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ORIGINAL ARTICLE

Smoking cessation program impacts on mortality and hospitalizations for cardiovascular diseases

Impacto do programa de cessação do tabagismo na mortalidade e hospitalizações por doenças cardiovasculares

Impacto del programa de cesación del tabaquismo en la mortalidad y hospitalizaciones por enfermedades cardiovasculares

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ABSTRACT

Background and Objectives: Smoking is an important risk factor for CVD. Tobacco use is associated with health system expenditures and loss of life expectancy and quality of life. Brazil has a tobacco control program and has shown a continuous decline in prevalence. This study verified whether the decrease in smoking prevalence was reflected in mortality and hospitalizations due to CVD, comparing with the same variables for RTD. **Methods:** The period 2006-2023 was divided into six triennia. Data on smoking prevalence, population, and mortality and hospitalizations due to CVD and RTD were extracted from VIGITEL, IBGE, and DATASUS. The Rstudio software, version 4.1.2, was used to perform the linear regression model and the correlation test. **Results:** Prevalence tended to decrease in Brazil and its regions, except for the Midwest. Mortality and hospitalization rates per 100,000 inhabitants showed an upward trend in Brazil. Hospitalizations due to RTD showed a strong downward trend, with only the South showing stability. There was no positive correlation between the prevalence of smoking and the variables mortality rate and hospitalizations per 100,000 due to CVD, while there was a strong positive correlation for hospitalizations due to RTD. **Conclusion:** The participation of other risk factors in mortality and hospitalizations due to CVD should be investigated and awareness campaigns about smoking should be expanded. The tobacco control program is an example of a successful public policy.

Keywords: *Hospitalization. Mortality. Tobacco. Cardiovascular Diseases.*

RESUMO

Justificativa e Objetivos: O tabagismo é um importante fator de risco para doenças cardiovasculares (DCV). O uso do tabaco está relacionado com gastos do sistema de saúde e

com a perda da expectativa e qualidade de vida. O Brasil possui um programa de controle do tabagismo e tem apresentado contínua queda da prevalência. Este estudo verificou se houve reflexo da queda da prevalência do tabagismo na mortalidade e hospitalizações por DCV, comparando com as mesmas variáveis para doenças do aparelho respiratório (DAR). **Métodos:** O período de 2006-2023 foi dividido em 6 triênios. Os dados de prevalência do tabagismo, população e mortalidade e hospitalizações por DCV e por DAR foram extraídos do VIGITEL, IBGE e DATASUS. Para realizar o modelo de regressão linear e o teste de correlação foi usado o *software* Rstudio, versão 4.1.2. **Resultados:** A prevalência tendeu a queda no Brasil e suas regiões, com exceção do Centro-Oeste. Os coeficientes de mortalidade e de internamentos hospitalares por 100.000 habitantes apresentaram tendência de alta no Brasil. As hospitalizações por DAR registraram forte tendência de queda, com somente o Sul apresentando estabilidade. Não houve correlação positiva entre prevalência do tabagismo com as variáveis coeficiente de mortalidade e internações hospitalares a cada 100.000 por DCV, enquanto para as hospitalizações por DAR houve forte correlação positiva. **Conclusão:** Deve-se investigar a participação de outros fatores de risco na mortalidade e hospitalizações por DCV e ampliar campanhas de conscientização sobre o tabagismo. O programa de controle do tabagismo é um exemplo de política pública de sucesso.

Descritores: *Hospitalização. Mortalidade. Tabagismo. Doenças Cardiovasculares*.

RESUMEN

Justificación y Objetivos: El tabaquismo es un factor de riesgo importante para las enfermedades cardiovasculares (ECV). El consumo de tabaco está relacionado con gastos del sistema de salud y pérdida de esperanza y calidad de vida. Brasil tiene un programa de control del tabaco y ha experimentado un descenso continuo de su prevalencia. Este estudio verificó si la disminución de la prevalencia del tabaquismo se reflejó en la mortalidad y las hospitalizaciones por ECV, comparándolas con las mismas variables para ER. **Metodos:** El período 2006-2023 se dividió en 6 trienios. Los datos sobre prevalencia de tabaquismo, población y mortalidad y hospitalizaciones por ECV y ER se extrajeron de VIGITEL, IBGE y DATASUS. Para realizar el modelo de regresión lineal y la prueba de correlación se utilizó el *software* RStudio, versión 4.1.2. **Resultados:** La prevalencia tendió a disminuir en Brasil y en sus regiones, con excepción de la región Centro-Oeste. Las tasas de mortalidad y de admisión hospitalaria por cada 100 mil habitantes mostraron una tendencia ascendente en Brasil. Las hospitalizaciones por ER registraron una fuerte tendencia a la baja, mostrando estabilidad solo en la región Sur. No se encontró correlación positiva entre la prevalencia de tabaquismo y las variables tasas de mortalidad y de hospitalización por ECV por cada 100.000 habitantes, mientras que para las hospitalizaciones por ER hubo una fuerte correlación positiva. **Conclusión:** Se debe investigar la participación de otros factores de riesgo en la mortalidad y hospitalizaciones por ECV y ampliar las campañas de concientización sobre el tabaquismo. El programa de control del tabaco es un ejemplo de una política pública exitosa.

