Influence of economic indicators on the spatial distribution of hospitalizations related to chronic noncommunicable diseases

Influência dos indicadores econômicos na distribuição espacial de internações relacionadas as doenças crônicas não transmissíveis

Influencia de los indicadores económicos en la distribución espacial de las hospitalizaciones relacionadas con enfermedades crónicas no transmisibles

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ABSTRACT
Objective: to analyze the distribution of hospitalizations for conditions relating to chronic noncommunicable diseases and amenable to primary care in São Carlos, São Paulo and to ascertain correlations with economic variables. **Method:** this ecological study used secondary data collected from the survey of hospitalization authorization (AIH) forms in the period from 2015 to 2018, which were analyzed using descriptive statistics and Pearson's correlation. Geocoding and geoprocessing were performed using ArcGis and Google Earth Pro software. The study was approved by the research ethics committee. **Results:** 21% and 25% correlations were found with, respectively, census tract income and per capita income, suggesting that the higher the income, the lower the number of hospitalizations. **Conclusion:** the increase in the coefficient for such hospitalizations in low-income regions indicates that income is a determining factor in the health-disease process.
Descriptors: Primary Health Care; Chronic Noncommunicable Diseases; Hospitalization; Economic Indexes.

RESUMO
Objetivo: analisar a distribuição das Internações por Condições Sensíveis à Atenção Primária relacionadas às Doenças Crônicas Não Transmissíveis em São Carlos, SP, Brasil, e verificar a correlação com as variáveis econômicas. **Método:** Trata-se de um estudo ecológico, utilizando dados secundários coletados por meio do levantamento nas fichas de Autorização de Internação Hospitalar no período de 2015 a 2018 e analisados por meio da estatística descritiva e correlação de Pearson. A geocodificação e geoprocessamento foram realizadas nos softwares ArcGis e Google Earth Pro. A pesquisa foi aprovada pelo comitê de ética em pesquisa da instituição. **Resultados:** Foram encontradas correlações (21% e 25%), referente, respectivamente, às variáveis renda do setor censitário e renda per capita, sugerem que quanto maior a renda, menor será o número de internação. **Conclusão:** O aumento do coeficiente de ICSAP em regiões de baixa renda, indica que a renda consiste em um fator determinante no processo saúde-doença.
Descritores: Atenção Primária à Saúde; Doenças Não Transmissíveis; Hospitalização; Indicadores Econômicos.

RESUMEN
Objetivo: analizar la distribución de Hospitalizaciones por Condiciones Sensibles a la Atención Primaria relacionadas con Enfermedades Crónicas No Transmisibles en São Carlos-SP y verificar la correlación con variables económicas. **Método:** se trata de un estudio ecológico, utilizando datos secundarios recolectados a través de la encuesta en formularios de Autorización de Hospitalización (AIH) en el período de 2015 a 2018 y analizados mediante estadística descriptiva y correlación de Pearson. La geocodificación y el geoprocesamiento se realizaron utilizando el software ArcGis y Google Earth Pro. La investigación fue aprobada por el comité de ética. **Resultados:** se encontraron correlaciones (21% y 25%), referidas, respectivamente, a las variables 'ingresos del sector censal' e 'ingresos per cápita', sugiriendo que cuanto más altos sean los ingresos, menor será el número de hospitalizaciones. **Conclusión:** el aumento del coeficiente ICSAP en las regiones de bajos ingresos indica que los ingresos son un factor determinante en el proceso salud-enfermedad.
Descriptores: Atención Primaria de Salud; Enfermedades no transmisibles; Hospitalización; Indicadores Económicos.

INTRODUCTION

Hospitalizations for Ambulatory Care Sensitive Conditions (ACSCs) are considered as preventable hospitalizations as they are caused by the worsening of the health conditions that could have been solved in the health services provided by the Primary Health Care (PHC), in a resolute manner, decreasing the costs to the health care system. The high number of these hospitalizations may indicate that PHC has difficulties in ensuring the effectiveness of the assistance to users, as well as it may be related to the lack of a higher level of coverage of this assistance[1].

The ACSCs have decreased over the years, but there is still a need to minimize the damage caused by chronic non-communicable diseases (NCDs), which include cardiovascular diseases, malignant neoplasms, chronic respiratory diseases,

Systemic Arterial Hypertension (SAH) and Diabetes Mellitus (DM). In 2016, NCDs were responsible for 56% of all deaths in the population aged 30-69 years in Brazil[2].

The institutionalization of the use of indicators, such as ACSCs, is part of a strategy to improve the planning and management of health care services by national, state and local authorities[3]. The number of ACSCs cannot only be associated with the effectiveness of PHC, but also with socioeconomic indicators, since care is based on the user's adherence to drug and non-drug treatments and is strictly related to income and level of education[4].

In this context, spatial analysis has become an important ally in health management, with the advancement of technology and computerization of health databases, which provided a broader access to data collected in the municipality, making easier its submission to evaluation procedures of its spatial distribution. The spatial analysis established a panorama in which diagnoses can be identified so that measures can be taken by the management authorities. It has a direct impact on the quality and access to health care services, in addition to allowing the mapping of areas of greatest economic vulnerability, in order to ensure that the equity of the resources allocated to SUS is respected[5].

The analysis of the distribution of NCDs and the coefficients of ACSCs can help to reorganize the PHC in the municipalities based on the identification of inequalities and adapt the necessary resources to each region in the municipality, contributing to a planning that is more consistent with the specificities of each location[1,3].

In line with the above, this study was structured around the question-problem: What is the spatial distribution of ACSCs due to NCDs and its relation with the economic indicators in the municipality of São Carlos? Thus, this study aimed to analyze the spatial distribution of Hospitalizations for Ambulatory Care Sensitive Conditions (ACSCs) due to Chronic Non-Communicable Diseases (NCDs) in the municipality of São Carlos, SP, Brazil and to analyze its correlation with economic variables.

