem may be that men seek the health services less often. This may contribute to the lack of knowledge about DM involvement, favoring the evolution of the disease, associated diseases and increasing the chances of mortality.

In view of this, it is relevant that health professionals are attentive, especially Nurses, in order to propose strategies to guide the users of health services about DM, and about prevention and management actions, seeking with this The promotion of health, the quality of life of the subjects and the reduction of expenses to the health system.

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