Palabras Clave: *Hospitalización. Mortalidad. Tabaquismo. Enfermedades Cardiovasculares.*

INTRODUCTION

Smoking is recognized as the leading cause of preventable deaths in Brazil and worldwide, constituting a major risk factor for non-communicable chronic diseases (NCDs). In 2021, more than 1.3 billion people were smokers globally, with approximately 80% residing in middle- and low-income countries. From 1990 to 2019, tobacco use was responsible for more

than 200 million deaths. Tobacco consumption is strongly associated with the development of cardiovascular diseases (CVDs), respiratory diseases, and various types of cancer.[1-4]

In Brazil, smoking remains a significant public health issue, causing approximately 400 deaths every day. Statistics indicate that smoking is responsible for about 80% of deaths from lung cancer and a substantial proportion of deaths from chronic respiratory diseases such as chronic obstructive pulmonary disease (COPD), in addition to contributing to deaths from heart disease and stroke. In terms of years of life lost, it is estimated that smoking results in the loss of more than 2.6 million years of life annually, either through reduced life expectancy or decreased quality of life. Between 1996 and 2020, smoking accounted for more than 2.3 million deaths among individuals aged 35 years or older, representing approximately 8.5% of total mortality in the country. Around 43% of deaths attributed to tobacco use were due to cardiometabolic causes. Furthermore, COPD remains one of the main causes of death associated with smoking. According to recent data, smoking-related illnesses cost the Brazilian health system more than 23 billion reais annually, of which about 11% are due to diseases resulting from exposure to secondhand smoke. More than 8.7 billion reais are linked to cardiovascular diseases, and almost 6.8 billion to COPD-related conditions.[4-8]

Cardiovascular diseases stand out as the leading cause of death in Brazil, with ischemic heart disease (IHD) and stroke being the primary specific conditions. Approximately 30% of deaths from NCDs in the country are due to cardiovascular causes. Tobacco use, whether through cigarettes or heated products, induces endothelial dysfunction and oxidative stress, promotes the development of atherosclerosis, peripheral arterial disease, and aneurysms, increases blood pressure, activates the sympathetic nervous system, and can lead to atrial fibrillation. These factors culminate in events such as IHD, stroke, venous thromboembolism, and hospitalizations due to heart failure. Regarding respiratory diseases, hospitalizations among smokers frequently occur due to exacerbations of COPD or asthma, pleural effusion, spontaneous pneumothorax, cancer-related complications, and pneumonia. In addition, smoking is associated with conditions such as idiopathic pulmonary fibrosis, emphysema, and tuberculosis.[1,9–13]

In 1989, the National Tobacco Control Program (PNCT) was established, coordinated by the National Cancer Institute (INCA), with the objective of reducing the social acceptance of smoking, preventing initiation, supporting cessation, and protecting the population from exposure to tobacco smoke. Since the implementation of the PNCT, Brazil has recorded a

significant decrease in smoking prevalence, which dropped from 34.8% in 1989 to 15.2% in 2006 and further to 9.4% in 2014.[2,14-16]

The justification for the present research lies in the importance of addressing smoking as a public health issue that directly affects mortality and the population's quality of life. This study seeks to contribute to the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), which aims to ensure healthy lives and promote well-being for all at all ages, and SDG 10 (Reduced Inequalities), which aims to reduce health inequalities related to risk factors such as smoking. Understanding the relationship between smoking prevalence and its health outcomes is essential to improving prevention and control policies and to more effectively directing public health resources and efforts.

In this context, the objective of this study is to assess whether the decline in smoking prevalence has had an impact on mortality and hospitalizations due to cardiovascular diseases (CVDs), comparing these data with the same variables for respiratory diseases (RDs).

METHODS

This study consists of an ecological epidemiological time-series analysis, covering the period from 2006 to 2023, structured into six three-year periods: the first (2006-2008), the second (2009-2011), the third (2012-2014), the fourth (2015-2017), the fifth (2018-2020), and the sixth (2021-2023). The independent variable is the prevalence of smoking, while the dependent variables are the mortality and hospitalization rates related to chronic diseases.

Data on the prevalence of smoking were extracted from the Surveillance of Risk and Protective Factors for Chronic Diseases by Telephone Survey (VIGITEL), which provides this information annually since 2006, with the exception of 2022. Data on mortality and hospitalizations were obtained from the Mortality Information System (MIS) and the Hospital Information System (HIS), accessed through TABNET of the Department of Informatics of the Unified Health System (SUS) (DATASUS), focusing on ICD-10 codes related to diseases of the circulatory system (ICD I00 to I99) and the respiratory system (ICD J00 to J99). However, mortality data for the year 2023 were not yet available on DATASUS. Population data were obtained from the Brazilian Institute of Geography and Statistics (IBGE), based on the 2022 population census. As VIGITEL only covers the adult population (18 years or older) of the capitals and the Federal District (FD), the mortality and hospitalization data were also restricted to the population residing in these locations.

The extracted data were organized in a Google Spreadsheets, where the average prevalence of smoking, as well as the mortality and hospitalization rates for chronic diseases

for each three-year period in the different regions and in Brazil, were calculated. To calculate the average prevalence of smoking in each region, the sum of the annual smoking prevalences of the capitals was divided by the total number of capitals in the region. The average was then summed over the years available in the three-year period, and the result was divided by the total number of years with available data. The average prevalence of smoking in Brazil was obtained similarly, by summing the overall prevalences as disclosed by VIGITEL and dividing by the total number of years with available data.

For the averages of mortality and hospitalizations due to chronic diseases in each region, the deaths or hospitalizations that occurred in the capitals were summed, and the total was divided by the total number of years with available data in the three-year period. Then, the mortality and hospitalizations rates per 100,000 inhabitants were calculated, using direct standardization with the total population of Brazil (203,080,756 inhabitants according to the 2022 census) as the standard population. The choice of three-year periods was a strategy to minimize the random variation of the coefficients, given that there were no major changes in mortality rates when analyzing the data year by year.