THEORETICAL FRAMEWORK

Diseases classified as ACSCs are defined as diseases that could be prevented by timely and quality care in PHC, in order to avoid a worsening of a previous disease. An ACSC can be understood as an indicator of the quality of care provided to users, as well as a mean to indirectly assess the effectiveness of PHC[6].

The theoretical framework considered in the construction of this indicator followed the model proposed by Caminal-Homar and Casanova-Matutano, adapted to Brazilian requirements in accordance with Ordinance No. 221/2008 of the Ministry of Health, which established a list of 74 classes of diseases, grouped into 18 categories, including NCDs[3,7-9].

The group of NCDs has been gaining prominence because of its magnitude and the social and personal costs that they can cause to people's lives. NCDs have variable distributions in different regions of Brazil, disproportionately affecting the poorest and most vulnerable population[10-12]. However, it is known that risk factors lead to the development of one or more NCDs, which often overlap, affecting more severely the most socially vulnerable portion of the population, especially in developing countries that historically have a considerable part of the population in vulnerability situation.

Among the main NCDs, SAH and DM stand out because of their magnitude and potential to trigger other diseases and complications. Data from the Ministry of Health indicate that one in every four Brazilian adults has a diagnosis of SAH, characterized as the main risk factor for cardiovascular diseases and responsible for the death of approximately 302 thousand Brazilians in 2017. Worldwide, statistics show that 40% of the population over 25 years old have SAH[1,11-14]. In Brazil, it is estimated that there are 12.5 million Brazilians with DM, being the country ranked 4th in the world[15].

Just like DM and SAH, Heart Failure (HF) represents a large-scale problem and is the second leading cause of death among cardiovascular diseases in Brazil[16]. A study carried out in Paraíba analyzed hospital admissions between 2008 and 2015 and showed that HF was responsible for 2,380,133 (21%) hospitalizations, being considered the main cause of hospital care in the country. HF was responsible for 2.54% and 2.25% of all causes of hospital admissions in Paraíba and Brazil, respectively[5].

In this scenario, angina also represents an important problem of the cardiovascular system, characterized by severe pain and/or a sensation of pressure in the chest. Usually, angina is one of the main red flags that precede acute myocardial infarction, which is responsible for the death of approximately 100 thousand Brazilians per year. There is a high prevalence of angina in the Brazilian population, 33% of patients report angina in their consultations with the cardiologist[17].

Cerebrovascular accident (CVA) is the main injury in the group of cerebrovascular diseases and can manifest itself as ischemic or hemorrhagic stroke, with significant importance in people over 40 years of age[18]. According to DATASUS, in Brazil, cerebrovascular diseases were responsible for 34% of deaths registered in the elderly population (60 years old and over) in 2014, in the State of São Paulo, with a proportion of 33.5%[19].

According to the World Health Organization (WHO), of the 38 million deaths that occurred in the world in 2012, 68% were caused by NCDs and, of these, four million resulted from Chronic Respiratory Diseases (CRDs)[20]. The group of CRDs is mainly composed of chronic obstructive pulmonary disease (COPD) and asthma. Studies have highlighted the increase in mortality rates for COPD, especially when associated with the aging process that the country has been experiencing, which compromises the disability-adjusted life years (DALYs) of the population[21].

Coping with NCDs requires different technological densities associated with strategies that encourage lifestyle change[10,12]. This leads to the assumption that the geographic distribution of ACSCs does not occur uniformly, that is, there are regions that are more at risk than others, which requires a more detailed investigation of the relation between the distribution of NCDs and socioeconomic variables.

METHOD

This is an ecological study that uses secondary data in time series and was carried out in the municipality of São Carlos-SP. The population of São Carlos is estimated at 251,983 inhabitants and has an urbanization rate of 95.99%. In health, PHC is composed of 12 Basic Health Units (BHU) and 22 Family Health Strategies (FHS)[22]. In 2020, the municipality had three Emergency Care Units (ECU) and three hospitals for emergency and high complexity care: one public, one philanthropic and one private[22].

Data on Hospital Admission Authorizations (HAA) were obtained from the Department of Health of the municipality of São Carlos. A List of Ambulatory Care Sensitive Conditions contained in Ordinance No. 221/2008 of the Ministry of Health was used to categorize the hospitalizations as due to ACSCs. The information obtained from the HAA were: 4-digit ICD, age, neighborhood, address and zip code. For the inclusion criteria, the study population consisted of residents in the municipality of São Carlos who, regardless of age, were hospitalized for ACSC. Hospitalized patients residing outside the municipality and patients who had incomplete medical records, which could make spatial analysis impossible, were excluded.

Data organization, tabulation and statistical analyzes were performed using the *Statistical Package for the Social Sciences* (SPSS®), Excel® and R *Studio*®. The ACSC coefficient was calculated (number of ACSC cases in the municipality of São Carlos-SP divided by the size of the population of the municipality, multiplied by one thousand inhabitants). Pearson's coefficient, which measures the degree of correlation between two metric scale variables and can be positive or negative, was calculated to establish the correlation between the distribution of hospitalizations and economic indicators.

In this study, chronic conditions related to ACSC coefficients were considered as the outcome variable, in accordance with the current Review of the International Classification of Diseases (ICD-10), and the NCDs considered as ambulatory care sensitive conditions were: Lung diseases; SAH; Angina; Heart Failure; Cerebrovascular diseases and DM, recorded from 2015 to 2018.

The economic data were collected from the database of the Brazilian Institute of Geography and Statistics (IBGE), referring to the 2010 Census, and the calculations of per capita income and household income were updated based on the minimum wage in force in 2020. Population size estimation data used to calculate the ACSC coefficient were obtained from estimates of resident population of the Brazilian municipalities[23]. The correlation between the distribution of hospitalizations and economic indicators was calculated between the two metric scale variables using the Pearson coefficient, which estimates the degree of correlation and the direction and can be positive or negative.

The municipality of São Carlos-SP is composed of 5 Districts, which are subdivided into 322 census sectors, 29 located in rural areas and 293 in urban areas, according to the IBGE. In this study, the division of territory by districts was used.

The units of the spatial analysis were defined using the Geographic Information System - ArcGis®, the geographic base was geo-referenced using the Universal Transverse Mercator Projection (UTM) coordinate system, Datum SIRGAS2000 UTM Zone 23 S. The addresses in the HAA were geocoded by Google Earth Pro software. In this process, addresses of patients hospitalized in the municipality of São Carlos and residents in other municipalities were excluded. After the geocoding process, the data were exported to ArcGis® software version (10.5) and were spatialized, giving rise to thematic maps.

The research was approved by the Research Ethics Committee (REC) of the institution, under the Certificate of Presentation for Ethical Assessment (CPEA) 02162018.5.0000.5504. Opinion number 3,051,504, on December 3, 2018.

RESULTS AND DISCUSSION

In the period of analysis, 5,269 hospitalizations for NCDs were identified, with 64.93% (3,421) of hospitalizations referring to residents in the municipality of São Carlos-SP, and 3.47% (183) of hospitalizations were disregarded due to problems in filling out the hospital admission authorization form (HAA) (Table 1).

These problems were mainly due to the lack of information required for the georeferencing of hospitalizations, with the absence of the zip code or incorrect filling of the address being the most frequent reasons. Preventable hospitalizations resulting from NCDs represented 10.47% of the total number of hospitalizations recorded in the period of analysis.

TABLE 1: Hospitalizations for NCDs and the ACSC coefficient per thousand inhabitants in the period from 2015 to 2018 in the municipality of São Carlos-SP. São Carlos, SP, Brazil, 2018.

Year	General hospitalizations	Hospitalizations for NCDs	Hospitalizations for NCDs of residents in São Carlos	ACSC coefficient
2015	9814	1244	769	3.19
2016	12600	1294	623	2.56
2017	13491	1461	1211	4.92
2018	14399	1270	816	3.27

Source: Prepared by the author based on data from DATASUS and the HAA of the municipality.

In the period of analysis, from 2015 to 2018, the ACSC coefficient showed an average of 3.49/1,000 inhabitant. Between 2015 and 2016, the ACSC coefficient/1,000 inhabitants showed a reduction of 19.75%; in 2017, there was an increase and this coefficient was 4.92/1,000 inhabitants; and, in 2018, the ACSC coefficient was 3.27/1,000 inhabitants.

The decrease in the number of NCDs may be associated with the increase in FHS coverage in the municipality, which was 28.31% in December 2017, serving a population estimated in 69,000 people; in 2018, also considering the month of December, there was an increase in FHS coverage in the municipality, which now has a coverage of 30.84%, serving a population of 75,900 people[24].

A nationwide study carried out in municipalities with more than 100 thousand inhabitants, showed that the Southeast region showed an ACSC coefficient of 89.81/10 thousand inhabitants[25], showing a downward trend in the ACSC indicator, with periods of slight increments in the period from 2009 to 2014[25], very similar to the findings in the municipality of São Carlos-SP.

Studies conducted in the Federal District (FD) and in other state capitals between 2009 and 2018 showed that the form the organization of the health system in PHC, with or without centrality, can have a direct impact on the ACSC coefficients[26]. In the FD, efforts to expand care in PHC had the greatest effects in reducing hospitalizations in young adults, especially in the 40-59 age group. The relation between the number of ACSCs and PHC coverage is found in a country of continental dimensions and with scenarios as different as the access and quality of medical care[6,25-27].

In relating the variables hospitalizations for NCDs and per capita income, a downward trend was found, that is, the probability of hospitalization for NCDs decreases as the variable per capita income increases. In 2015, this correlation was (-0.253), that is, the variable per capita income can explain up to 25% of hospitalizations registered in the municipality. In 2016, this correlation coefficient was (-0.212), showing that per capita income can explain up to 21% of hospitalizations; in 2017, a correlation coefficient of (-0.206) was found, which can explain up to 21% of hospitalizations. Finally, in 2018, a correlation of (-0.296) was found; therefore, the variable per capita income can explain up to 29% of hospitalizations for NCDs recorded in 2018 (Figure 1).

Although the correlation value is considered to be a low value, when it is related to the spatial analysis of hospitalizations, there is a concentration of points in regions with the lowest per capita income values. These correlations explain a significant part of the hospitalizations for NCDs in the municipality, since the socioeconomic situation has a direct impact on the individual's health condition, as it generates stress and concern due to the lack of financial resources.