The statistical analysis was conducted in RStudio (version 4.1.2), where a linear regression model was applied to assess the temporal trends of the study variables. The regression model provided trend coefficients, confidence intervals, p-values, and r^2. In addition, Pearson's correlation test was performed to verify the relationship between the prevalence of smoking and the mortality and hospitalization rates. The test generated the correlation coefficient, confidence intervals, and p-values, considering that $p<0.05$ indicates a statistically significant correlation between the variables. Regarding ethical issues, the study respected the ethical guidelines for health research, ensuring data confidentiality, anonymity of individuals, and guaranteeing that the use of information followed the stipulated ethical principles, in accordance with the standards of scientific research in Brazil (single paragraph of article 1 of CNS Resolution No. 510/2016).

RESULTS

For the period between 2006 and 2023, a decrease in the prevalence of smoking was observed in all regions and in Brazil, however, the Central-West region showed a trend towards stability (-0.79%; 95% CI [-1.65% - 0.05%]; p = 0.060). Brazil showed a trend of a 1.29% decrease (95% CI [-1.81% - -0.77%]; p = 0.002) in prevalence every three years. Among the regions, the one with the greatest downward trend was the North, with a trend coefficient of -1.53 (95% CI [-2.57% - -0.48%]; p = 0.015), followed by the South, with a decrease of 1.41% (95% CI [-2.09% - -0.72%]; p=0.004). The Southeast and Northeast regions showed a trend of

reduction in prevalence of 1.28% (95% CI [-1.69% - -0.87%]; p<0.001) and -1.23% (95% CI [-2.04% - -0.42%]; p = 0.013) every three years, respectively (Figure 1A).

Regarding the temporal trend of hospitalizations for cardiovascular diseases, hospitalization rates per 100,000 inhabitants increased by 1.74 (95% CI [0.45 - 3.02]; p = 0.019) from one three-year period to another in Brazil. The Northeast Region was the only one that showed an upward trend in hospitalizations, with an increase of 0.79 (95% CI [0.07 - 1.51]; p = 0.037). Regarding the coefficients of the linear regression model for hospitalizations, the North Region showed an increase of 0.46 (95% CI [-0.45 - 1.38]; p = 0.231), the South Region of 0.30 (95% CI [-0.08 - 0.68]; p = 0.095), the Southeast Region of 0.15 (95% CI [-0.74 - 1.06]; p = 0.652) and the Central-West Region of 0.02 (95% CI [-0.46 - 0.50]; p = 0.899) (Figure 1B).

Regarding mortality from cardiovascular disease (CVD) in the period from 2006 to 2023, an increasing trend was observed in almost all regions of Brazil (Figure 1D). The CVD mortality rate increased by 1.05 (95% CI [0.73 - 1.36]; p < 0.001) per 100,000 inhabitants in Brazil as a whole. The only region that showed a divergent trend was the South Region, showing a reduction of 0.04 deaths from CVD every three years (95% CI [-0.12 - 0.03]; p = 0.208), therefore, tending towards stability. The Southeast Region stood out with the highest upward trend in the mortality coefficient, with an increase of 0.38 (95% CI [0.15 - 0.60]; p = 0.009) per 100,000 inhabitants. The Central-West Region registered an increase of 0.17 (95% CI [0.13 - 0.21]; p < 0.001). The Northeast and North regions also showed an increasing trend, with linear regression coefficients of 0.29 (95% CI [0.25 - 0.32]; p < 0.001) and 0.24 (95% CI [0.22 - 0.27]; p < 0.001), respectively.

In the trend of hospitalizations for acute respiratory diseases (ARD) per 100,000 inhabitants, Brazil showed a decrease of 5.23 (95% CI [-7.90 - -2.56]; p = 0.005) every three years (Figure 1C). The Northeast Region recorded the largest decreasing trend, with a variation of -2.21 (95% CI [-2.87 - -1.56]; p < 0.001) every three years. The Southeast Region followed with a decrease of 1.10 (95% CI [-1.85 - -0.36]; p = 0.014) in hospitalizations for ARD. The Central-West and North Regions also showed reductions, with trends of -1.02 (95% CI [-1.72 - -0.31]; p = 0.016) and -0.68 (95% CI [-1.21 - -0.15]; p = 0.023), respectively. Stability was observed for the South Region, the decrease in hospitalization rates was -0.20 (95% CI [-0.62 - 0.21]; p = 0.244) every three years.

Finally, the trend of mortality coefficients for ARD during the period from 2006 to 2023 for Brazil showed an increase of 1.05 (95% CI [0.40 - 1.69]; p = 0.010) every three years (Figure 1E). The Southeast Region stood out as the one with the highest increasing trend in deaths from acute respiratory distress syndrome (ARDS), with a coefficient of 0.54 (95% CI

[0.18 - 0.89]; p = 0.013). Following this, the Northeast Region registered an increase of 0.28 (95% CI [0.12 - 0.43]; p = 0.007) every three years. For the North Region, the trend was a slight increase with a coefficient of 0.16 (95% CI [0.10 - 0.23]; p = 0.001). Meanwhile, in the Central-West and South regions, the trend was one of stability. The linear regression coefficient was 0.07 (95% CI [-0.02 - 0.16]; p = 0.103) for the Central-West and -0.01 (95% CI [-0.07 - 0.04]; p = 0.556) for the South.