Financial health has an impact on biological health through changes in the individual's psyche and, according to a survey carried out by the Credit Protection Service (CPS), about 70% of defaulting customers suffer from anxiety and other psychological disorders[28]. This situation is further exacerbated when it affects a person with a NCD, which can compromise adherence to drug and non-drug treatments due to the lack of financial resources, especially with regard to access to food in terms of quantity and quality.
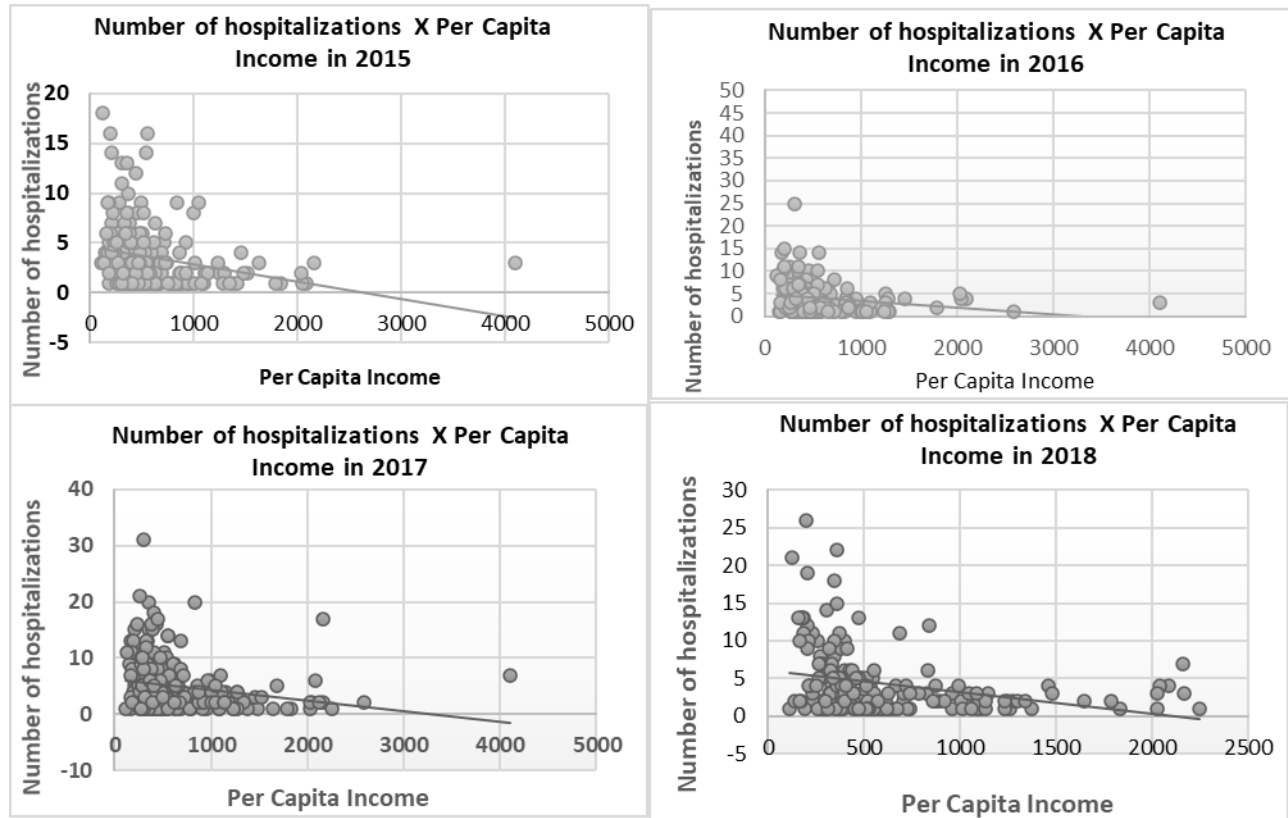

FIGURE 1: Relation between the number of hospitalizations for NCDs and the per capita income of residents in São Carlos-SP from 2015 to 2018. São Carlos, SP, Brazil, 2018.
Source: Prepared by the authors.

A similar study carried out in the metropolitan region of Porto Alegre – RS showed a relation between the increase in ACSCs, income and the indicator for income inequality (which analyzes particularities in the location of the diseases that have more impact on a given population). It has also been shown that the length of study has also had an impact on the development of NCDs, with a higher incidence of these diseases among people with lower levels of education (0 to 8 years of study)[29].

With respect to the household income, in 2015, a correlation of (-0.104) was found, which explains up to 10% of registered hospitalizations; in 2016, the correlation was (-0.120), which could explain up to 12% of hospitalizations; in 2017, the correlation was (-0.156), which explains up to 16% of hospitalizations; and in 2018, the correlation was (-0.254), which explains up to 25% of hospitalizations.

A negative correlation shows that there is an inversely proportional relation between the average household income and the number of hospitalizations for NCDs, it is also highlighted that, as of 2017, the results indicate a linear trend of negative values, that is, a reduction in hospitalizations in the group of people with income above R$3,000.00, when compared to 2015 and 2016.

It is also noted that, when compared to per capita income, the average household income had a lower level of significance, and this result can be explained in part because this value is not exact, but an estimated value. Thus, it can be inferred that the variable average household income reveals the situation of the set of families that reside in a given location and does not show the particularities of the economic situation of each person. Knowing the average household

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income is important to identify the demands of a particular region in the municipality, that is, the lower the average household income in a region, the greater its needs.

The spatial analysis showed a predominance of hospitalizations in the central and peripheral regions in the municipality (Figure 2). The central region of the municipality has a high concentration of elderly residents, who are considered more likely to develop NCDs, especially DM and SAH.
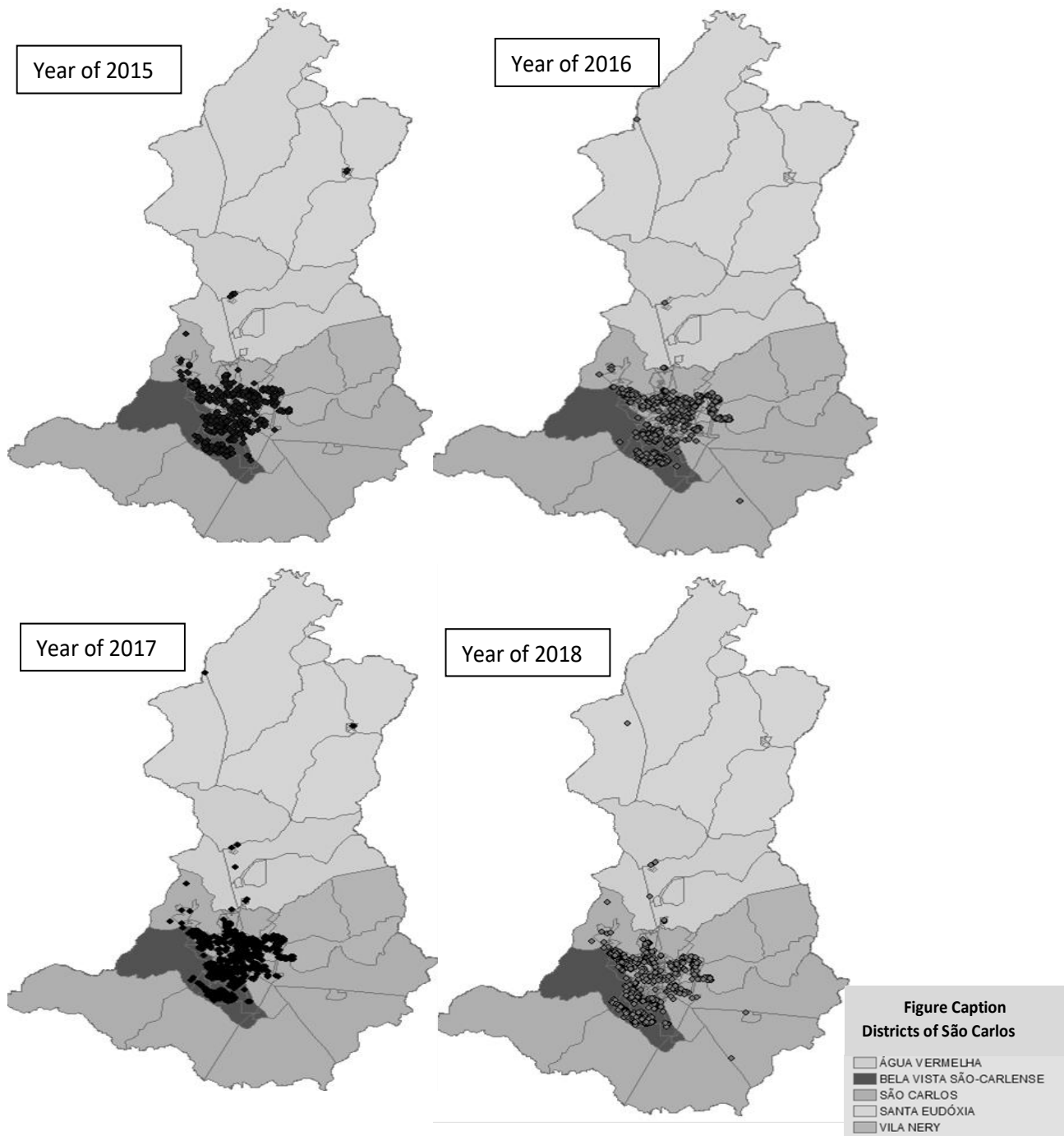

FIGURE 2: Spatial analysis of hospitalizations for NCD, classified by Districts in São Carlos-SP between 2015 and 2018. São Carlos, SP, Brazil, 2020.
Source: Prepared by the authors, based on cartographic data from IBGE, the 2010 Census and the HAA of the municipality of São Carlos-SP. São Carlos, SP, Brazil, 2020

Pereira HNS, Moschini LE, Uehara SCSA
Economic indicators and chronic non-communicable diseases

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: http://dx.doi.org/10.12957/reuerj.2021.58644

In 2017, a study carried out in São Carlos-SP found that 35% (5,690) of adults and elderly people had any NCD, which represented 76% of the sample[30]. Studies at national and international level also confirm this trend, due to the current scenario of greater longevity of the world population[6,30,31,34,35].

In addition, the results indicate a concentration of points in peripheral neighborhoods, showing a relationship between the incidence of NCDs and social vulnerability. Lack of financial means can lead to an increase in the NCDs burden and evidences the effects of inequalities in accessing the health services, rapid urbanization, sedentary living and high-calorie food intake, and marketing that encourages tobacco and alcohol use[12].

In the analysis of georeferenced data, it was also observed is a trend towards stability in the spatial distribution of cases of NCDs in 2015 and 2016. In 2017 and 2018, there is a discrete distribution of points in districts with rural characteristics (Figure 2).

In the rural context, it is relevant to evaluate the access of this population to health care and to propose strategies to make this population aware of the importance of monitoring NCDs, as well as the adherence to treatment and actions to prevent these diseases.

In the literature, there is a consensus that, in addition to the mobility difficulties in accessing the health system, the rural population is also more likely to have low levels of education. In this scenario, it should also be considered that due to changes in the capitalist economy, many rural properties stopped planting subsistence crops and started to invest in monoculture to sell products on a larger scale, contributing to a greater adherence to a dietary pattern that is rich in fat and carbohydrates[32].