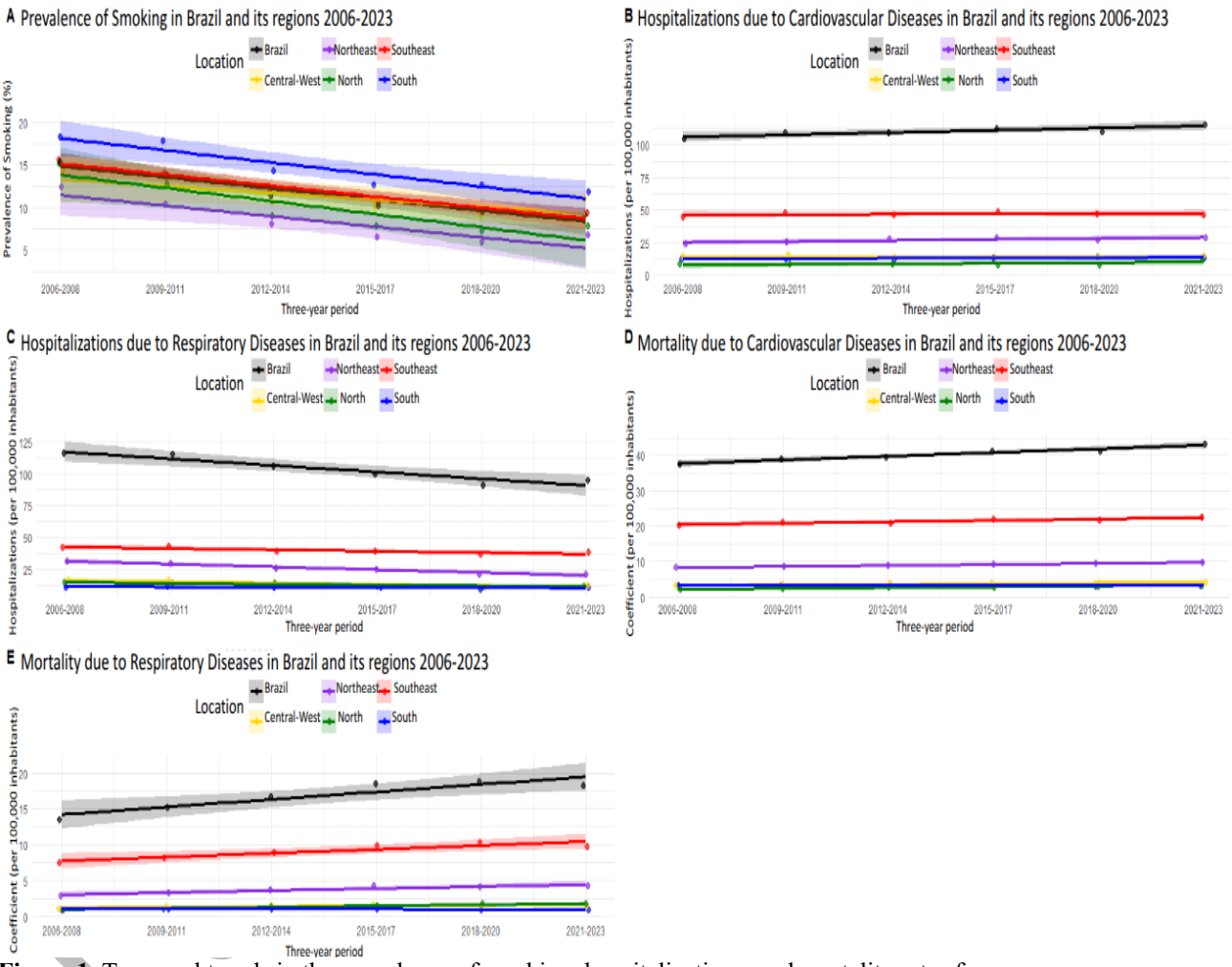

Figure 1. Temporal trends in the prevalence of smoking, hospitalizations, and mortality rates from cardiovascular disease and respiratory diseases.

For the country as a whole, a negative relationship was observed between the prevalence of smoking and hospitalizations for cardiovascular disease (CVD), with a coefficient of -0.84 (95% CI [-0.98 - -0.11]; p = 0.033) (Figure 2a).

Analyzing each Brazilian region, it was observed that in four of the five regions, the prevalence of smoking and hospitalizations for CVD were not correlated. The only region that showed a correlation was the Northeast Region (Figure 2e) with a coefficient of -0.90 (95% CI

[-0.98 - -0.33]; p = 0.013) between the prevalence of smoking and hospitalizations for CVD. The correlation values between the prevalence of smoking and hospitalizations for CVD in the six three-year periods from 2006 to 2023 were as follows: for the South Region (Figure 2b), the coefficient was -0.68 (95% CI [-0.96 - 0.29]; p = 0.137); for the Southeast (Figure 2c), Central-West (Figure 2d) and North (Figure 2f) regions, the correlation coefficients were -0.35 (95% CI [-0.90 - 0.64]; p = 0.489), 0.24 (95% CI [-0.70 - 0.88]; p = 0.644) and -0.25 (95% CI [-0.88 - 0.70]; p = 0.628), respectively.