The analysis of per capita income in the municipality of São Carlos-SP shows that most inhabitants have a per capita income of 1 to 2 minimum wages (Figure 3). However, the southwestern region in the municipality stands out, as shown in the zoom in Figure 3, with an average per capita income in a range from ½ to 1 minimum wage.
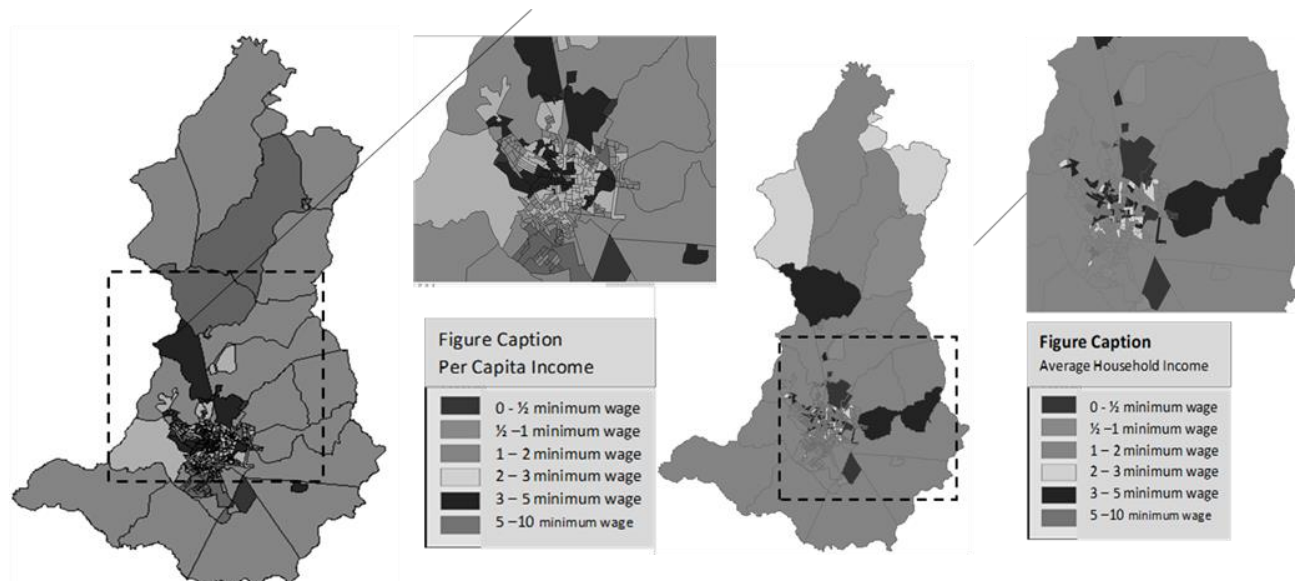

FIGURE 3: Per capita income and average household income in the municipality of São Carlos-SP from 2015 to 2018. São Carlos, SP, Brazil, 2018.
Source: Prepared by the authors.

When analyzing the average household income in the municipality's districts, there is a predominance of incomes from one to two minimum wages in most part of the municipality; however, the southern region is characterized by presenting an area of high economic vulnerability (Figure 3).

In the municipality of São Carlos there is a phenomenon in which the periphery is valued due to the presence of luxury condominiums. The municipality has a pattern of growth in two sectors, with one being towards the west region, with popular allotments; and the other one towards the north/northeast region with the expansion of luxury condominiums, a region that has aspects very different from those seen in the periphery of the western region[33,34]. This phenomenon reveals the municipality's heterogeneity and makes a warning so that urban segregation does not

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perpetuate even further in the municipality, resulting in an even more pronounced social exclusion of this population that has historically suffered from socio-territorial inequalities.

Knowing the particularities of the municipality is essential for understanding the distribution of NCDs, since not only housing located on the periphery should be considered vulnerable, but also the entire demographic and social context in which the population is inserted.

Therefore, the relation between income and access to quality health care is evidenced, which has a direct impact on the prevention and health promotion in this most vulnerable population. The lack of preventive measures considered simple in PHC, such as blood pressure control and blood glucose control, makes more difficult the diagnosis and early treatment of a NCD, making its treatment more costly for both the patient who will live with limitations resulting from this comorbidity and the health system[35,36]. Some authors emphasize that the low adherence to NCDs treatments and the difficulty in reducing risk factors may be related to a poor training in health education, which does not address the psychosocial dimensions of the health-disease process and makes difficult the professional's role in rising awareness of the patient living with a NCD[35].

Study limitations

The limitations of this study are due to the quality of secondary sources, elaborated from handwritten information, which does not always come from a reliable record, and does not allow the analysis of these data, especially information related to address and zip code. With the increase in the elderly population in Brazil, further studies will be needed to understand the factors that can be modified in order to reduce and control the increase in NCDs and, consequently, in ACSC in Brazil.

CONCLUSION

This study evidenced a greater concentration of hospitalizations in the most vulnerable areas of the municipality, showing that the economic variable represents one of the determining factors on the distribution of hospitalizations for NCDs, since income has a direct impact on access to health products, healthy eating and health services. The relation between the number of people hospitalized for NCD and housing in rural areas was also explored in this study, warning of possible studies on the subject and whether this population actually has access to health promotion and disease prevention strategies.

A greater concentration of hospitalizations was also found in the regions of the municipality where there is a higher concentration of elderly people, and this finding can help the municipal authorities to structure prevention strategies in the areas of greater vulnerability.

REFERENCES

1. Magalhães, A. L. A., & Morais Neto, O. L. D. Intra-urban differences in rates of admissions for ambulatory care sensitive conditions in Brazil's Center-West region. Ciênc Saúde Colet. [Internet]. 2017 [cited 2020 Sep 13]; 22:2049-62. DOI: 10.1590/1413-81232017226.16632016.
2. Ministério da Saúde (Br). Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Norma informativa: Aspectos metodológicos do coeficiente de mortalidade prematura por doenças crônicas não transmissíveis. Brasília, 2018. [cited 2020 Sept 13]. Available from: http://portalarquivos2.saude.gov.br/images/pdf/2018/novembro/23/Notainformativan-final.pdf.
3. Alfradique, M. E., Bonolo, P. D. F., Dourado, I., Lima-Costa, M. F., Macinko, J., Mendonça, C. S., ... & Turci, M. A. Ambulatory care sensitive hospitalizations: elaboration of Brazilian list as a tool for measuring health system performance (Project ICSAP – Brazil). Cad Saúde Pública. [Internet]. 2009 [cited 2020 Sept 13]; 25:1337-49. Available from: https://www.scielosp.org/article/csp/2009.v25n6/1337-1349/pt/.
4. Tavares, Noemia Urruth Leão et al. Fatores associados à baixa adesão ao tratamento farmacológico de doenças crônicas no Brasil. Rev Saúde Pública. [Internet]. 2016 [cited 2020 Ago 15]; 50:10s. DOI: https://doi.org/10.1590/S1518-8787.2016050006150.
5. Fernandes, ADF et al. A 10-Year Trend Analysis of Heart Failure in the Less Developed Brazil. Arq Bras Cardiol [Internet]. 2019 [cited 2020 Ago 15]; 114(2):222-31, DOI: https://doi.org/10.36660/abc.20180321.
6. Pinto LF, Giovanella L. The Family Health Strategy: expanding access and reducing hospitalizations due to ambulatory care sensitive conditions (ACSC). Ciên Saúde Colet. [Internet]. 2018 [cited 2021 Mar 02]; 23(6):1903-14. DOI: 10.1590/1413-81232018236.05592018.
7. Ministério da Saúde (Br). Portaria no 221, de 17 de abril de 2008. Publica a lista brasileira de internações por condições sensíveis à atenção primária. Diário Oficial da União, Brasília, p. 70, 18 abr. 2008. Seção 1. [cited 2020 Ago 15]. Available from: https://bvsms.saude.gov.br/bvs/ saudelegis/sas/2008/prt0221_17 _04_2008.html.

8. Figueiredo filho, Dalson Britto; SILVA JÚNIOR, José Alexandre da. Desvendando os Mistérios do Coeficiente de Correlação de Pearson (r). Revista Política Hoje [Internet]. 2009 [cited 2021 Mar 02]; 18(1):115-46, Available from: https://periodicos.ufpe.br/revistas/politicahoje/article/viewFile/3852/3156.

9. Guanais F, Gómez-Suárez R, Pinzón L. Series of avoidable hospitalizations and strength–ening primary health care: primary care effectiveness and the extent of avoidable hospitalizations in Latin America and the Caribbean. Inter-American Development Bank. [Internet]. 2012 [cited 2021 Mar 02]. Available from: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=37846490.

10. Cureau, Felipe Vogt; Duarte, Paola Marques; Teixeira, Fernanda de Souza. Simultaneity of behavioral risk factors for chronic non-communicable disease among low-income undergraduate students from a city in southern Brazil. Cad. Saúde Colet. [Internet]. 2019 [cited 2021 Mar 02]; 27(3):316-24, DOI: https://doi.org/10.1590/1414-462X201900030178.

11. Kishore, Sandeep P. et al. Overcoming obstacles to enable access to medicines for noncommunicable diseases in poor countries. Health Affairs [Internet]. 2015 [cited 2021 Mar 02]; 34(9):1569-77, DOI: 10.1377/hlthaff.2015.0375.

12. Malta, D. C., Gosch, C. S., Buss, P., Rocha, D. G., Rezende, R., Freitas, P. C., & Akerman, M. (2014). Chronic Non Communicable Diseases and the support of intersectorial action to tackle them. Ciênc Saúde Colet. [Internet]. 2014 [cited 2021 Mar 02]; 19:4341-50. DOI: https://doi.org/10.1590/1413-812320141911.07712014.

13. Maia LG, Silva LA, Guimarães RA, Pelazza BB, Pereira ACS, Rezende WL, et al. Hospitalizations due to primary care sensitive conditions: an ecological study. Rev. Saude Publica [Internet]. 2019 [cited 2021 jan 10]; 53(2):1-10. DOI: https://doi.org/10.11606/S1518-8787.2019053000403.

14. Malta, Deborah Carvalho; SILVA, Marta Maria Alves da. Noncommunicable Chronic Diseases: the contemporary challenge in Public Health. [Internet]. 2018. [cited 2021 jan 10]; 23(5):1350. DOI: https://doi.org/10.1590/1413-81232018235.31552017.

15. Sociedade brasileira de diabetes. Diretrizes da sociedade brasileira de diabetes, 2019. [cited 2020 sep 13].Available from: http://www.saude.ba.gov.br/wp-comtent/uplo ads/2020/02/Diretrizes-Sociedade-Brasileira-de-Diabetes-20192020.pdf.

16. Oscalices MIL, Okuno MFP, Lopes MCBT, Campanharo CRV, Batista REA. Discharge guidance and telephone follow-up in the therapeutic adherence of heart failure: randomized clinical trial. Rev. Latino-Am. Enfermagem. 2019;27:e3159.]. [cited 2020 Aug 15]. DOI: 10.1590/1518-8345.2484-3159.

17. Sociedade Brasileira de Cardiologia. Campanha de conscientização da angina, 2019. [cited 2021 jan 06]. Available from: https://servier.com.br/sociedade-brasileira-de-cardiologia-faz-campanha-sobre-angina.

18. Furukawa, Tatiane Sano; MATHIAS, Thais Aidar de Freitas; MARCON, Sonia Silva. Stroke mortality by residence and place of death: Paraná State, Brazil, 2007. Cad Saúde Pública. [Internet]. 2011 [cited 2021 jan 06]; 27:327-34, DOI: https://doi.org/10.1590/S0102-311X2011000200014.

19. Bacurau, Aldiane Gomes de Macedo et al. Mortality due to cerebrovascular disease among the elderly and vaccination against influenza: São Paulo State, Brazil, 1980-2012. Cad. Saúde Pública. [Internet]. 2019 [cited 2021 jan 06]; 35:e00145117, DOI: https://doi.org/10.1590/0102-311X00145117.