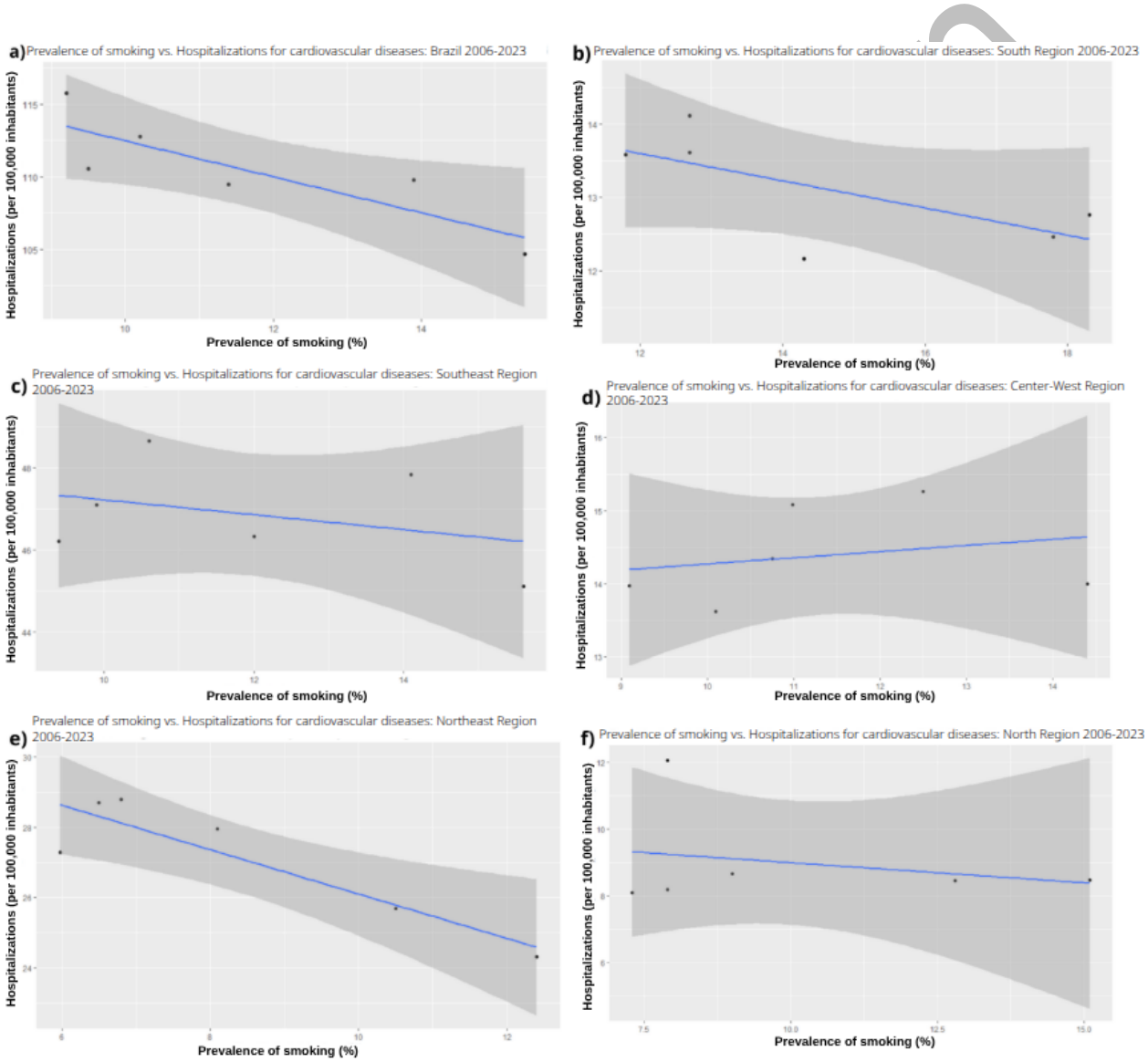

Figure 2. Temporal trends in the prevalence of smoking and hospitalizations for cardiovascular disease (per 100,000 inhabitants). Brazil and regions: 2006-2023.

Regarding the relationship between smoking prevalence and cardiovascular disease (CVD) mortality rate for Brazil and its regions (Figure 3), during the study period, there was a negative correlation (p= 0.008; -0.92 (95% CI [-0.99 - -0.44])) between these variables in the

country (Figure 3a). The Southeast (p= 0.013) (Figure 3c), Northeast (p= 0.025) (Figure 3e), and North (p= 0.026) (Figure 3f) regions showed a correlation between smoking and CVD mortality with the following correlation values, respectively: -0.90 (95% CI [-0.98 - -0.35]), -0.86 (95% CI [-0.98 - -0.18]), and -0.86 (95% CI [-0.98 - -0.17]). In the South (p= 0.240) (Figure 3b) and Central-West (p= 0.097) (Figure 3d) regions, smoking prevalence was not related to the CVD mortality rate, with the correlation value for the South Region being 0.56 (95% CI [-0.45 - 0.94]) and for the Central-West Region being -0.73 (95% CI [-0.96 - 0.19]).

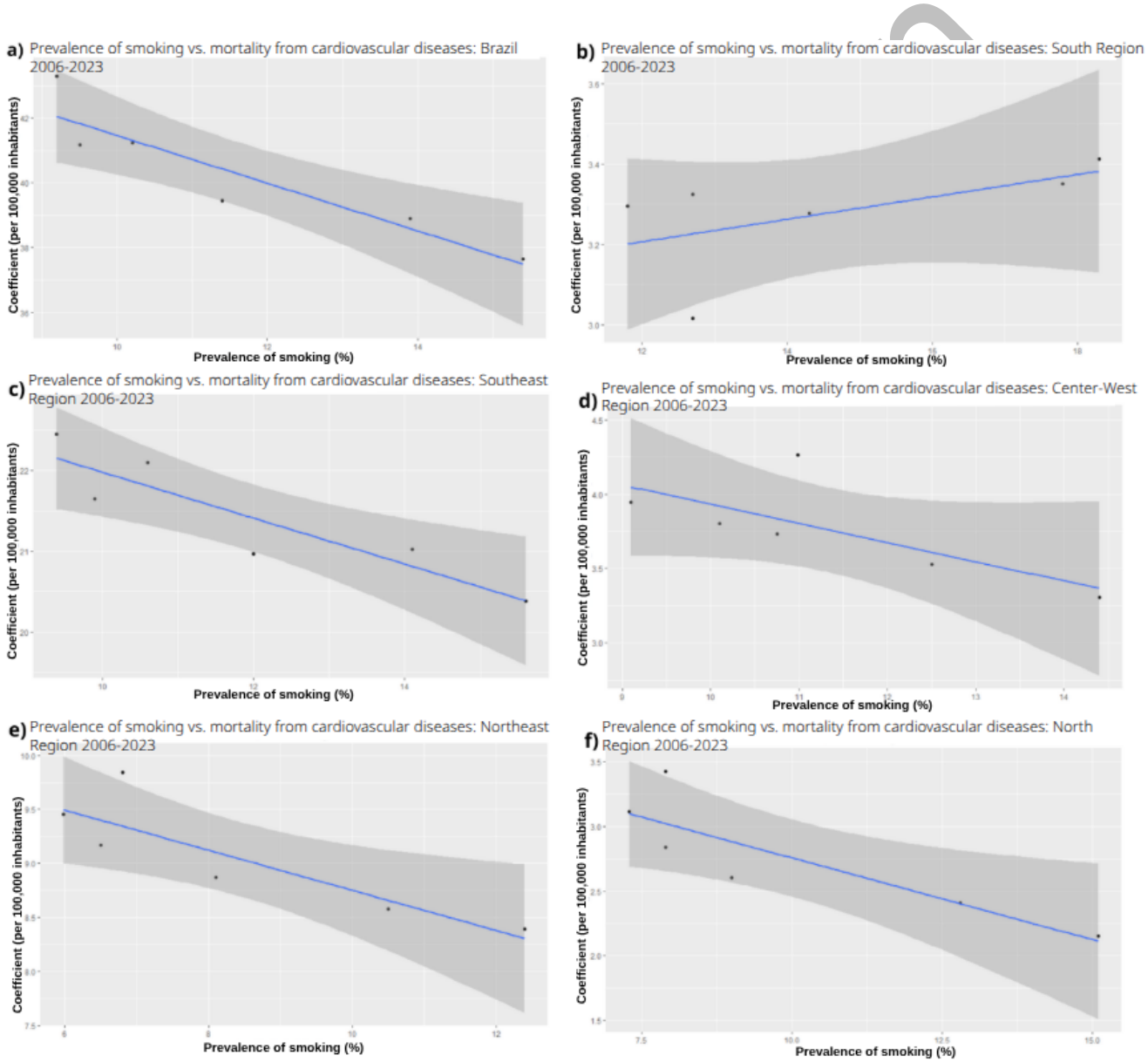

Figure 3. Temporal trend between smoking prevalence and cardiovascular disease mortality rate (per 100,000 inhabitants). Brazil and regions: 2006-2023.

Analyzing the variables of smoking prevalence and hospitalizations (per 100,000) due to respiratory diseases in three-year periods (Figure 4), Brazil showed a positive correlation

(p=0.003) with a correlation value of 0.95 (95% CI [0.62 - 0.99]) between them (Figure 4a). The Brazilian regions followed the country's result; however, the Southern Region (p=0.267; correlation value: 0.54 (95% CI [-0.48 - 0.93])) was an exception (Figure 4b). The regions with a positive correlation between smoking prevalence and hospitalizations due to respiratory diseases presented the following p-values and correlation values: Southeast Region (p=0.005; correlation value: 0.93 (95% CI [0.52 - 0.99])) (Figure 4c); Central-West Region (p=0.018; correlation value: 0.88 (95% CI [0.27 - 0.98])) (Figure 4d); Northeast Region (p=0.005; correlation value: 0.93 (95% CI [0.53 - 0.99])) (Figure 4e); and Northern Region (p=0.046; correlation value: 0.81 (95% CI [0.01 - 0.97])) (Figure 4f).