20. World Health Organization – WHO, 2014. Global Status Report on Noncommunicable Diseases. [cited 2021 jan 07]. Available from: http://apps.who.int/iris/bitstream /handle/10665/148114/9789241564854_eng.pdf;jsessionid=1F17B50ED4BC4F835518BE77F010E790?sequence=1.

21. Leal, Lisiane Freitas et al. Epidemiology and burden of chronic respiratory diseases in Brazil from 1990 to 2017: analysis for the Global Burden of Disease 2017 Study. Rev Bras Epidemiol [Internet]. 2020 [cited 2021 jan 07]; 23:e200031, 2020. [cited 2021 jan 07]. DOI: https://doi.org/10.1590/1980-549720200031.

22. Unidades de saúde. Prefeitura de São Carlos, São Carlos,2020. [cited 2020 set 20]. Available from: http://www.saocarlos.sp.gov.br/index.php/saude/115420-unidades-desaude.html.

23. Instituto Brasileiro de Geografia e Estatística (IBGE). Estimativas populacionais para os municípios brasileiros (2015;2016;2017;2018). 2020. [cited 2020 sep 20]. Available from: https://www.ibge.gov.br/estatisticas/sociais/populacao/9103-estimativas-de-populacao.htm l?edicao=17283&t=downloads.

24. Brasil. Ministério da saúde. Secretaria de Atenção Primária à saúde (SAPS). Cobertura da atenção básica dez.2017- dez.2018. [cited 2020 oct 23] Available from: https: //egestorab.saude.gov.br/paginas/acessoPublico/relatorios/relHistoricoCobertura AB.xhtml.

25. Pereira, Francilene Jane Rodrigues et al. Mapeando os atos e ações de saúde ofertadas nas unidades da estratégia saúde da família e as internações por condições sensíveis à atenção primária: ancorando a construção de um indicador sintético em municípios brasileiros.2015. [cited 2020 dez 03] Available from: https://repositorio.ufpb.br/jspui/handle/tede /7963.

26. Pinto, Luiz Felipe et al. Hospitalisations due to ambulatory care sensitive conditions (ACSC) between 2009 and 2018 in Brazil's Federal District as compared with other state capitals. Ciênc Saúde Colet. [Internet]. 2019 [cited 2020 dez 03]. 24:2105-14, DOI: https://doi.org/10.1590/1413-81232018246.08582019.

27. Soranz D, Pinto LF, Penna GO. Themes and Reform of Primary Health Care (RCAPS) in the city of Rio de Janeiro, Brazil. Ciênc Saúde Colet. [Internet]. 2016 [cited 2020 dez 03]; 21(5):1327-38. DOI: https://doi.org/10.1590/1413-81232015215.01022016.

28. Cndl/ serviço de proteção ao crédito (SPC), 2020. [cited 2021 jan 10]. Available from: https://www.spcbrasil.org.br/pesquisas/.

29. Schmitt, Lucianna. Relação das internações por condições sensíveis à atenção primária em saúde com o índice de desenvolvimento humano e internações na região metropolitana de Porto Alegre/RS. 2017. [cited 2021 mar 02]. Available from: https://www.lume.ufrgs.br/ handle/10183/169590.

30. Sato, Tatiana de Oliveira et al. Chronic Noncommunicable Diseases Among Family Health Unit Users - Prevalence, Demographics, Use of Health Services and Clinical Needs. Rev Bras Ciênc Saúde [Internet]. 2017 [cited 2021 mar 02]; 21(1):35-42, DOI:10.4034/RBCS.2017.21.01.05.

31. Melo, Silvia Pereira da Silva de Carvalho et al. Chronic noncommunicable diseases and associated factors among adults in an impoverished urban area of the Brazilian northeast. Ciênc Saúde Colet. [Internet]. 2019 [cited 2021 mar 02]; 24:3159-68, DOI: https://doi.org/10.1590/1413-81232018248.30742017.

32. Braga, Ana Claudia Rocha et al. Entre a monocultura e a diversidade: alternativas para o desenvolvimento rural da região de Tomé-Açu, Pará. 2017. [cited 2021 mar 02]. Available from: http://repositorio.unicamp.br/ handle/REPOS IP/322735.

33. Jordão, Larissa CS. Novas Periferias urbanas: A expansão de São Carlos através de Condomínios Fechados. São Carlos, 2010. [cited 2021 mar 02]. Available from: https://www.historia.uff.br/estadoepoder/7snep /docs/020.pdf.

34. Siqueira, Barbara Vallilo. O atual modelo de produção periférica nas cidades brasileiras: o Programa Minha Casa Minha Vida nos municípios paulistas de São Carlos e São José do Rio Preto. In: VII Seminario Internacional de Investigación en Urbanismo, Barcelona-Montevideo, junio 2015. Departament d'Urbanisme i Ordenació del Territori. Universitat Politècnica de Catalunya, 2015. [cited 2021 mar 02]. Available from: http://hdl.handle.net/2117/81312.

35. RIBEIRO, Amanda Gomes; COTTA, Rosângela Minardi Mitre; RIBEIRO, Sônia Machado Rocha. The promotion of health and integrated prevention of risk factors for cardiovascular diseases. Ciênc Saúde Colet. [Internet]. 2012 [cited 2021 oct 03]; 17:7-17, DOI: https://doi.org/10.1590/S1413-81232012000100002.

36. Brasil. Ministério da saúde. Cadernos de atenção básica. Estratégias para o cuidado da pessoa com doença crônica. Brasília.2014. [cited 2021 oct 03]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/estrategias_cuidado_pessoa_doenca_cronica_cab35.pdf.