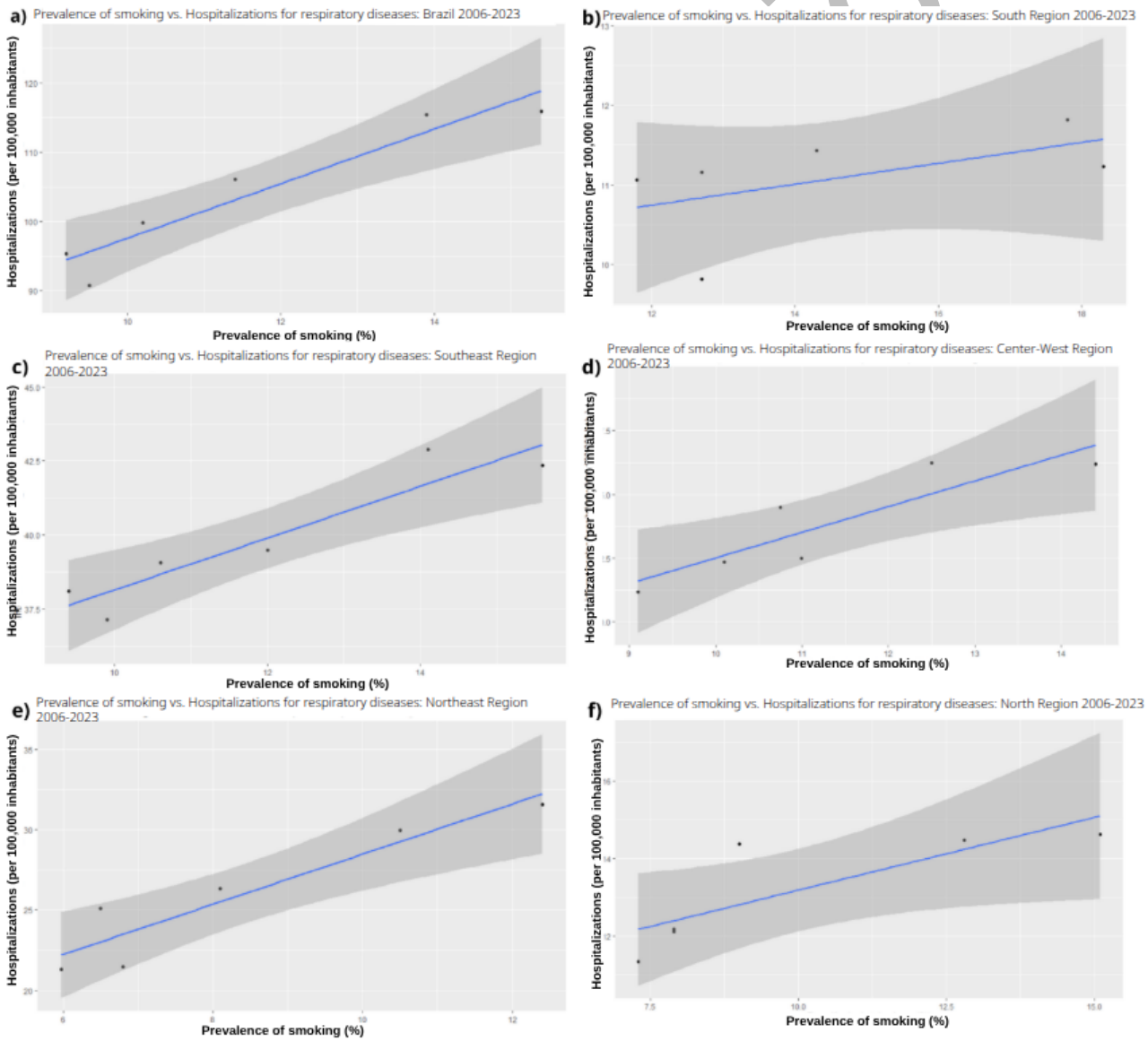

Figure 4. Temporal trend between smoking prevalence and hospitalizations due to respiratory diseases (per 100,000 inhabitants). Brazil and regions: 2006-2023.

Regarding the correlation between the variables of smoking prevalence and mortality rate (per 100,000) from respiratory diseases (Figure 5), a negative correlation was observed at the level of all Brazilian capitals (p-value <0.001; correlation value -0.98 (95% CI [-0.99 - -0.83])) (Figure 5a). Again, the Southern Region diverges from the other regions of the country, showing no correlation (p=0.975) between the variables (correlation value: 0.01 (95% CI [-0.80 - 0.81])) (Figure 5b). The other Brazilian regions follow the trend of Brazil as a whole, presenting the following correlation values between smoking prevalence and deaths per 100,000 inhabitants: Southeast Region (p=0.001; correlation value: -0.96 (95% CI [-0.99 - -0.70])) (Figure 5c); Central-West Region (p=0.014; correlation value: -0.89 (95% CI [-0.98 - -0.32])) (Figure 5d); Northeast Region (p=0.001; correlation value: -0.97 (95% CI [-0.99 - -0.75])) (Figure 5e); and Northern Region (p=0.010; correlation value: -0.91 (95% CI [-0.99 - -0.41])) (Figure 5f).

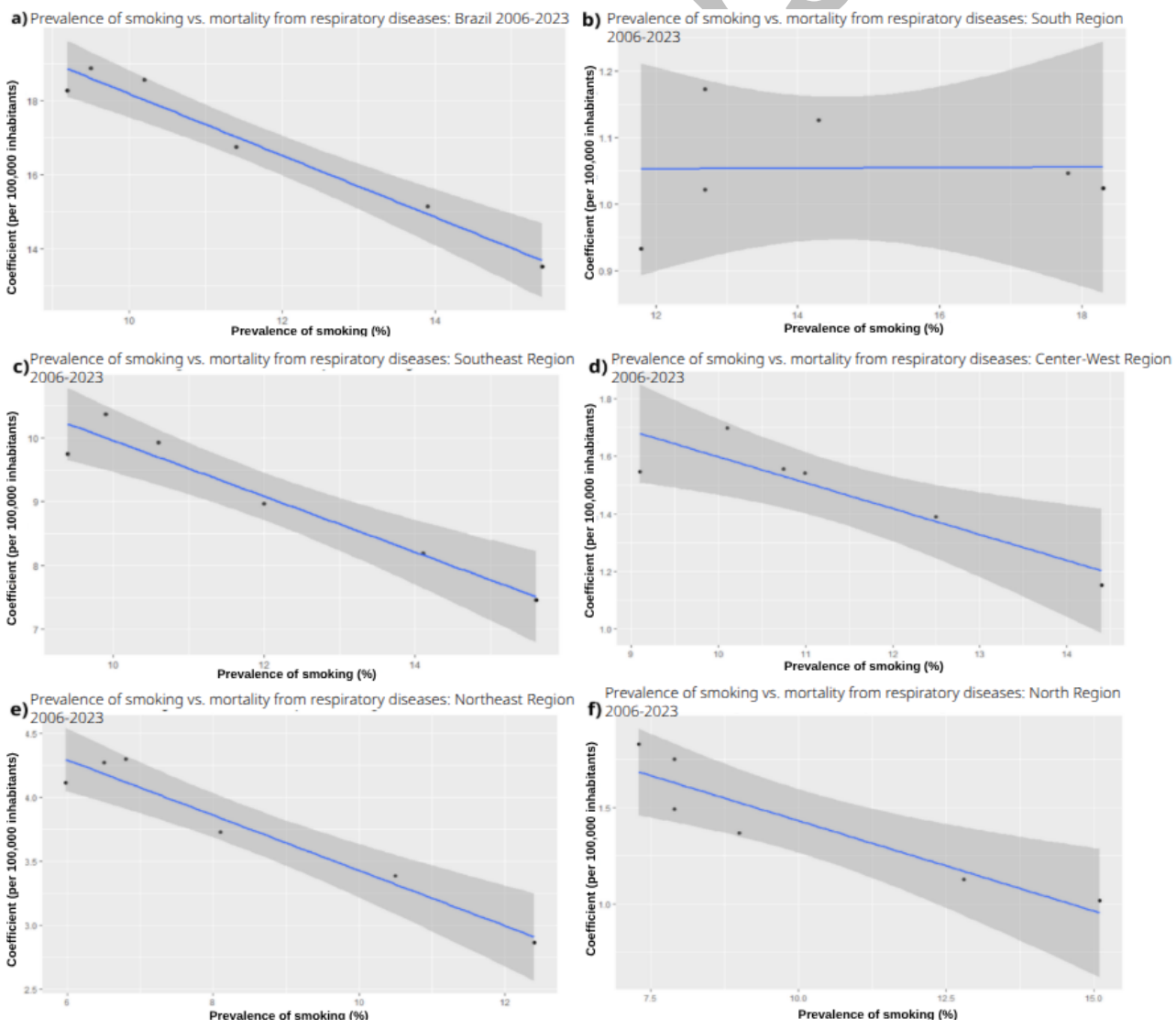

Figure 5. Temporal trend between smoking prevalence and mortality rate from respiratory diseases (per 100,000 inhabitants). Brazil and regions: 2006-2023.

DISCUSSION

The prevalence of smoking in Brazil showed a generalized decline throughout the national territory. However, the regional distribution of this reduction was not uniform. The Southern Region had the highest prevalence of smoking throughout the analyzed period, while the Northeast stood out for having the lowest prevalence in all the three-year periods studied.[17]

The Northern Region, which occupied the third position in terms of prevalence, moved to the fourth position. On the other hand, the Central-West Region, after showing a decrease in smoking rates in the first five three-year periods, experienced an increase in prevalence in the sixth three-year period, exceeding the levels observed in the third three-year period. This increase led the region to show a trend of stability and to rise from the fourth to the second position in the ranking of smoking prevalence.[17]

Brazil has implemented a comprehensive set of strategies for tobacco control, encompassing both legislative measures and sanitary surveillance and treatment actions within the Unified Health System (SUS). In terms of legislation, highlights include the prohibition of advertising and sponsorship by the tobacco industry, the prohibition of tobacco consumption in enclosed public spaces, the requirement of health warnings on tobacco product packaging, and increased taxes on cigarettes, as well as the definition of a minimum price for their sale.[14]

The National Health Surveillance Agency (Anvisa) plays a fundamental role in tobacco control, being responsible for regulating the registration, packaging, and content of tobacco products. Additionally, SUS offers treatment for smoking cessation in Basic Health Units (BHU), where qualified health professionals apply smoking cessation programs.[14,18]

These joint actions aim to reduce the prevalence of smoking in Brazil, minimizing the damage caused by tobacco consumption to individual and collective health. Approximately 80% of smokers want to quit smoking, but only 3% succeed. Due to the chemical dependence on nicotine, several attempts are necessary before cessation. In a study conducted in Curitiba, the majority of participants in the cessation group were female, had completed only elementary school, and had low family income. More than half of those who did not live alone lived with other smokers. The reasons for smoking and the situations that lead to smoking involve anxiety, sadness, post-meal periods or with coffee, and the search for a feeling of pleasure.[18]

People want to quit smoking because they feel it harms their own health and that of their families, in addition to the cost of maintaining the addiction and the example it sets for

children. More than 75% of participants in these smoking cessation groups end up using some medication available through the public health system (SUS), 28% abandon the program, and half manage to quit smoking, but with difficulty maintaining abstinence in the following months. Regarding the National Health Surveys (PNS) of 2013 and 2019, passive smoking at home and at work and exposure to pro-tobacco media decreased, but exposure to anti-tobacco elements, such as warnings and anti-tobacco campaigns, also decreased.[14, 18, 19]

This study demonstrates that the upward trend in hospitalizations for cardiovascular diseases (CVD) in the country was driven by the Northeast Region, while the other regions remained stable. Thus, there was no impact of the reduction in prevalence on hospitalizations for CVD, as the variables are not related or are negatively related. For comparison purposes, hospitalizations for respiratory diseases (RD) showed a sharp decrease in Brazil, and all regions showed a decrease, although the South tended towards stability.

Regarding mortality from cardiovascular disease, there was also no impact from the decrease in smoking prevalence in this study, as Brazil and almost all regions showed an upward trend in deaths per 100,000 inhabitants or maintained stability. Mortality from respiratory diseases followed the trend of CVD for Brazil.

CVDs do not have tobacco use as the only risk factor; they are also linked to the development and mortality from this group of diseases, including systemic arterial hypertension (SAH), diabetes mellitus, elevated non-HDL cholesterol, obesity, sedentary lifestyle, high alcohol intake, depressive symptoms, air pollution (with a greater effect on strokes), and poor eating habits. CVDs are multifactorial; several situations can lead to pathological changes.[20]

For respiratory diseases, tobacco is directly associated with their etiology. Asthma is related to the exposure of the fetus or newborn to toxic substances in smoke, with non-exposure of the patient to smoke improving disease control. For COPD, the third leading cause of death in the world, quitting smoking is the only intervention that alters the natural history of the disease. In addition to increasing the chance of interstitial lung diseases and lung cancer, smoking also increases the risk of tuberculosis and bacterial pneumonia. Thus, in smoking patients with respiratory diseases, comprehensive clinical approaches and assessments are necessary, as well as encouragement to quit smoking.[12,13]

In conclusion, this study shows a decrease in hospitalizations for respiratory diseases and an increase in mortality rates from these diseases, indicating a higher frequency of fatal outcomes in hospital admissions for respiratory diseases. This study highlights the need for further studies on risk factors and their participation in the burden of CVD in Brazil, as well as investigating the reasons for the stability in smoking rates in the Central-West region. It is

necessary to reinforce or expand awareness campaigns about the risks of the habit and about smoking cessation itself. The study demonstrates that, over time, actions in the field of tobacco control are examples of successful public policies, provided they are well coordinated.

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AUTHORS' CONTRIBUTIONS

Emílio Augusto Andrade Borges contributed to the bibliographic research, writing of the abstract, introduction, discussion, interpretation and description of the results, and conclusions. **Erildo Vicente Muller** contributed to the writing of the introduction, methodology, discussion, description of the results, and text revision. **Camila Marinelli Martins** contributed to the

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